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**SUSTAINABLE START-UP INCUBATION:
AN INDONESIAN CASE**

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SUSTAINABLE START-UP INCUBATION: AN INDONESIAN CASE

The aim of this dissertation is to obtain a doctoral (PhD) degree in the scientific field of
“Management and Business”

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- No dissertation which is fully or partly identical to the present dissertation was submitted to any other university or doctoral school for the purpose of obtaining a PhD degree.

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Table of Contents

DECLARATION	iv
LIST OF FIGURES	viii
LIST OF TABLES	ix
LIST OF ABBREVIATIONS	x
1. INTRODUCTION OF THE TOPICS AND OBJECTIVES.....	1
1.1 Objectives of the Research	5
1.2 Dissertation Structure	6
2. LITERATURE REVIEW	8
2.1 Overview of the Chapter Structure.....	8
2.2 Systematic Literature Review of the Thesis.....	8
2.2.1 PRISMA Analysis	9
2.2.2 Bibliographic Network Analysis and Visualization	11
2.3 Literature Background of the Thesis	16
2.3.1 Entrepreneurship Theory	16
2.3.2 Business Incubator and Start-up Incubation	20
2.3.3 Sustainable Entrepreneurship Theory	22
3. MATERIALS AND METHODS OF THE THESIS	23
3.1 Research Approach.....	23
3.2 Research Design of the Thesis	23
3.3 Timeframe and Geographical Scope of the Research	25
3.4 Sample Frame and Population.....	25
3.5 Data Collection.....	26
3.6 Data Analysis Methods	26
4. RESEARCH PART 1: UNIVERSITY BUSINESS INCUBATOR PROFILE AND PERFORMANCE	27
4.1 Introduction of the Research Part 1	27
4.2 Literature Review of the Research Part 1	27

4.2.1 University Business Incubators	27
4.2.2 Sustainable Business Incubator and Performance Evaluation.....	29
4.2.3 Incubators and Regional Development.....	30
4.2.4 Sustainable Business Model Innovation.....	31
4.3 Material and Methods of Research Part 1	32
4.3.1 Research Instrument	32
4.3.2 Data Collection Design.....	32
4.3.3 Data Analysis Method	32
4.4 Results of the Research Part 1	33
4.4.1 Profile of University Business Incubators	33
4.4.2 Resources of the University Business Incubators.....	39
4.4.3 Support Mechanism of the UBIs for Sustainable Start-up Development.....	41
4.4.4 The Successfulness of Sustainable Start-up Incubation	45
4.4.5 Opinions Regarding Start-up Development on Sustainable/Social Benefits.....	47
5. RESEARCH PART 2: SUSTAINABLE START-UP PERFORMANCE	51
5.1 Introduction of the Research Part 2.....	51
5.2 Literature Review of the Research Part 2.....	52
5.2.1 Sustainable Entrepreneurial Ecosystem.....	52
5.2.2 Sustainable Entrepreneurship Process	53
5.2.3 Production and Commercialization	54
5.2.4 Sustainable Impact Assessment (SIA) for Start-ups.....	54
5.3 Conceptual Framework and Hypotheses Development	55
5.4 Material and Methods of the Research Part 2	57
5.4.1 Research Instrument	57
5.4.2 Data Collection	59
5.4.3 Data Analysis Method	59
5.5 Results of the Research Part 2.....	61
5.5.1 Profile of Respondents.....	61
5.5.2 Measurement Model Evaluation.....	62
5.5.3 Structural Model Evaluation.....	65
5.6 Discussion of the Research Part 2	70
5.7 Conclusion of the Research Part 2	72

6. DISCUSSION, IMPLICATION AND NOVELTY OF THE THESIS	73
6.1 Discussion of the Thesis.....	73
6.1.1 Introduction.....	73
6.1.2 Literature Review Results of Sustainable Start-up Incubation.....	73
6.1.3 The Role of University Business Incubators in Bali Province, Indonesia.....	74
6.1.4 Critical Evaluation of Current Incubation Program.....	78
6.1.5 Recommendations for a New Incubation Model for Indonesian Universities	80
6.2. Implications of the Thesis	84
6.3 Novelty of the Thesis	87
7. CONCLUSION, CONTRIBUTIONS AND LIMITATIONS OF THE THESIS.....	89
7.1 Conclusion	89
7.2 Contributions of the Thesis	90
7.3 Limitations of the Thesis.....	91
7.4 Recommendations for Future Research	92
7.5 Final Remarks.....	92
SUMMARY	93
REFERENCES.....	97
APPENDICES	112
Appendix 1. Survey of Research Part 1 - Questions and References.....	112
Appendix 2: Survey of Research Part 2 - Questions and References	118

LIST OF FIGURES

Figure 1: Number of Unicorns in Asia-Pacific by Countries (2022).....	3
Figure 2: Leading Start-ups in Indonesia by Fundings in Million U.S. Dollars (2024)	3
Figure 3: Number of Start-ups in Indonesia by Cities (2024).....	4
Figure 4: The PRISMA Diagram of the Research	10
Figure 5: Co-occurrence of Author Keywords Network Map (2016-2025).....	12
Figure 6: Research Design of the Thesis	24
Figure 7: Minimum Sample Size Statistical Calculation of SEM	25
Figure 8: Survey Framework of the Research Part 1	28
Figure 9: Entities forming Ownerships of the Incubators	34
Figure 10: Innovation/technology Transfer Units/Organisations (%) Operating at the Universities .	35
Figure 11: Types of Services (%) the Incubator Provides to Clients.....	36
Figure 12: The Industry or Field of Knowledge (%) that the Incubator is Explicitly Targeting	37
Figure 13: Average Start-ups Stay (Years) in Incubators	38
Figure 14: The Percentage of Annual Budget Allocation to Develop Innovations that Provide Sustainable/Community Benefits.....	40
Figure 15: Income Sources (Indonesian Rupiah) of the University Business Incubators	41
Figure 16: The Incubator's Efforts (%) to Actively Encourage Tenants to Achieve Specific Goals.	42
Figure 17: The Incubator's Activeness (Numbers) in Encouraging Start-ups to Achieve Benefits...	43
Figure 18: The Importance Level of Economic, Social, Environmental, and Cultural Benefits for Incubators.....	44
Figure 19: Frequency (Numbers) Considers the Impacts in the UBIs New Tenant Selection Criteria	45
Figure 20: Percentage of Start-ups Founded in the last 3 years to Provide Sustainable/Societal Benefits	46
Figure 21: Aspects that are Necessary for the Primary Purpose of the Incubators (Numbers)	47
Figure 22: Agreement Opinions of Start-up Development on Sustainable/Social Benefits (Numbers)	48
Figure 23: Proposed Conceptual Framework of Research Part-2.....	55
Figure 24: The Final Path Model and Coefficient Estimates.....	66
Figure 25: Contextual framework of University Business Incubators in Indonesia.....	77

LIST OF TABLES

Table 1: Start-up Ecosystem Ranking Position in Indonesia by Cities (2023).....	4
Table 2: Main Research Topics based on Co-occurrence Network Analysis.....	12
Table 3: Data of the Respondents of Survey 1 (Bali, Indonesia).....	33
Table 4: Sources and Abbreviations of Latent Variables and Indicators.....	57
Table 5: Descriptive Statistics, Factor Loadings, and Collinearity Statistics of the Items	62
Table 6: Measurement Model Evaluation Results	64
Table 7: Fornell-Larcker Measures Discriminant Validity.....	64
Table 8: Total, Direct, and Indirect Effects of the Path Models	65
Table 9: Specific Indirect Effects.....	67
Table 10: Adjusted R ² and Q ²	68
Table 11: Effect Size (F ²).....	68
Table 12: PLS-SEM Predictions	69
Table 13: Summary of Research Novelty	88

LIST OF ABBREVIATIONS

Abbreviation	Full Form
CS	Corporate Sustainability
SUPIE	Start-up incubation ecosystem
SBI	Sustainability-driven Business Incubations
SLR	Systematic Literature Review
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analyses
STI	Science, Technology, and Innovation
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
RBV	Resource-based view
VRIN	Valuable, rare, inimitable, non-substitutable
RBET	Resource-based entrepreneurship theory
BI	Business Incubator
ITI	Incubation, Technology, and Innovation
BICs	Business innovation centers
IPIs	Independent private incubators
CPIs	Corporate and private incubators
SE	Sustainable Entrepreneurship
TBL	Triple Bottom Line
UNs	United Nations
SEM	Structural equation modeling
AIBI	Association of Indonesian Business Incubators
UBIs	University Business Incubators
HEIs	Higher education institutions
SBMI	Sustainable Business Model Innovation
SIA	Sustainable Impact Assessment
SEE	Sustainable entrepreneurship ecosystems
SEP	Sustainable entrepreneurship process
EC	Enabling Cadence

SE	Sustainable entrepreneurship
SM	Social metabolism
MVP	Minimum viable product
EE	Entrepreneurial ecosystem
SO	Sustainability orientation
EO	Entrepreneurial orientation
CR	Composite Reliability
CA	Cronbach's Alpha
AVE	Average variance extracted
ESG	Environmental, social, and governance
IP	Intellectual Property
TTOs	Technology transfer offices
AI	Artificial Intelligence

1. INTRODUCTION OF THE TOPICS AND OBJECTIVES

Start-up is the practical activity of starting a business in an uncertain environment (Wang et al., 2022). Start-ups introduce new products and services, create jobs and customer value, improve living standards, and resolve global challenges (Aldrich & Ruef, 2012; Fini et al., 2018). Through creative destruction (Schumpeter, 2017), start-up firms play a critical role in developing the economy and society. The development of start-ups incorporates the idea of corporate sustainability. Corporate Sustainability (CS) is now a critical link in the causal chain connecting business success to the economic, environmental, and social dimensions. By balancing economic health (the economy), social equality (the people), and environmental resilience (the planet), sustainable entrepreneurs attempt to manage the "triple bottom line" (Kuckertz & Wagner, 2010).

However, starting a business does not happen in a vacuum. Innovative companies continually make use of their available resources, interact with other people, firms and exchange goods and services (Gnyawali & Fogel, 1994; Spigel & Harrison, 2017; Spilling, 1996; Van De Ven, 1993), interacting closely with their surrounding settings (Szerb et al., 2019). Start-up Incubation Ecosystems (SUPIEs) are a collection of interconnected actors and variables that work together to create a supportive environment for start-up formation and successful development (Novotny et al., 2020). The SUPIE idea highlights how ecosystems play a significant role in forming new businesses during their early stages, which has long-term effects on their ability to survive and expand (Beckman & Burton, 2008).

University students start an essential share of innovative start-ups; (Eesley & Miller, 2018; Roberts & Eesley, 2011), who are mostly novice (inexperienced) entrepreneurs. While there is a considerable volume of literature addressing the processes of e.g., patenting, licensing, and the establishment of firms initiated by university faculties, there exists a notable lack of comprehensive data and insights concerning the inception and growth of start-ups founded by students. As student interest in entrepreneurship continues to rise, universities and policymakers across the globe are actively developing and implementing a diverse array of support mechanisms and initiatives. These efforts aim to facilitate entrepreneurial skill development, provide access to funding, foster mentorship opportunities, and create ecosystems that nurture innovative ideas, thereby empowering students to transform their entrepreneurial aspirations into viable business ventures. These measures include entrepreneurship education, university incubators and accelerators offering students access to office space and labs, technology transfer and business development services (Breznitz & Feldman, 2010). Entrepreneurship education is defined broadly, as it equips students with knowledge and competencies on how to start a new firm and develops their ambitious spirit and innovation skills that they can utilize as employees of larger organizations (Gibb, 2002). Both international findings emphasize that entrepreneurial education is a crucial factor of entrepreneurship ecosystems and a key

determinant of start-up success (Belitski and Heron 2017; Csákné Filep, Radácsi, and Timár 2020; Kuti and Bedo 2018; S. Gubik 2013). Despite the increasing resources devoted to inspiring students to start a firm at the national and university levels, there needs to be more knowledge on how various support mechanisms should be implemented to facilitate the birth and growth of student start-ups (Thompson, 2013). Very few studies focus on incubating student start-ups from an ecosystem point of view (Wright et al., 2017). What specific improvements are needed in frameworks for developing student start-ups in resource scarce contexts? What metrics or criteria can be used to measure the effectiveness of these frameworks in emerging regions?

Indonesia is the fourth most populous emerging country in the world according to the World Bank as of 2022, with a population of 275 million people. As the country with the largest market size in Southeast Asia, Indonesia benefits from a majority young, internet savvy workforce, creating leading start-ups and unicorns. According to the GUESS National Report (2021), a significant number of Indonesian students express a desire to become employees (49.79%) or business founders (31.48%) immediately after completing their studies. However, five years post-graduation, this preference shifts, with 31.48% aspiring to be employees and 60.29% aiming to be business founders. Notably, the interest in pursuing careers as business successors remains low, at approximately 3.5% (Suhartanto, 2021).

While most startups in Indonesia are digital focused, the unicorn companies span a diverse range of industries, including logistics, travel, ticketing, and financial technology services. Unicorns are defined as startup companies with a valuation of \$1 billion, while decacorns are those valued at \$10 billion. Currently, Indonesia is home to eight unicorns and two decacorns: GoTo Group and J&T Express. Notably, GoTo Group is set to launch its initial public offering (IPO) in 2022. The first five Indonesian e-commerce platforms to obtain unicorn status are Gojek, Tokopedia, Traveloka, Bukalapak, and OVO. As of 2022, Indonesia ranks among the top seven countries in the Asia-Pacific region for producing unicorn start-ups, following China, India, South Korea, Singapore, Australia, and Japan (Figure 1).

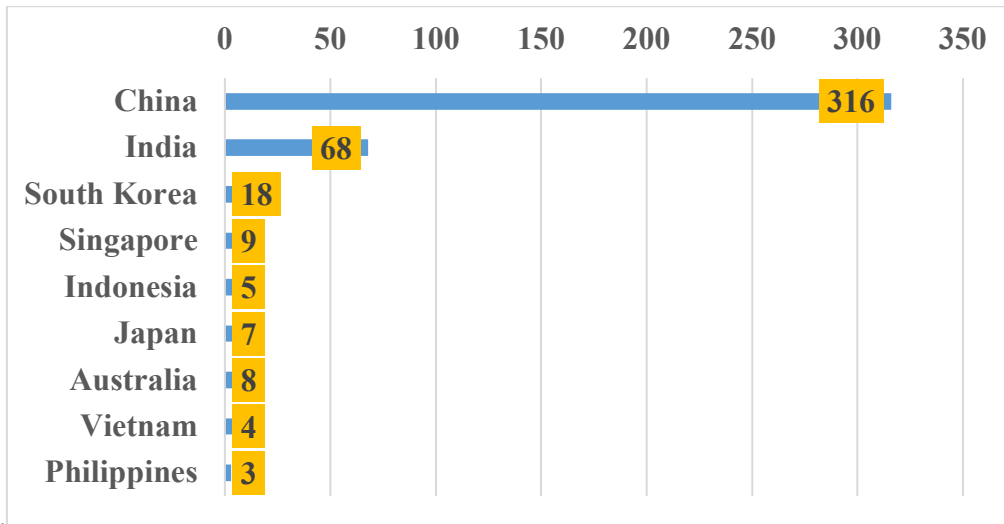


Figure 1: Number of Unicorns in Asia-Pacific by Countries (2022)

Source: (Statista, 2024)

Indonesia's start-up ecosystem ranked 41st globally and 2nd in Southeast Asia (Statista, 2024). In addition, Figure 2 shows the leading startups in Indonesia as of January 2024 by total funding amount (in million U.S. dollars).

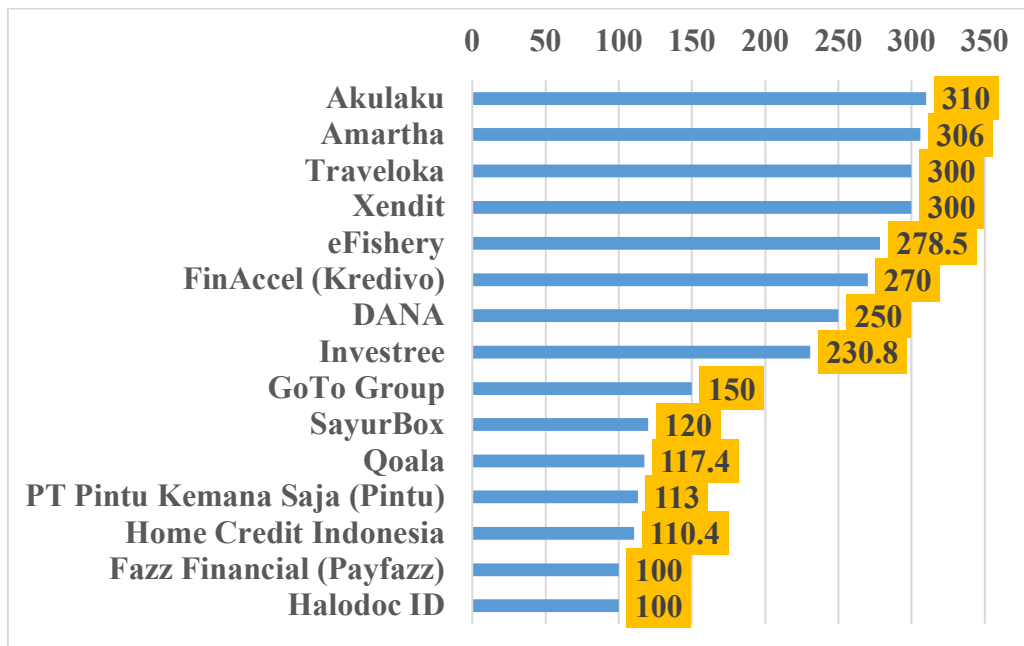


Figure 2: Leading Start-ups in Indonesia by Fundings in Million U.S. Dollars (2024)

Source: (Statista, 2024)

Table 1 presents the 2023 rankings of the startup ecosystem across various cities in Indonesia, highlighting their relative positions on the global stage. In 2023, Indonesia's capital city, Jakarta, ranked 29 regarding its startup ecosystem. Other cities such as Bandung, Denpasar, Yogyakarta, and

Surabaya have successively ranked 386, 874, 931, and 938 globally, indicating that the start-up ecosystem is conducive to Indonesia.

Table 1: Start-up Ecosystem Ranking Position in Indonesia by Cities (2023)

City	Global ranking out of 1,000 cities
Jakarta	29
Bandung	386
Denpasar	874
Yogyakarta	931
Surabaya	938

Source: (Statista, 2024)

As of January 2024, Greater Jakarta, also known as the Jakarta metropolitan area, had around 539 start-ups, making it the area in Indonesia with the highest number of start-ups (Figure 3). Jakarta serves as the economic hub of Indonesia, and in 2023, it ranked 29th among 1,000 cities globally for its vibrant start-up ecosystem. Followed by Bandung, Yogyakarta, Denpasar, Surabaya, Medan, Semarang, and Pandeglang, respectively.

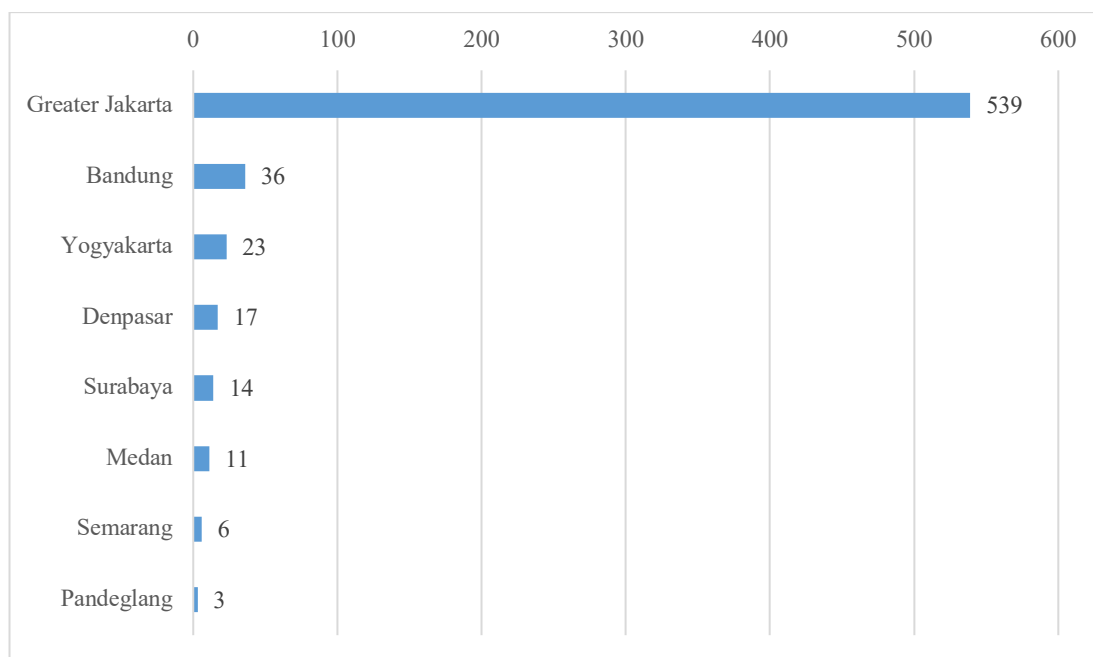


Figure 3: Number of Start-ups in Indonesia by Cities (2024)

Source: (Statista, 2024)

In the 2023 Global Start-up Environment Index, Jakarta is ranked 10th in Asia Pacific and the top 30 globally as the city with the most developed start-up ecosystem. Jakarta's standing in this index differs from other cities in Indonesia. Several cities in Indonesia have the potential to create a welcoming atmosphere for businesses. Denpasar, Bali Province, is one of them.

Recent years have seen a substantial surge in the growth of start-ups in Indonesia, including in Bali Province. This phenomenon is inseparable from the development of digital technology, changes in consumer preferences, and government support through various incubation and business acceleration programs. Despite this growth, the sustainability of many start-ups remains a substantial challenge. A substantial proportion of these nascent enterprises face the prospect of insolvency due to their inability to adapt dynamic business environment, to address market demands, or to manage resources efficiently (Vincent & Zakkariya, 2021).

Bali Province, renowned as a global tourism destination, possesses distinctive potential for the cultivation of sustainable start-ups. Three main factors drive this potential. Firstly, there is a global trend towards a green economy. Secondly, there is a demand for environmentally friendly solutions. Thirdly, there is a local Balinese culture that emphasizes harmony with nature. However, in practice, many start-ups have not fully utilized sustainability principles in their business models. Moreover, existing incubation programs frequently lack integration with sustainability aspects, resulting in inadequate guidance for start-ups to incorporate Environmental, Social, and Governance (ESG) principles into their operations. However, research on sustainable start-up incubation remains scarce, particularly in regions such as Bali Province. The extant research predominantly emphasizes the technical dimensions of incubation, neglecting the broader integration of sustainability principles (Vincent and Zakkariya 2021). However, sustainability is not merely a social responsibility, it is critical in establishing long-term competitive advantage for start-ups. Hence, there is a necessity to investigate the way incubators in Bali can be designed and operated to support sustainable start-up development.

1.1 Objectives of the Research

The research comprises three distinct sections. The first session is a bibliometric analysis (review) and visualization of start-up incubation literature. The second one (Research Part I) is focused on the profile of university business incubators that carry out the start-up incubation process. The third one (Research Part 2) analyzes the performance of start-ups resulting from the incubation process at the universities. Moreover, the results of this study are also expected to investigate the environments (elements and layers of SUPIEs) in which student start-ups are created and supported before their birth (hatching), as well as during their early development, and identify the critical environmental components that influence the birth, survival, and growth of student firms. This research also adopts an ecosystem perspective. This analysis will explore the functioning of student ideas, specifically focusing on the interactions among individuals, organizations, and various elements within the ecosystem that contribute to the growth of successful student start-ups. The detailed objectives are as follows:

- This study focuses on the development of a bibliometric analysis and visualization of start-up incubation. We have reviewed the literature concerning the interconnectedness of research streams related to start-ups and incubation.
- The exploration of the role of business incubators in supporting start-ups will include factors such as access to resources and mentorship.
- Additionally, we will examine the limitations of these programs, particularly their tendency to favor short-term success over sustainability. In this regard, the research will emphasize sustainable practices, e.g., environmentally friendly initiatives and business strategies, to address challenges faced by start-ups.
- The primary objective of this thesis is to identify future applications and models that can lead to recommendations for sustainable practices at Indonesian universities, aimed at enhancing existing business ecosystem processes and support mechanisms. This approach includes the concept of Sustainability-driven Business Incubations (SBIs) for the establishment of student ventures.
- By integrating insights from various entrepreneurship research fields and adopting a multidimensional perspective, this thesis advocates for employing innovative data and methodologies to gain a deeper understanding of the incubation process and its broader socio-economic impacts.

1.2 Dissertation Structure

This thesis is focused on the evaluation of University Business Incubators that support student start-ups, specifically by examining these incubators through the lens of sustaining a mission rooted in sustainability.

The dissertation begins with an introductory chapter. This chapter provides a concise overview of the subject matter. It further outlines the development and ecosystem of start-ups in Indonesia, with a particular focus on Bali Province. Following this approach, the importance of the topic and the objectives of the dissertation are discussed.

The second chapter of the dissertation continued with the literature review. This study employs the PRISMA method to identify relevant literature, followed by a bibliometric analysis and visualization process. For instance, the research adopts a Co-occurrence Network analysis approach within the broader framework of bibliographic network analysis. This method is used to examine selected key terms, where the connections between nodes reflect the frequency with which these terms appear together across publications. These terms can reveal underlying patterns, themes, and emerging trends within the field. The literature review chapter presents the theoretical foundations that guide the study,

including the theories of entrepreneurship, business incubators and start-up incubation, as well as sustainable entrepreneurship.

The materials and methods chapter employ a quantitative approach to investigate the phenomenon of sustainable start-up incubation. The quantitative approach was chosen because the research aims to collect primary data that can be measured statistically, providing an objective perspective on how business incubators support start-up sustainability.

The next chapters present the results and findings of the study. Following the presentation of the results, a discussion section compares these findings with previous studies on the topic. Finally, the study concludes with a summary of implications, limitations, future research directions, and novel contributions.

2. LITERATURE REVIEW

2.1 Overview of the Chapter Structure

The literature review serves as the fundamental basis of this thesis, offering a comprehensive analysis of pertinent research and theoretical frameworks related to the study. Its primary purpose is to outline the context of the research problem, identify key themes and emerging trends within the existing scholarly discourse, and highlight essential gaps that necessitate this investigation. By combining and rigorously critiquing prior studies, this section constructs a well-grounded theoretical and empirical framework for the research questions and methodological approach. The chapter is organized thematically and focuses on sustainable start-up incubation, concluding by the research contributions to knowledge advancement in this field.

The chapter begins with an introduction that provides a concise overview of the significance and purpose of this chapter, as well as the systematic framework utilized in its development. Following the introduction, the chapter proceeds with an explanation of the systematics and methods employed in the literature review. This section outlines the methodology used for the literature review and details the process of conduction. The subsequent section will concentrate on the bibliographic network analysis and visualization of the results obtained from the systematic literature review. After presenting these analyses, the discussion shifts to the theoretical foundation and concepts related to sustainable start-up incubation. In this section, the grounded theory that underpins this research will be elaborated.

2.2 Systematic Literature Review of the Thesis

This thesis presents a systematic literature review methodology consisting of two distinct phases. The initial stage employs the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method (Moher et al., 2009; Page et al., 2021), while the subsequent stage involves conducting a bibliographic network analysis. The initial stage of this literature review employs the PRISMA methodology to systematically evaluate the relevant literature, thereby obtaining articles that are in accordance with the research objectives. The exclusion criteria are based on relevance, quality, and duplication. A meticulous examination of the abstracts and conclusions of articles obtained from multiple databases is undertaken. The relevance of each article is assessed based on its alignment with the keywords used in the search query. The quality of each article is strictly evaluated to ensure that the selection process adheres to strict standards.

The next phase of the literature review involves performing a bibliographic network analysis. This approach integrates descriptive content analysis and review questions that are established at the initiation of the review process. The primary objective of bibliographic network analysis in literature

review research is to identify inter-literature relationships, visualize knowledge structures, identify trends and patterns, and detect gaps in the literature. This approach provides a clearer and more objective view of research dynamics in a specific field, thus aiding the development of focused and impactful research efforts. The subsequent section will focus on the bibliographic network analysis and visualization of the results obtained from the systematic literature review. In this case, the authors' keyword co-occurrence network analysis will be used.

2.2.1 PRISMA Analysis

This study began with establishing a review procedure based on the framework proposed by (Page et al., 2021), as shown in Figure 4. This framework is derived from PRISMA and has been tailored to align with the research objectives. PRISMA entails a minimum four-stage process for "evidence-based" analysis, systematically reviewing and reporting existing literature through "systematic reviews and meta-analyses" (Isnaini et al., 2025; Singh et al., 2025). The selection process for the final study population is detailed below. The initial database search yielded a total of 289 articles from the Scopus and Web of Science (WoS) databases. However, only 168 met the inclusion criteria and were subsequently included in this study. This reduction in the number of articles facilitated a more focused explanation for the subsequent review process. The review procedure enabled the creation of a systematic, replicable, and transparent analysis (Boršoš & Koman, 2025).

This thesis established a set of inclusion and exclusion criteria to guide the selection process. The inclusion criteria encompassed specific keywords, publication timeframe, document type, and language. The search results were derived from English-language journal articles published between 2016 and 2025 in peer-reviewed journals. For the preliminary search, the following query search keyword terms were employed:

```
TITLE-ABS-KEY (( sustainable OR eco-friendly OR green OR environmental) AND ( startup* OR start-up* OR spinout* OR spin-off) AND ( incub* OR accelerator )) AND ( LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2021 ) OR LIMIT-TO ( PUBYEAR , 2022 ) OR LIMIT-TO ( PUBYEAR , 2023 ) OR LIMIT-TO ( PUBYEAR , 2024 ) OR LIMIT-TO ( PUBYEAR , 2025 ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ).
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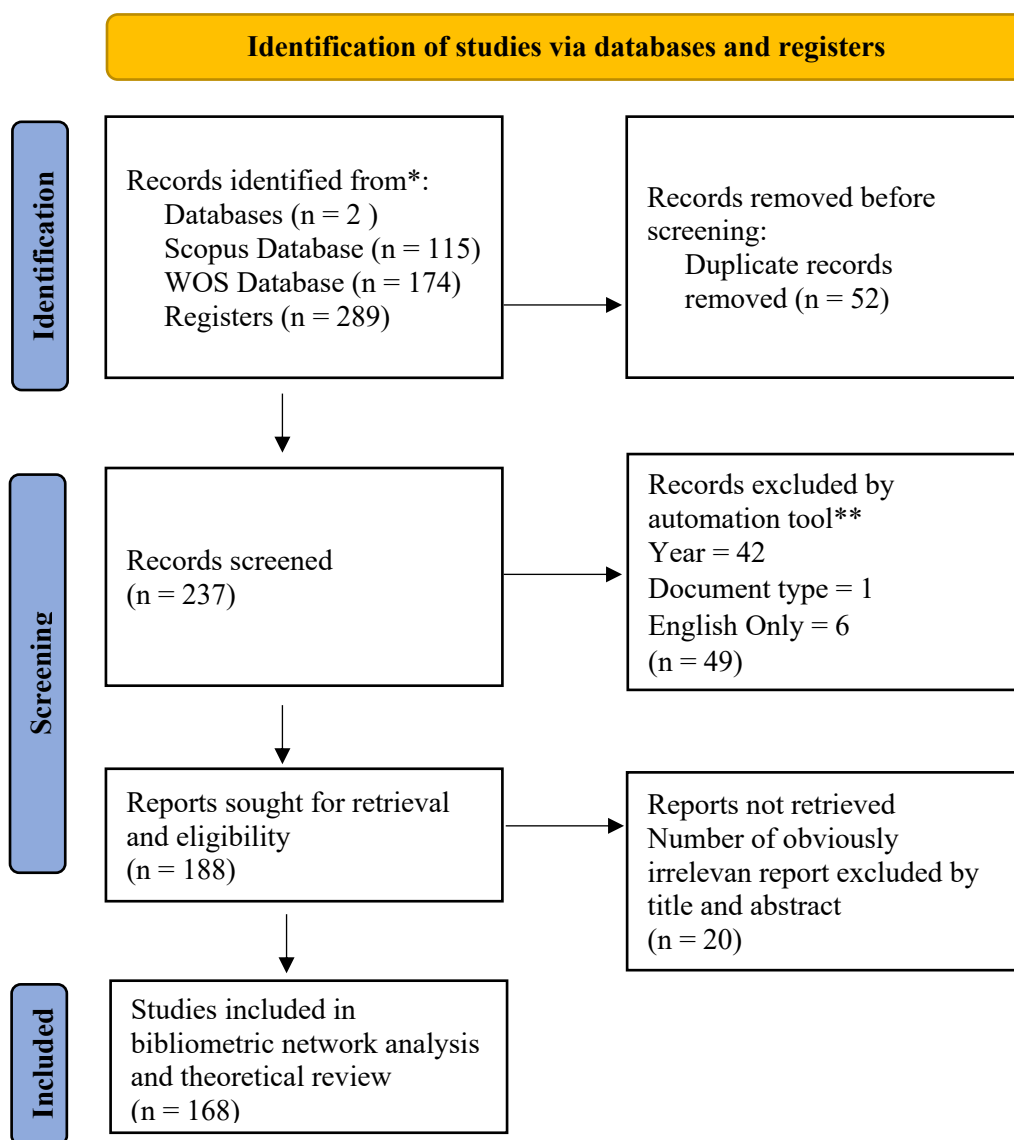


Figure 4: The PRISMA Diagram of the Research

Source: author's compilation (2025)

Note: *Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers). **If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

This study employed a defined set of inclusion criteria to screen papers for the review process. The criteria required that papers be written in English, published in 2016 or later, and appear in peer-reviewed journals. Additionally, the papers were required to address sustainable start-up incubation as the central focus of the research. The year 2016 was chosen as the starting point to capture the most recent literature, coinciding with the period following the United Nations (UN) official adoption of the Sustainable Development Goals (SDGs) as a global development framework. This timing underscores the increasing academic focus on the United Nation's Sustainable Development Goals (SDGs). Furthermore, the document types considered for inclusion encompassed journal articles, conference papers, book chapters, reviews, and books.

The criteria for exclusion in this study encompassed considerations of relevance, methodological quality, and duplication of data or findings. The abstracts and conclusions of articles retrieved from various databases were meticulously reviewed. The relevance of each article was assessed according to its alignment with the keywords in the search query. Furthermore, the quality of each article was evaluated to guarantee that the selection process adhered to rigorous standards and upheld a high level of academic integrity.

2.2.2 Bibliographic Network Analysis and Visualization

The present study employs the methodology of Co-occurrence Network analysis in the context of bibliographic review. A co-occurrence network is employed to analyse selected terms, where the links within the network illustrate the frequency with which these terms appear together across various publications. The nodes in the network represent the keywords identified by the authors. These words or phrases may be pertinent to the research topic and can reveal underlying patterns and trends within the discipline when they are used frequently.

The following procedure was implemented to conduct a co-occurrence analysis using VOSviewer. VOSviewer software (release 1.6.19) utilizes three methods to generate maps that display keyword networks. Initially, abstracts from the database were filtered, resulting in the selection of 168 publications. Keywords were then extracted from titles, abstracts, and author-provided keywords. Subsequently, the data underwent a "cleaning" process, during which synonyms, abbreviations, and full phrases were consolidated before being processed as a batch file. Keywords considered for analysis and inclusion in the network were required to appear in at least two papers (Khitous et al., 2020).

VOSviewer generated a total of 31 nodes, which were organized into seven distinct clusters (Figure 5). Given the absence of overlap between node clusters, specific keywords are exclusively associated with one cluster. The co-occurrence network comprises 80 links, with a cumulative link strength of 110. Higher values indicate the relative importance of a keyword within the network and its frequent co-appearance with other phrases. Keywords that occur more frequently in the dataset are represented by larger and more transparent nodes (Ejmont et al., 2020). Furthermore, the more yellow the nodes and links appear, the more they signify their timeliness and relevance to key themes such as start-up incubation, incubation phases, incubation process, and start-up ecosystem.

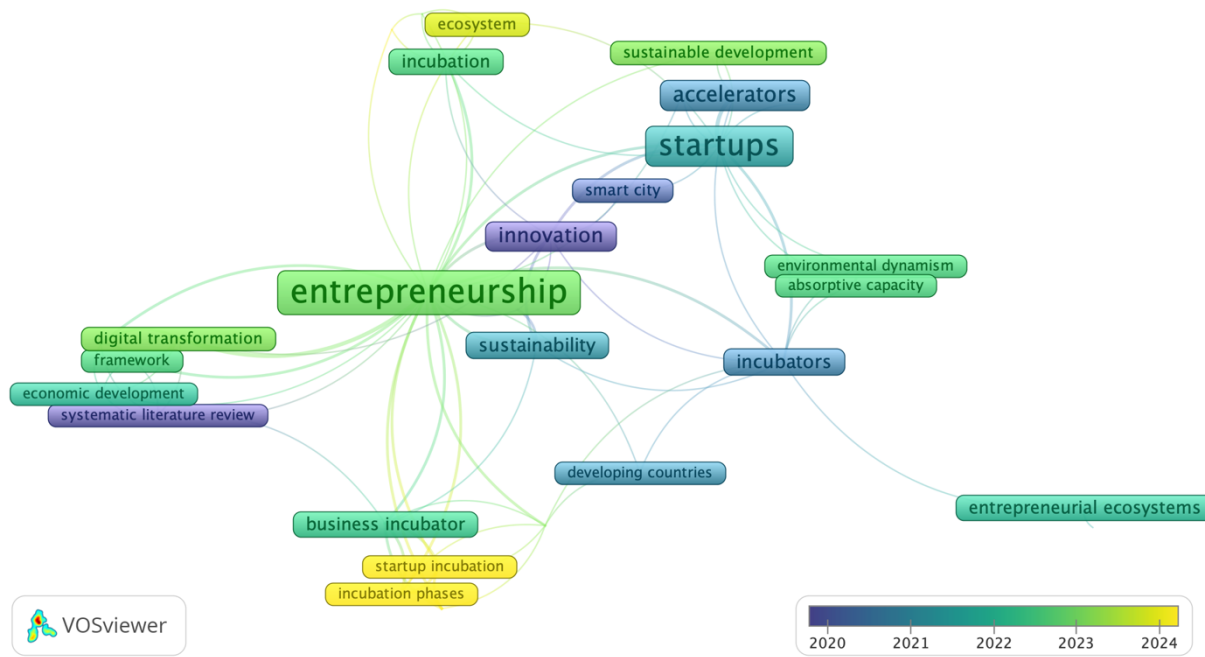


Figure 5: Co-occurrence of Author Keywords Network Map (2016-2025)

Source: author's compilation (2025)

Table 2 offers comprehensive details on the keywords and their respective clusters. These clusters describe seven distinct thematic areas. The thematic areas are subsequently organized according to the frequency of keyword co-occurrence within the dataset.

Table 2: Main Research Topics based on Co-occurrence Network Analysis

Cluster	Keywords	Total Link Strength	Occurrences*	Main Research Topics
1	Business incubator	11	4	Business incubator and sustainable development goals
	Sustainable development goals	8	3	
	Developing countries	3	2	
	Incubation phases	9	2	
	Incubation process	9	2	
	Startup incubation	9	2	
2	Startups	17	13	Start-ups and accelerators
	Accelerators	6	7	
	Sustainable development	3	3	
	Asia	1	2	
	Social innovation	3	2	
3	Entrepreneurship	36	15	Entrepreneurship and incubation

	Incubation	7	4	
	Ecosystem	4	3	
	Startup ecosystem	3	3	
	India	4	2	
4	Digital transformation	10	3	Digital transformation and economic development
	Economic development	5	2	
	Framework	8	2	
	Systematic literature review	6	2	
	Virtual incubator	8	2	
5	Innovation	11	6	Innovation and sustainability business model
	Sustainability	8	5	
	Business model	4	3	
	Smart city	2	3	
6	Entrepreneurial ecosystems	3	4	Entrepreneurial ecosystem and social entrepreneurship
	Business accelerators	1	2	
	Social entrepreneurship	1	2	
7	Incubators	12	5	Incubators, absorptive capacity and environmental dynamism
	Absorptive capacity	4	2	
	Environmental dynamism	4	2	

Source: author's compilation (2025)

Cluster 1 primarily centres on the incubation phase and processes associated with business incubators, alongside the formulation and implementation of sustainable development goals. The incubation process at a business incubator consists of four distinct phases. It begins with the phase of spreading entrepreneurship, followed by the pre-incubation phase, the basic incubation phase, and concludes with the advanced incubation phase (Asensio-Ciria et al., 2024, 2025). The phase of spreading entrepreneurship is crucial and plays a vital role in determining the success of start-ups during the incubation period (Asensio-Ciria et al., 2024). Surana et al. (2020) posited that the interrelationship between Science, Technology, and Innovation (STI) is crucial for the effective attainment of sustainable development goals (SDGs). They emphasized that advancing STI capabilities is essential for addressing complex global challenges and enhancing sustainable outcomes across various sectors. Their analysis highlights the critical contributions of STI in addressing complex socio-environmental challenges and fostering pathways toward sustainability. Policymakers should strengthen the incubation system to improve the effectiveness of STI-based incubators. This improvement can be accomplished by aligning specific incubator objectives with targeted Sustainable Development Goals

(SDGs), enhancing coordination among existing incubator programs, developing a performance monitoring framework, and initiating comprehensive capacity-building initiatives at different levels (Surana et al., 2020). Most start-ups within incubators are established by young entrepreneurs who have developed business plans and whose ventures are based on innovative concepts (AlMatrook & Munir, 2024). This factor serves as a critical indicator of success in achieving environmental sustainability goals.

Cluster 2 focused on start-up and accelerator. Accelerators are specialized entrepreneurship programs designed to help start-ups rapidly scale by providing mentoring, intensive consulting, training, and access to valuable business networks (Beyhan & Findik, 2022; Stayton & Mangematin, 2019). Three mechanisms enable rapid start-up launches, enhancing our understanding of how accelerators operate in this context: survival (the necessity for a swift start to ensure the start-up's viability), resource networking (leveraging existing networks to hasten the launch process), and catch-up (where accelerators assist inexperienced entrepreneurs in achieving a quick start) (Stayton & Mangematin, 2019). The issue of environmental challenges has gained increasing importance in the context of business (Sheoran & Kumar, 2020). (Beyhan & Findik, 2022) revealed that for start-ups committed to social and environmental sustainability, the amount of previous equity funding and philanthropic support sourced externally significantly influences their chances of being selected by accelerators.

Cluster 3 concentrated on entrepreneurship and incubation. The role of business incubators in supporting the entrepreneurial process is highlighted as a crucial factor that significantly enhances the survival and success rates of incubated companies, both during their time in the program and after they graduate (Vaz et al., 2023). However, given the dynamic nature of the ecosystem, incubators must adapt and evolve to maintain their relevance and effectiveness (Jha & Rajan, 2024). The facilities, support, and services offered by business incubators are not static and tend to evolve. Notable shifts in their operating models have been observed across generations. One prominent example is the transition to a virtual business incubator model, which reflects the adaptability of these programs to changing technological and entrepreneurial landscapes (Vaz et al., 2023). A proposed model has been developed to emphasize the critical resources and support provided by virtual business incubators. These key aspects are categorized into six subdimensions: knowledge transfer; mentoring and consultancy assistance; access to benefits and collaborative opportunities; exchange of services and expertise among incubatees; networking and professional events; and support for investment and funding (Vaz et al., 2023).

Cluster 4 focused on digital transformation and economic development. (De-Esteban-Escobar et al., 2024) highlighted the critical role of diverse socio-demographic and environmental factors that interact, both directly and indirectly, within the entrepreneurial ecosystem. These interactions impact

the dynamics of entrepreneurship and innovation, suggesting a complex interplay that practitioners and researchers must consider in their analyses. These factors play a critical role in influencing the persistence of start-ups, irrespective of the underlying motivations that drive an entrepreneur to initiate their business ventures. Recent studies, including the work of (Vaz et al., 2023), highlight that digital business incubators serve as critical drivers of entrepreneurship and innovation across multiple sectors. These incubators play a significant role in fostering sustainable economic growth and advancing social development. Concentrated on the integration of innovation and sustainable business models. The ongoing enhancement of the green innovation chain plays a critical role in fostering sustainable entrepreneurship and tackling environmental challenges (Eghbali et al., 2024).

All stakeholders must be involved, including the triad of technology companies, start-ups, and accelerators (Eghbali et al., 2024). In addition, static and dynamic government intervention in the development of the green innovation chain is also necessary (Eghbali et al., 2024; Surana et al., 2020). The implementation of a circular business model constitutes a significant strategy to address environmental issues within the business realm (Huynh, 2022). For instance, three archetypes of digitally driven circular business models can be distinguished in the fashion industry: blockchain-based supply chain models, service-based models, and pull-demand-driven models. In addition to incremental innovations, radical business models and digital innovations, as presented in the pull-demand-driven model, may be critical to the transition of the fashion circular economy. The demand-driven model has the potential to alter economies of scale, transform the entire process of how fashion goods are conceived, manufactured, and utilized, and reform consumer behavior. The adoption of digital fashion circular business models varies among large fashion companies, Small and Medium Enterprises (SMEs), and fashion start-ups.

Cluster 6 focused on entrepreneurial ecosystem and social entrepreneurship. Business incubators have demonstrated a significant positive influence on the promotion of entrepreneurship and innovation across various industries (Shahin et al., 2022; Vaz et al., 2023). Moreover, they play a crucial role in promoting sustainable economic growth and social development. A range of programs has been instituted to bolster the function of business incubators. These initiatives include virtual business incubator services (Vaz et al., 2023) and the creation of supportive entrepreneurial ecosystems, such as district innovation (Shahin et al., 2022). De-Esteban-Escobar et al. (2024) examined the influence of the entrepreneurial ecosystem, highlighting the effects of digitalization alongside various internal and environmental sociodemographic variables. These factors are identified as crucial drivers of firm success, serving as indicators of business resilience and growth. The concept of innovation districts integrates research institutes, innovative companies, and entrepreneurs with the benefits and conveniences of urban life, forming the core focus of this study (Shahin et al., 2022). A total of eight

factors were identified from this principle that have the potential to enhance the overall performance and progress of innovation districts.

These factors are as follows. (1) Identity: ensure innovations are visibly and widely recognized by the public; (2) Diversity: Blend the innovation with a variety of other uses; (3) Sociability: gather the district community through venues and programs; (4) Continuity: the foundation of this initiative should be existing places, buildings, and people; (5) Proximity: construct supplementary spaces on the ground, not merely on a map; (6) Mobility: facilitate transportation within and through the district; (7) Flexibility: communities are the experts; (8) Unity: the implementation of a holistic and inclusive vision and strategy is paramount.

Cluster 7 concentrated on incubators, absorptive capacity and environmental dynamism. (Surana et al., 2020) examined the efficacy of science, technology, and innovation (STI)-focused incubators, highlighting the need for policymakers to enhance the 'incubation system.' The authors argue that strengthening this framework is critical for fostering innovation and economic development. In light of this dynamic landscape, policymakers are working to create a more conducive environment for the growth of entrepreneurial ecosystems (EEs), with a particular focus on the development of sustainable development start-ups (SDSs) (van Rijnsoever, 2022). Another focal point is the establishment of a dynamic environment that prompts companies to assimilate external knowledge, which examines the relationship between absorptive capacity, innovation, and environmental dynamism (Carvalho et al., 2021). The research yielded several notable findings, including the following: (1) A dynamic external environment has a positive influence on start-up innovation. (2) A dynamic environment exerts a significant influence on companies, prompting them to adopt external knowledge. (3) Absorptive capacity influences innovation, so the greater the capacity, the greater the company's innovation. (4) Capacity mediates the relationship between a dynamic environment and innovation.

2.3 Literature Background of the Thesis

The subsequent section provides a summary and an elaboration of the theoretical frameworks that underpin this thesis, drawing upon the findings from the previously cited literature review.

2.3.1 Entrepreneurship Theory

Entrepreneurship theories attempt to explain or forecast the causes, consequences, and general processes connected with phenomena such as creativity, organizational formation, new entrance, initial resource identification and assemblage, and opportunity perception and exploitation (Kuratko & Covin, 2025).

F. H. Knight a renowned economist, made significant contributions to the field of entrepreneurship by studying its role in uncertain and risky environments. In his foundational text, Knight (1921)

articulated that entrepreneurship serves as a crucial economic mechanism centered around the decision-making process amidst uncertainty. Knight distinguished between measurable risks and unquantifiable uncertainties, asserting that the entrepreneurial role involves navigating these uncertainties to create value and drive innovation in the market. Given the inherent uncertainty in entrepreneurial endeavors, it is not surprising that entrepreneurs often rely on intuitive judgment, experience, and subjective assessment when making critical decisions. It underscores the notion that entrepreneurship is not solely dependent on logical analysis but is also characterized by elements of creativity and vision. In the contemporary digital age and the era of technological disruption, Knight's theory holds pertinence. In this context, many industries encounter elevated levels of uncertainty due to the rapid shifts in consumer preferences, technological advancements, and regulatory frameworks.

Joseph Schumpeter (1883-1950) was a seminal figure in the fields of entrepreneurship and innovation theory. Schumpeter is widely recognized as the progenitor of the concept of "creative destruction," which subsequently became a foundational principle in comprehending the function of entrepreneurs within the context of economic dynamics. According to Schumpeter, entrepreneurs are defined as individuals or groups who introduce innovations into the economic system (Schumpeter, 1934). For Schumpeter, entrepreneurship entails more than merely establishing new ventures; it involves the transformation of established practices through the introduction of novel products, processes, or business models. Entrepreneurs, as Schumpeter theorized, function as pivotal agents in the process of economic growth through innovation. Schumpeter introduced the term "creative destruction" to explain how innovation continuously replaces old technologies, products, or methods with new ones (Schumpeter, 1942). This process, as Schumpeter conceptualized it, lies at the heart of entrepreneurial activity, wherein entrepreneurs are said to engender value by disrupting entrenched patterns within the market.

2.3.1.1 Resource-Based View (RBV)

A review of the extant literature reveals that common entrepreneurship theories used to explain the decisions and behaviours of multinational corporations and new ventures include the resource-based view and dynamic capabilities theory (Velez-Ocampo et al., 2025).

Resource-based view (RBV) theory is a strategic approach that focuses on an organization's internal resources as the basis for creating a competitive advantage. The initial introduction of this concept occurred in 1991 through Jay B. Barney's seminal work, "Firm Resources and Sustained Competitive Advantage" (Barney, 1991). In this article, Barney articulates how unique firm resources contribute to achieving and maintaining a competitive edge in the market. According to RBV, companies can achieve sustainable competitive advantage if they have resources that meet the VRIN (valuable, rare, inimitable, non-substitutable) criteria:

- Valuable: Resources should be able to exploit opportunities or neutralize threats.
- Rare: The resource must be owned by a few competitors.
- Inimitable: Competitors cannot easily copy or replicate the resource.
- Non-substitutable: No alternative or substitute can deliver similar results.

RBV emphasizes that internal resources, such as physical assets, human capital, knowledge, technology, and relationships with stakeholders are crucial to differentiating oneself from competitors and maintaining a competitive position in the long run. The presence of these characteristics within an organization's resources enables the establishment of a sustainable competitive advantage.

RBV serves as a foundational principle for theories in entrepreneurship, including resource-based entrepreneurship theory (RBET), which demonstrates how entrepreneurs can develop businesses utilizing their resources (Alvarez & Busenitz, 2001). In the context of entrepreneurship, entrepreneurs frequently encounter limitations in their resources. Consequently, they are compelled to exercise greater creativity in identifying and leveraging their available resources. RBV assists entrepreneurs in comprehending the way resources, including knowledge, networks, and innovative concepts, can be employed to generate value.

In the context of start-up incubation, RBV theory is particularly pertinent because start-ups frequently operate with limited resources and require effective strategies for resource utilization to ensure their survival in a competitive marketplace (Hanson et al., 2022). Business incubators facilitate the identification, development, and utilization of internal resources by start-ups, thereby enabling the creation of a competitive advantage (Chen et al., 2023; Dourado Freire et al., 2023).

2.3.1.2 Dynamic Capabilities Theory

Dynamic Capability Theory is a theoretical framework that explains how organizations can adapt, innovate, and remain competitive in a dynamic and complex business environment. This theory was introduced by David J. Teece, Gary Pisano, and Amy Shuen (Teece et al., 1997). The theoretical underpinnings of dynamic capabilities emphasize the capacity of organizations to methodically cultivate, augment, or transition their resource base in response to environmental shifts. The text encompasses three primary dimensions, e.g., sensing, seizing, and reconfiguring (Teece et al., 1997), along with essential core processes such as coordination, organizational learning, and innovation. The sensing dimension pertains to an organization's ability to recognize and comprehend opportunities that emerge from changes in the environment. This capability requires the foresight to anticipate future trends and transformations, allowing the organization to innovate and cultivate new competencies. The seizing dimension emphasizes the organization's ability to assimilate and leverage new knowledge to seize opportunities effectively. It includes choosing the right knowledge to take

advantage of new opportunities and planning how to take advantage of external opportunities by obtaining, combining, changing, and employing knowledge to get ahead of the competition. Reconfiguration dimension relates to the organization's capacity to reorganize and adjust its resources in response to environmental changes. It underscores the necessity of cultivating innovation and enhancing new competencies within the business to guarantee agility and response to evolving circumstances.

In the context of sustainable start-up development and incubation, dynamic capability theory is particularly relevant because start-ups often operate in environments of uncertainty, rapid technological change, and intense competition. Dynamic capabilities are crucial binding constraints in the early phases of start-up growth (Bethlendi et al., 2025). The subsequent discussion will provide a comprehensive elaboration on the theory's tenets and their implications for the domains of sustainable start-up development and incubation.

Dynamic capability theory emphasizes the importance of an organization's ability to detect, capture, and reconfigure resources to remain relevant (Al-Aali & Teece, 2014; Aldianto et al., 2021). In the context of start-up incubation, this is particularly relevant because start-ups often operate in unproven or emerging markets, such as Artificial Intelligence (AI), blockchain, or renewable energy technologies. In addition, incubators help start-ups develop dynamic capabilities by providing training, mentoring, and access to networks to accelerate their adaptation to change.

According to dynamic capability theory, organizations should build flexible core capabilities to meet challenges (Teece et al., 1997). In start-up incubation, incubators serve as strategic partners to assist start-ups in identifying their competitive advantages, developing effective innovation processes, and enhancing their management, technology, and operational capabilities.

A fundamental aspect of dynamic capability theory pertains to sensing, defined as the capacity to discern opportunities and threats in the external environment (Teece et al., 1997). Incubators, which are entities designed to support the growth and development of new business ventures, play a pivotal role in facilitating this process for nascent enterprises. They facilitate the comprehension of customer requirements and prevailing industry trends (Sun et al., 2025). The provision of a mentor network: These networks facilitate interactions with industry experts and investors, offering insights that can inform strategic decisions and accelerate growth. Access to new technologies facilitates the utilization of state-of-the-art technology to discern potential prospects.

Once an opportunity is identified, the start-up must be able to capitalize on it (seize it) (Teece et al., 1997). Incubators support start-ups during this stage (de Paula et al., 2023):

- Product development: Assisting with prototypes, testing, and iterations.

- Go-to-market strategy: Assisted start-ups in developing effective marketing strategies.
- Funding: Introducing entrepreneurs to investors or funding programs.

In dynamic environments, start-ups frequently find themselves compelled to modify their business model, a process often referred to as "reconfiguring," to maintain competitiveness (de Paula et al., 2023; Teece et al., 1997). Incubators provide support for this process by assisting the start-ups in identifying areas that necessitate modification and facilitate connections between their potential partners for collaborative endeavours. It provides guidance on how to optimize resources (Gerlich et al., 2025).

The dynamic capability theory highlights the value of collaboration in acquiring external resources. Collaboration is essential in start-up incubation, as incubators offer (Wei et al., 2021). A network of mentors and experts provides strategic advice. Collaboration with universities or research by institutes: to gain access to technological advancements. Moreover, start-up communities exchange ideas and possibilities.

New business ventures frequently encounter elevated levels of risk, including market failure or insufficient funding. According to the principles of dynamic capability theory, organizational entities that possess dynamic capabilities exhibit enhanced resilience to risk. Incubators have been identified as a pivotal factor in fostering the development of dynamic capabilities in nascent organizations. Risk management training assists start-ups in identifying and managing risks (Oliveira-Dias et al., 2022). Financial mentoring is guiding cash flow management and funding. Moreover, sustainability education is imperative to encourage start-ups to integrate environmental and social aspects into their business models (Oliveira-Dias et al., 2022).

Following the successful development of a product and business model by a start-up, the subsequent challenge is to expand operations. Dynamic capability theory highlights the importance of sustainable scalability for businesses. Incubators play a vital role in supporting start-ups by providing the following strategies (Zhou, 2024):

- Guidance on entering new markets or enhancing product features.
- Access to investors, which aids in securing capital for growth.
- Operational optimization to enhance process efficiency, thereby supporting scaling efforts (Gerlich et al., 2025).

2.3.2 Business Incubator and Start-up Incubation

A Business Incubator (BI) is an organization that provides long-term support to a new company through tangible assets such as office space and administrative services or intangible assets such as

knowledge and networking connections (Leitão et al., 2022). The notion of the incubator, as we know it in innovation and business, originated in 1959 in the United States when Joseph Mancuso established the Batavia Industrial Centre in Batavia, New York (Klofsten & Bank, 2016). Incubators first appeared in Europe during the mid-1960s. In the 1980s, the notion spread fast throughout the remainder of the United States and quickly became a newcomer to the United Kingdom and Europe. Tenants or incubees are used in the literature to describe enterprises that have established themselves in incubators (Klofsten & Bank, 2016).

Business incubators can be instrumental in helping young firms survive and thrive during their start-up years, making them a vital component of any community or region (Al-Mubarak & Busler, 2010). Most of the literature on BI focuses on incubators that are not limited to a specific sector. A study from Germany found that between 1999 and 2008, one-third of all newly created incubators were niche incubators specializing in one or more complementary incubator sectors (Schwartz & Hornyk, 2008). However, not all BI requirements and different specialized BIs with a specific sector focus can offer advantages, particularly the potential availability of specialized equipment and structures, sector-specific knowledge of BI specialised staff, valuable networks, and synergies between incubators. The findings of this study propose a new taxonomy for BI classification based on three pillars: human capital, social capital, and organizational capital (Leitão et al., 2022). Human capital development, including employees and their knowledge, is crucial. The formation of networks and the company's social performance fall under the umbrella of social capital. The third pillar is organizational capital, which encompasses the BI's physical structure, including the building, laboratories, research facilities, auditoriums, conference rooms, and other components.

Cooper and Zedtwitz (1985; 2003) identified five distinct categories of incubators: university-based incubators, independent commercial incubators, regional business incubators, corporate internal incubators, and virtual incubators. Each type serves unique functions and targets different market needs within the entrepreneurial ecosystem. Conflicts between competitive scope (industry, region, and segment (focus) and strategic goals (profit) have an impact on the nature, quality, and implementation of incubation services, as well as how they are managed (von Zedtwitz & Grimaldi, 2006). (Thierstein & Willhelm, 2001) outlined the theoretical and methodological foundations for a survey of Incubation, Technology, and Innovation (ITI) centers. (Grimaldi & Grandi, 2005) categorize business incubators into four distinct types: business innovation centers (BICs), university business incubators (UBIs), independent private incubators (IPIs), and corporate and private incubators (CPIs). The authors argue that the diversity of incubation organizations is driven by evolving business needs and expectations, which, in turn, prompts incubators to diversify their services.

2.3.3 Sustainable Entrepreneurship Theory

Sustainable Entrepreneurship (SE) theory is a comprehensive and interdisciplinary paradigm for addressing the complex concerns of economic development, environmental protection, and social equality (Calabretta et al., 2025). It emphasizes the importance of long-term viability and resilience in human operations, while also reducing negative environmental and societal consequences. Achieving sustainability necessitates the equitable consideration of the environmental, social, and economic dimensions (Gorski & Ranf, 2024).

The beginning of SE theory is the concept of the triple bottom line (Elkington, 1994). John Elkington formulated a sustainability framework that facilitates a comprehensive analysis of an organization's economic, social, and environmental impacts. Success encompasses three critical dimensions: economic profitability, environmental stewardship, and social equity (Elkington, 1994). This tripartite approach encourages organizations to evaluate their performance not only through traditional financial metrics but also through their contributions to sustainable development. The Triple Bottom Line (3P, TBL) concept incorporates three major areas that form the abbreviation 3P: profit, people, and planet/environment. According to (Elkington & Zeitz, 2014), an organization's mission should not only focus on economic achievements ('Profit') but also catalyze positive social ('People') and environmental ('Planet') development.

In 2015, the United Nations (UNs) adopted the Sustainable Development Goals (SDGs) through the resolution entitled "Transforming Our World: The 2030 Agenda for Sustainable Development." The overarching ambition of the SDGs is to address pressing global challenges, including but not limited to poverty, climate change, social inequality, and environmental degradation, with a primary focus on the promotion of sustainable development. The SDGs encompass a total of 17 overarching global goals. The SDGs are predicated on three pillars of sustainability: e.g., the economic, social, and environmental. The impact of start-ups and entrepreneurship development on the achievement of several SDGs is significant, especially SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure) (Cho, 2024; Gionfriddo & Piccaluga, 2024).

3. MATERIALS AND METHODS OF THE THESIS

This chapter outlines the research methodology utilized in this thesis, which adopts a holistic approach to examine the start-up ecosystem. The investigation is structured around two distinct perspectives, facilitating a comprehensive analysis of the multifaceted dynamics at play within this environment. The initial perspective considers the university business incubator as an institution that facilitates the incubation process for start-ups. The second perspective examines the start-ups as tenants within these university business incubators. A more detailed explanation of the methodology will be provided in each sub-study, as outlined earlier. The following discussion will begin with an overview of the research approach, research design, the temporal and geographical context of the study, and the sample and population involved. Subsequent sections will address the data collection and analysis methods used in the two sub-studies.

3.1 Research Approach

This research employs a quantitative approach to investigate the phenomenon of sustainable start-up incubation. The quantitative approach was chosen because the research aims to collect numerical data that can be measured and analyzed statistically, providing an objective perspective on how business incubators support start-up sustainability. Creswell & Creswell (2018) that the quantitative methodology is appropriate when researchers aim to empirically test hypotheses or systematically characterize distinct phenomena through structured data-gathering techniques. In this case, we employed a structured survey methodology to gather data focusing on incubation practices and the range of services offered to start-ups. The objective was to assess the correlation between these services and their influence on the sustainability of new ventures. The data that was thus generated was then subjected to analysis using statistical techniques, such as quantitative descriptive analysis, with the objective of providing a comprehensive insight into the state of business incubators in supporting sustainable start-ups. Another statistical approach that can be utilized is structural equation modeling (SEM) analysis. SEM is a sophisticated statistical technique designed to explore the relationships between variables within complex models (Becker et al., 2018; Hair et al., 2017).

This method is particularly valuable in research focusing on the interplay between the sustainable start-up ecosystem and the entrepreneurial process, which includes stages such as idea generation, prototype development, validation, as well as production and commercialization.

3.2 Research Design of the Thesis

In order to achieve the study's objectives Figure 6 is illustrated. The research will be conducted in three stages. Initially, a literature review will be conducted using bibliometric data to gather literature relevant to the research objectives. Following this objective, two surveys will be administered,

utilizing a structured questionnaire as the tool. The follow-up survey (Part 1) will focus on all university business incubators in Bali Province, Indonesia, with the aim of obtaining and analyzing the profile of the business incubators. The subsequent survey will target all start-ups currently or previously incubated in each university business incubator in Bali Province. The goal of the second survey (Part 2) is to gather a comprehensive profile and evaluate the performance of these start-ups.

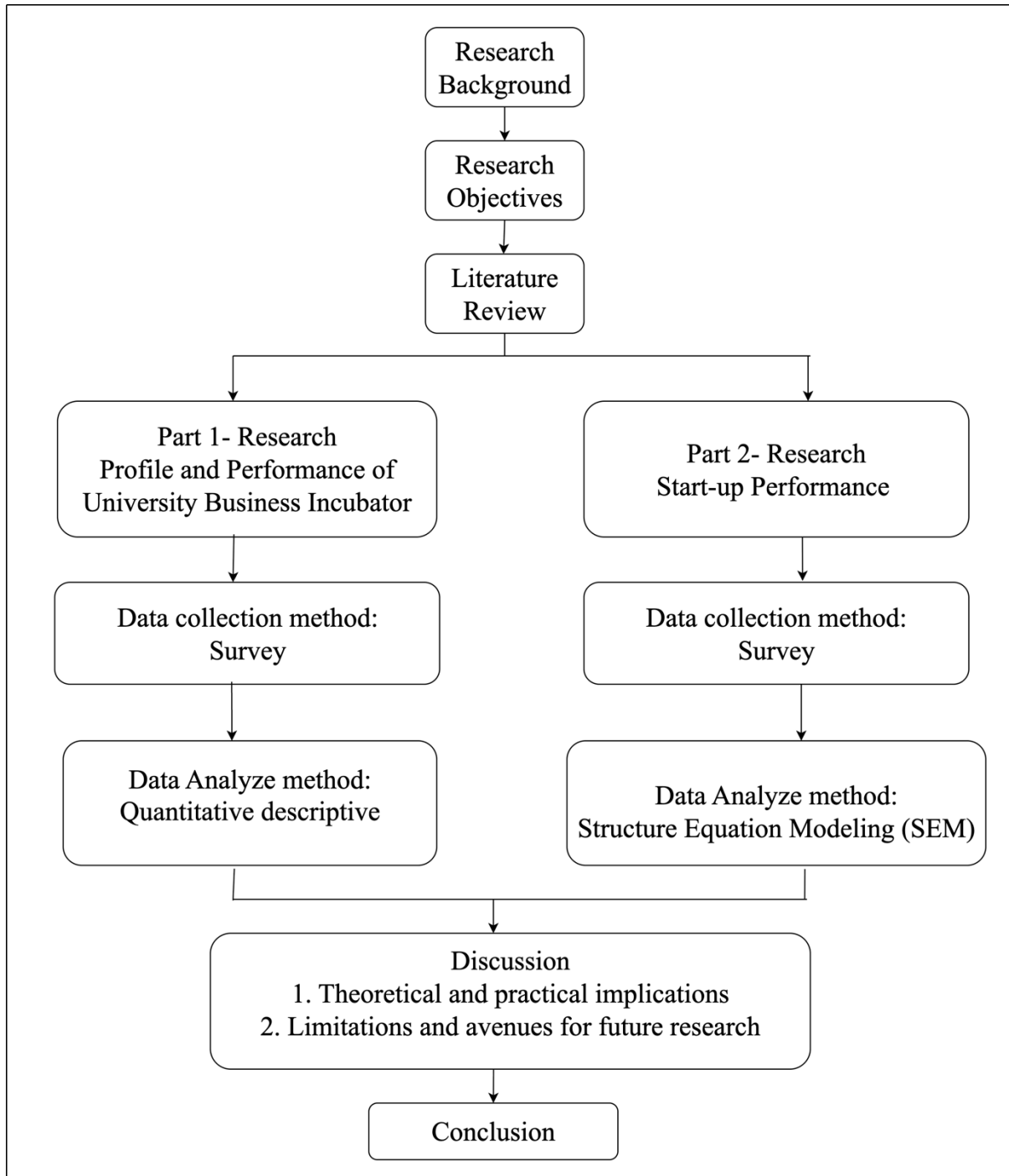


Figure 6: Research Design of the Thesis

Source: author's compilation (2025)

3.3 Timeframe and Geographical Scope of the Research

The initial survey was conducted among all university business incubators in Bali Province, Indonesia, with the purpose of obtaining and analyzing their profiles. According to data from the Association of Indonesian Business Incubators (AIBI), there are currently 14 university business incubators in Bali Province. The implementation of a survey and the distribution of questionnaires will take place from 2023 to 2025 and will be divided into two separate surveys.

3.4 Sample Frame and Population

3.4.1 Research Part 1

The population for Part 1 of the study comprised all university business incubators in Bali Province. The sampling technique employed in this research utilized a census approach, which is a data collection method where the entire population serves as the subject of investigation or survey. The total research sample consisted of 14 higher education business incubators located in Bali Province. The respondents responsible for completing the questionnaire in this study were managerial staff or employees affiliated with the university business incubators.

3.4.2 Research Part 2

The population for the research Part 2 includes all start-up tenants who have been incubated or are currently being incubated by university business incubators in Bali Province. The total population based on the results of data mining in Part 1 of the research survey was 487 tenant start-ups. Using this calculation method (Soper 2025), an online calculator was employed to determine the minimum sample size. The online calculator technique is relevant (Cohen, 1992; Westland, 2010). There are two lower bounds for determining sample size in Structural Equation Modeling (SEM). The first is based on the ratio of observed (indicator) variables to latent variables, while the second depends on the minimum effect size, statistical power, and significance level. The analysis yielded a minimum sample size of 150 for detecting the effect in SEM (see Figure 7).

Expected effect size:	<input type="text" value="0.3"/>	?
Latent variables:	<input type="text" value="5"/>	?
Observed variables:	<input type="text" value="36"/>	?
p-value:	<input type="text" value="0.05"/>	?
Statistical power:	<input type="text" value="0.8"/>	?
<input type="button" value="Calculate!"/>		
Minimum sample size to detect effect: 150		

Figure 7: Minimum Sample Size Statistical Calculation of SEM

Source: author's compilation (2025)

3.5 Data Collection

The research employs a survey method, a recognized primary data collection technique. The survey was conducted using Google Forms, an online platform that enables the efficient distribution of questionnaires. The survey focused on university business incubators and their tenants, with surveys sent via email to these entities.

3.6 Data Analysis Methods

The data analysis methods utilized in this thesis can be classified into two distinct categories, as outlined below:

Quantitative descriptive analysis aims to present a quantitative report on the profile of sustainable business incubators based on survey results. Quantitative descriptive analysis is a statistical method utilized to describe the characteristics of data numerically and systematically (Creswell & Creswell, 2018). This approach aims to provide a concise description or summary of the collected data without engaging in hypothesis testing or statistical inference (Luthan et al., 2024). Quantitative descriptive analysis is frequently employed in preliminary research to explore patterns, trends, and data distributions, thereby offering a foundational understanding of the phenomenon under investigation.

A Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis was performed. PLS-SEM is a statistical technique employed to examine the relationships among variables within complex models (Becker et al., 2018). In this study, a reflective model is utilized, in which indicators (observed variables) are influenced by latent constructs (Hair et al., 2017). Essentially, the latent variable serves as the underlying cause of the indicators, which are regarded as manifestations or reflections of the latent construct. This model assumes that changes in the latent variable directly affect the observed indicators, thereby establishing a causal relationship from the latent construct to its corresponding indicators. The constructs analyzed in this study were assessed using SmartPLS 4.0, a software program designed to evaluate the proposed model. The thesis consists of two analytical stages: the measurement model test and the structural model test.

4. RESEARCH PART 1: UNIVERSITY BUSINESS INCUBATOR PROFILE AND PERFORMANCE

4.1 Introduction of the Research Part 1

The purpose of this study is to examine the shortcomings and potential of incubator support systems in the process of incubating sustainable start-ups. The research will also address the identification of good practices and the transfer of good practices. The overall research questions are: (1) What kind of support do university business incubators offer to sustainable start-up incubation? (2) What is the profile and performance of university business incubators in relation to the incubation goals of sustainable start-ups? (3) What can we learn from good practices in the field of sustainable start-up incubation? (4) What are the characteristics and socio-economic impacts of business incubator universities in Bali Province, Indonesia?

In the following, we present the framework of the survey, as shown in Figure 8. As part of this work, the following research activities have been conducted such as literature review on university business incubators, development of survey questions and survey distribution to existing university business incubators in Bali Province, Indonesia. These activities are presented in the following statement, as they will be reported in the next part of this research.

4.2 Literature Review of the Research Part 1

4.2.1 University Business Incubators

University Business Incubators (UBIs) are becoming increasingly popular as they promote entrepreneurship, technology transfer, and economic development (Armas & Moralde, 2022; Redondo & Camarero, 2019). However, the structure, processes, and management models of UBIs can vary widely, leading to different issues that require different solutions (Armas & Moralde, 2022; Elena, 2014). Essentially, a business incubation program is a process that provides guided management and technical assistance to young and growing companies, accelerating their successful development through the incubator's network and facilities (Grimaldi & Grandi, 2005). Several critical factors that contribute to the effectiveness of start-up incubation programs, namely access to funding, mentorship and coaching, networking opportunities, and adequate infrastructure and human capital (Máté et al., 2024). The various models for incubation have different implications for resource management, including differences in funding, organization, personnel, technology, networks, and infrastructure (Moray & Clarysse, 2005). Furthermore, integrating sustainability practices and principles into incubation initiatives can significantly enhance start-up performance and impact, while also advancing broader societal and environmental objectives (Máté et al., 2024). In order to understand the process of start-up formation and graduation, a conceptual framework has been

proposed that includes pre-incubation, incubation, and post-incubation stages (Mungila Hillemane et al., 2019).

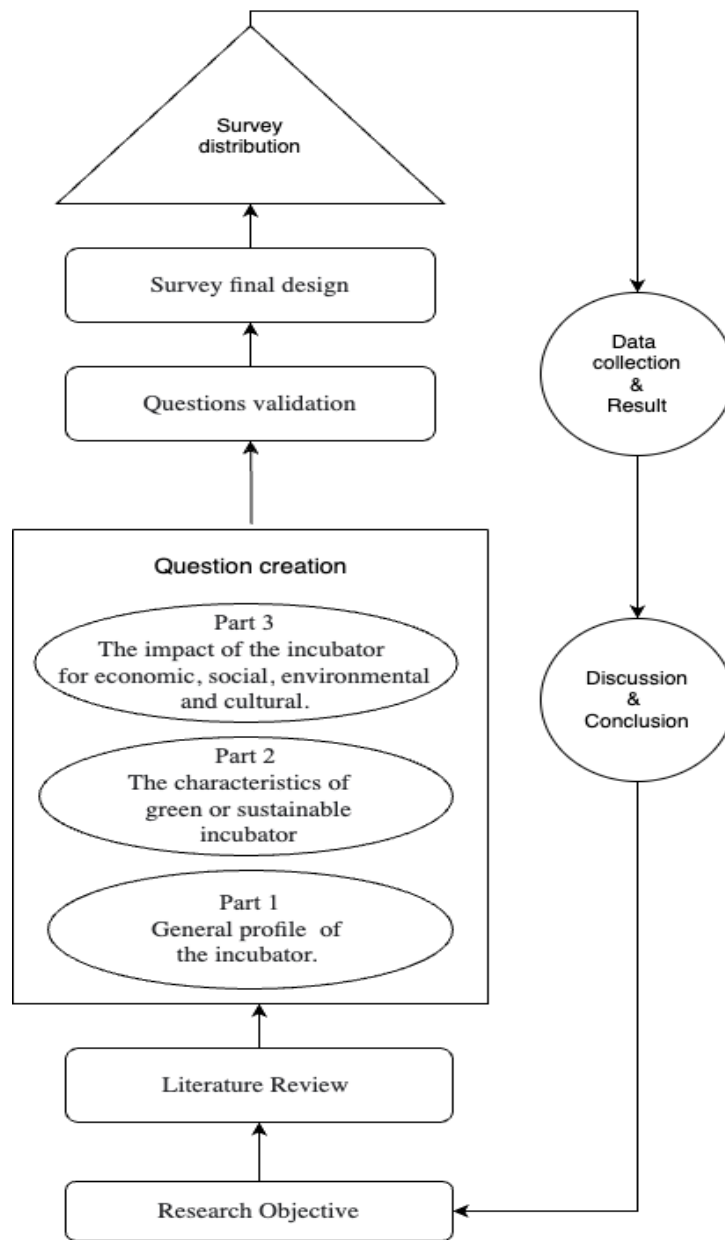


Figure 8: Survey Framework of the Research Part 1

Source: author's compilation (2025)

University incubator structures for spin-offs are a learning process that involves exercising decision-making power over the social network of senior management in the financial and business community (Moray & Clarysse, 2005). This approach provides science-based entrepreneurial ventures with the necessary human, financial, and technological resources to commercialize knowledge (Mascarenhas et al., 2017). The growth of technology-based organizations depends on spin-off creation, an essential component of university entrepreneurship. The creation of entrepreneurial universities involves selecting a commercialization strategy, financing a start-up, promoting a product, and planning an

exit (Yetisen et al., 2015). Institutions and local contexts play a crucial role in promoting academic spin-offs (Fini et al., 2011). During the industry's incubation stage, technological investments are necessary between a technological breakthrough and the first instance of commercialization (Moeen and Agarwal, 2017).

The University's program promotes sustainable entrepreneurship and its impact on regional development (Wagner et al., 2021). This educational approach to sustainable development applies the concept of planned behaviour to attitudes toward entrepreneurial forms of sustainability education. The data indicate a strong relationship between the perceived benefits of sustainability education entrepreneurship and new entrepreneurs' intention to employ these benefits. The outcomes of university entrepreneurial ecosystems depend on the processes of connectedness and filtration (Prokop, 2021). Thriving university entrepreneurial ecosystems are characterized by strong connectedness and effective filtration, with a solid local and interregional character.

4.2.2 Sustainable Business Incubator and Performance Evaluation

Measuring the performance of incubators can be executed from a macro perspective by evaluating their impact on wealth creation, local employment levels, or sustainable development (Deyanova et al., 2022). Public administrations are progressively recognizing the pivotal role that incubators play in fostering innovation and driving economic development. These entities are essential in nurturing and facilitating the commercialization of start-ups, thereby enhancing regional competitiveness, and creating sustainable economic growth (Escobar, 2020). A framework for the evaluation of technology incubators within science parks was established by (Chan & Lau, 2005). The primary benefits of these incubators are for instance, encompass resource sharing, access to advisory services, improved public perception, expanded networking opportunities, the generation of cluster effects, geographic proximity, cost subsidies, and financial assistance.

Pattanasak et al. (2022) identified six categories for measuring the performance of incubators, placing particular emphasis on the evaluation of social capital. Financial resources are also commonly considered by academics, as these concrete resources can demonstrate the success of business incubators, particularly regarding continued support for activities (Pattanasak et al., 2022). Networking and marketing aspects are also considered significant nonfinancial factors, as networking enables incubators to exchange resources with third parties, and marketing strategies might help businesses avoid market failure. However, knowledge-sharing and performance measurement systems were the least popular nonfinancial factors. As a result, business incubators must have effective management when dealing with external partners, particularly when acquiring capital.

On the other hand, intangible sub-factors are typically associated with internal operations, as they pertain to resources within the organization, such as business incubator professionals or incubation

services. Business incubators should prioritize social capital as a critical success metric. It reflects the importance of building external relationships and fostering a supportive ecosystem where businesses can collaborate with other stakeholders, both public and private. More attention should be given to tenant entry and exit procedures, as these are typically determined by government policies that can be challenging to navigate. It recommends monitoring innovation performance throughout the incubation process rather than concentrating exclusively on inputs and outputs. Additionally, the study advocates for the exploration of more innovative entry and exit criteria, as well as the adoption of management strategies like the Balanced Scorecard and Internal Control, which are vital for effective business intelligence.

Alongside the importance of social capital, the study highlights the necessity for business incubators to foster connections with external resources, such as investors, which are essential for driving innovation and growth. One promising avenue is venturing capital (VC), which not only serves as a vital source of funding but also functions as a cornerstone of a dynamic entrepreneurial ecosystem (Becsky-Nagy & Fazekas, 2024). Notably, government engagement in the VC sector has been recognized as a pivotal enabler of supportive environments for young, innovative enterprises, thereby amplifying the potential for scalable (Fazekas & Becsky-Nagy, 2021, 2026) and sustainable human resource management (HRM) integration (Estiyanti et al., 2025).

4.2.3 Incubators and Regional Development

Business incubators are instrumental in fostering regional development, as highlighted by Klofsten and Bank (2016). Moreover, Lamine et al. (2016) emphasize the critical importance of technology transfer and innovation within these incubators, underscoring their role as catalysts for economic growth and competitiveness in local ecosystems. Business incubators in regional entrepreneurial ecosystems promoting ecosystem biodiversity, accelerating start-ups within the entrepreneurial university, supporting green technology mechanisms for regional development, and connecting entrepreneurship education, experiential knowledge, and regional development. These aspects have been on the minds of early scholars who emphasized the importance of promoting regional development. The incubators act as tools for disseminating knowledge from knowledge-generating systems such as universities and research institutions to the economic sphere of society (Klofsten & Bank, 2016).

Mian et al. (2016) proposed a model for knowledge-based regional development consisting of four stages: inception, implementation, consolidation, and renewal. According to them, innovation policy is created through collaboration among three critical actors: business, government, and academics. This 'collective entrepreneurship' paradigm involves the active participation of all actors and is commonly known as the Triple Helix in literature. Etzkowitz & Klofsten (2005) contend that the

establishment of entrepreneurial universities is essential for fostering knowledge-driven regional development. They emphasize that such institutions serve as critical nodes for innovation, facilitating the transfer of knowledge and technology while enhancing collaboration between academia, industry, and government. This triadic relationship ultimately catalyzes economic growth and social progress in the surrounding areas. Higher education institutions (HEIs), including universities, are a valuable resource network for high-technology firms.

Universities support disseminating knowledge to improve sustainable entrepreneurial ecosystems that benefit economic revitalization or further regional development (Wagner et al., 2021). Additionally, they promote stakeholder involvement in crucial governance processes at the regional level. Wagner et al. (2021) offer a unique perspective that elucidates the various roles of universities, the processes through which knowledge exchange occurs, and the resulting outputs, outcomes, and impacts at both the regional level and beyond. Their study demonstrates that varying university configurations, pathways, and intervention points can foster sustainable entrepreneurial ecosystems, contingent on the specific regional context.

Entrepreneurs prioritizing sustainability are crucial in driving environmental innovation (Bank & Kanda, 2016). Sustainability-focused business incubators are specialized programs that nurture and promote start-ups and organizations prioritizing sustainability and environmental responsibility. These incubators offer valuable resources, guidance, and a supportive community to businesses committed to sustainable practices, eco-friendly products, and reducing their environmental footprint (Bank & Kanda, 2016; Saura et al., 2019).

Surana et al. (2020) emphasize that Science, Technology, and Innovation (STI) play a pivotal role in facilitating the attainment of sustainable development objectives over the long term. Their analysis underscores the integral relationship between STI and the advancement of comprehensive developmental strategies. Van Rijnssoever et al. (2016) examined how entrepreneurial support organizations can incorporate sustainable development of start-ups (SDSs) into their ecosystems. Meanwhile, business incubator support services focus on the long-term success of entrepreneurs. Meanwhile, business incubator support services focus on the long-term success of entrepreneurs (Karahan et al., 2022). Almansour (2024) analyzed the potential benefits of utilizing technological advancements, such as digital marketing, and the importance of aligning with relevant Sustainable Development Goals (SDGs) to enhance these initiatives.

4.2.4 Sustainable Business Model Innovation

Sustainable Business Model Innovation (SBMI) is one of the strategic approaches that incorporates environmental and social considerations into an organization's aims and operations (Baldassarre et al., 2020). Several trends and drivers are influencing sustainability-related business model innovation,

including the circular economy (recycling, veganism, upcycling), corporate social responsibility (sweatshop-free practices, fair trade, locally sourced products), the sharing economy and collaborative consumption (fashion libraries, second-hand goods, cooperative efforts), technological innovation (sustainable raw materials, zero waste initiatives, wearables), and heightened consumer awareness (capsule wardrobes, slow fashion) (Todeschini et al., 2017). SBMI requires creating value propositions that benefit numerous stakeholders simultaneously, including customers, shareholders, suppliers, and partners, as well as the environment and society (Baldassarre et al., 2017). User-driven innovation involves potential consumers, users, and/or other stakeholders in an experimental and iterative design process, allowing for the development of solutions that are meaningful for people and profitable for businesses. One of the major challenges of this strategy is that many business model concepts fail to reach the market, which is required to have an impact (Baldassarre et al., 2020).

4.3 Material and Methods of Research Part 1

4.3.1 Research Instrument

This research commenced with the development of a research instrument design, which was constructed based on a pre-established research model and supported by relevant academic literature. The instrument was subsequently structured into a questionnaire format, comprising items related to respondents' demographic profiles, the characteristics of university business incubators, and their societal impact. Prior to its finalization, the preliminary version of the questionnaire was submitted to three selected experts for review. These experts assessed each item in terms of its alignment with both academic theory and the practical context of business incubation in Indonesia. Following this review, a readability and interpretation test was conducted to evaluate the clarity and comprehensibility of the questionnaire from the respondents' perspective. This process was carried out to ensure the validity and reliability of the data to be collected. The finalized research instrument is presented in Appendix 1.

4.3.2 Data Collection Design

The data collection employed a survey in this research. The survey was administered using Google Forms, an online platform that facilitates the efficient distribution of questionnaires. The target population of the thesis was comprised University Business Incubators (UBIs), and the survey instrument was disseminated to these entities via email. Data collection for Part 1 of this research was conducted between September 2023 and March 2024.

4.3.3 Data Analysis Method

Data analysis in Research Part 1 employs the quantitative descriptive analysis method (Creswell & Creswell, 2018), wherein the data will be visualized through graphs and subsequently described in

detail. The primary objective of this study is to present a comprehensive quantitative report on the survey results, focusing on the profile and performance of sustainable business incubators.

4.4 Results of the Research Part 1

4.4.1 Profile of University Business Incubators

The results of the survey are presented in the following table and graph. The respondent data from universities willing to complete the questionnaire (Table 3). Business incubators were established at different times from 1998 to 2023. In addition, of the 14 respondents who completed the online survey, their position in the incubator was as head of the business incubator for 11 respondents (78.6%) and as staff for 3 respondents (21.4%).

Table 3: Data of the Respondents of Survey 1 (Bali, Indonesia)

No	Institutions	The year of incubator established
1	Universitas Hindu Indonesia	2017
2	Universitas PGRI Mahadewa Indonesia	2013
3	Universitas Warmadewa	2017
4	Universitas Pendidikan Nasional	2018
5	Universitas Mahasaraswati Denpasar	1998
6	Institut Bisnis dan Teknologi Indonesia	2016
7	Universitas Primakara	2014
8	Bali Tourism Polytechnic	2019
9	Universitas Ngurah Rai	2015
10	Institute of Technology and Business STIKOM Bali	2014
11	Universitas Pendidikan Ganesha	2018
12	Universitas Triatma Mulya	2023
13	Politeknik Negeri Bali	2021
14	Universitas Udayana	2016

Source: author's collection (2025)

Figure 9 illustrates the ownership composition of incubators. According to the survey results, the distribution of private investor ownership among university incubators is as follows: 11 incubators fall within the 0-24% ownership range, 2 in the 25-49% range, 1 in the 50-74% range, and none in the 75-100% range. For university ownership, the percentages are distributed as such: 0 incubators at

0-24%, 1 at 25-49%, 3 at 50-74%, and 10 at 75-100%. In terms of ownership by government agencies (federal, regional, or local), the numbers show 10 incubators in the 0-24% range, 2 in the 25-49% range, 2 in the 50-74% range, and none in the 75-100% range. For other forms of ownership, there are 12 incubators in the 0-24% category, none in the 25-49% range, 2 in the 50-74% range, and none in the 75-100% range. From this data, it can be concluded that university business incubators in Bali Province, Indonesia, are predominantly owned by universities. In contrast, private investors and others have the most minor ownership.

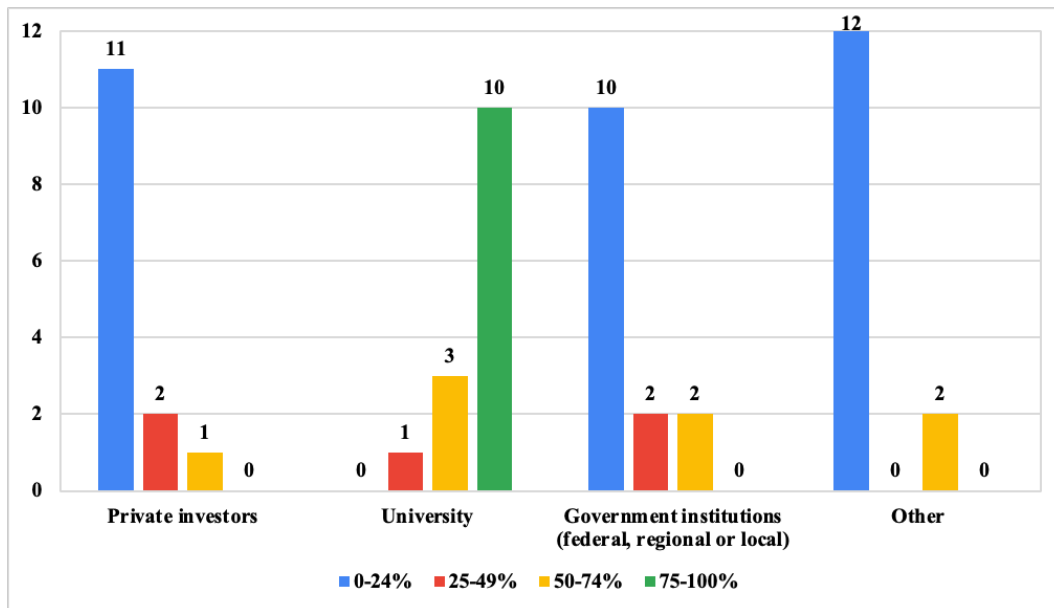


Figure 9: Entities forming Ownerships of the Incubators

Source: author's compilation (2025)

Note: The left axis is the number of ownership entities, right axis is the proportion (%) of ownership.

Figure 10 shows innovation/technology transfer units/organizations operating at incubators.

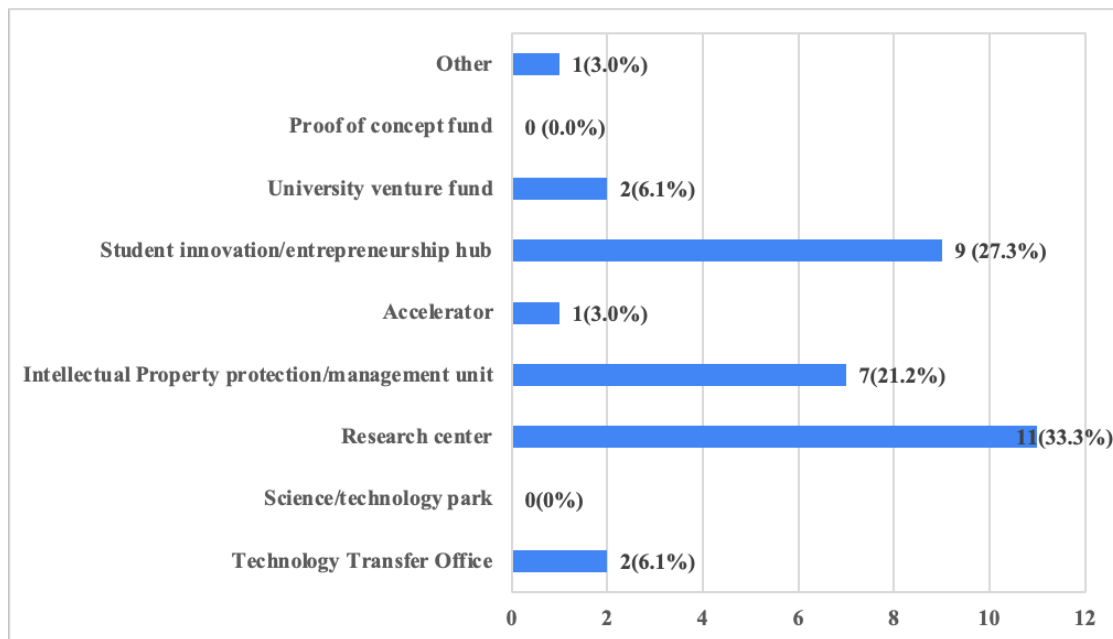


Figure 10: Innovation/technology Transfer Units/Organisations (%) Operating at the Universities

Source: author's compilation (2025)

Note: The left axis is the innovation/technology transfer units/organisations operating at the university other than incubators, and the right axis is the number of university business incubators,

The survey results indicate that the most prevalent units within universities are Research Centres, constituting 11 (33.3%) institutions. This result is followed by Student Innovation/Entrepreneurship Hubs at 9 (27.3%) and Intellectual Property Protection/Management units at 7 (21.2%). University Venture Funds and Technology Transfer Offices each account for 2 (6.1%) universities, while Accelerators comprise 1 (3.0%). Furthermore, the data reveals that no universities in Bali Province have established innovation units in the form of Science/Technology Parks or Proof of Concept funds.

Figure 11 outlines the various services that the incubator offers to its clients. According to the survey results, the most offered services are Training (which includes seminars and workshops) and Coaching (encompassing management, accounting, finance, and marketing), provided by 12 universities (85.7%). Following closely are Shared Resources (such as reception areas, meeting rooms, and parking facilities) available at 10 universities (71.4%). Additionally, Access to finance options (including loans, business angels, and seed and venture capital) and Scientific Equipment and Materials (laboratories) are offered by 9 universities (64.3%). Additionally, Access to Professional Services (such as patent attorneys, legal counseling, and strategy consulting) and Office Space are available at 8 universities (57.1%). Lastly, Other services are reported by 1 university (7.1%).

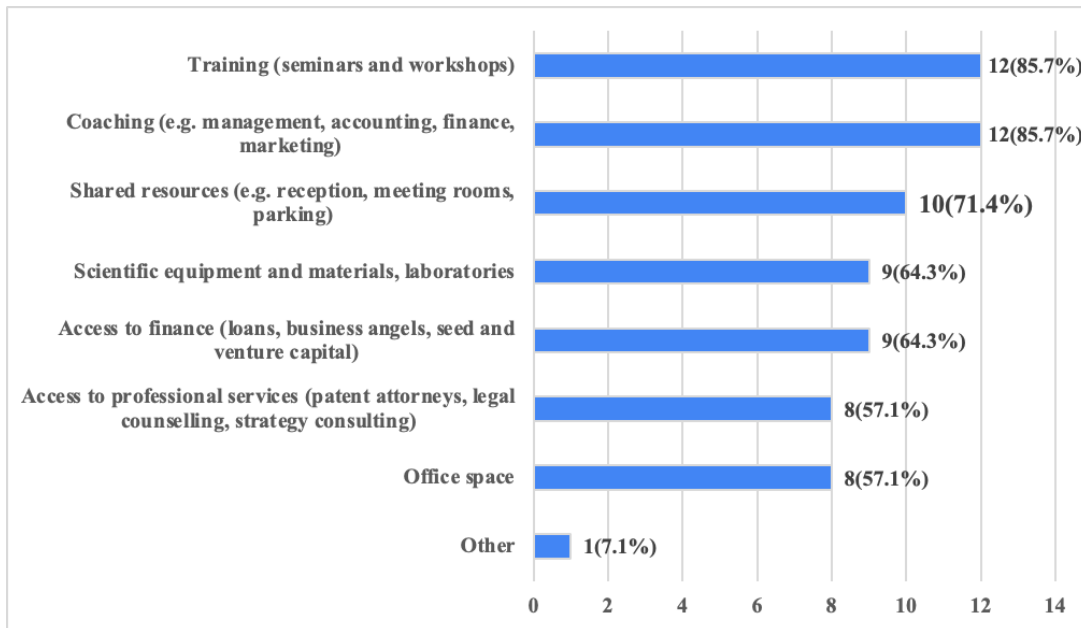


Figure 11: Types of Services (%) the Incubator Provides to Clients

Source: author's compilation (2025)

Note: The left axis is the types of services the incubator provides to clients, right axis is the number of university business incubators.

Figure 12 describes the industry or field of knowledge the incubator explicitly targets. The survey results indicate the following distribution: Culture, creative industries, and arts are represented in 9 universities (64.3%); IT, software, big data, AI, and telecommunications are found in 8 universities (57.1%); Cleantech, Greentech, renewable energy, and environmental services, along with biotech and life sciences, are present in 4 universities (28.6%); 2 universities (15.4%) reported no specific industry focus; and finally, both Other and Manufacturing and Fintech are represented in 1 university each (7.1%).

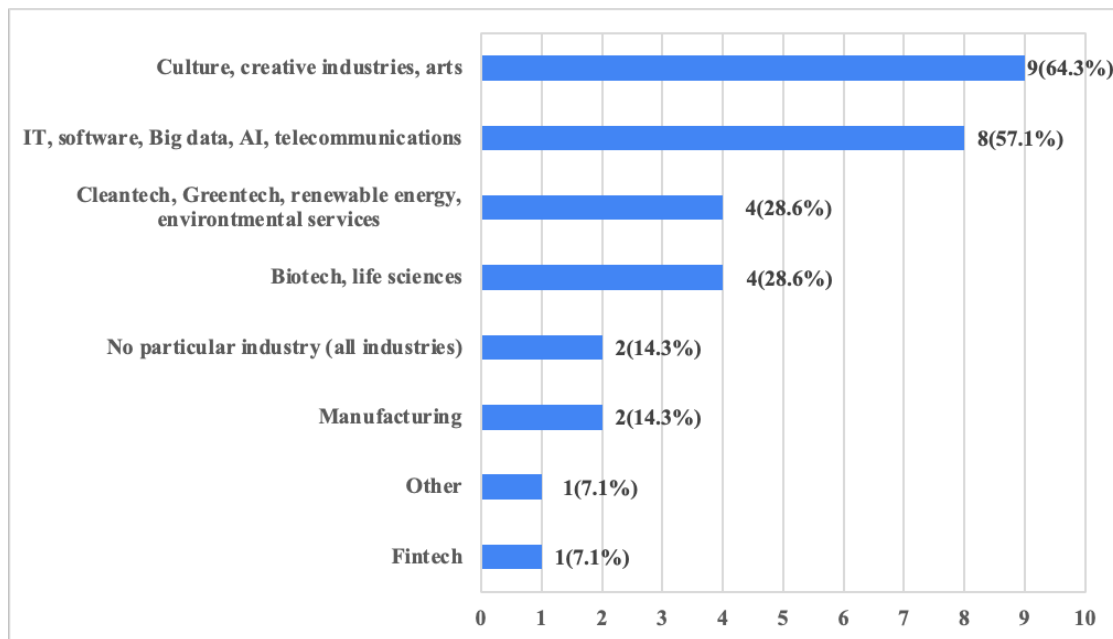


Figure 12: The Industry or Field of Knowledge (%) that the Incubator is Explicitly Targeting

Source: author's compilation (2025)

Note: The left axis is the industry or field of knowledge that the incubator is explicitly targeting, right axis is the number of university business incubators.

4.4.1.1 Start-up Tenants of University Business Incubators

In the past three years, the number of start-ups and spin-offs established at universities has been notably varied. According to survey findings, only one university, representing 7.7% of those surveyed, has successfully launched start-ups, with the highest individual count reaching 140. Over these three years, 21.4% of universities generated ten start-ups, while 14.3% managed to establish only one. One university accounted for 132 start-ups, which represents 7.1% of the total, and another university (also at 7.1%) launched start-ups in the numbers of 2, 5, 7, 24, 30, 45, and 70. In total, UBIs in Bali Province, Indonesia, have successfully established 487 start-ups and spin-offs over the last three years.

Figure 13 describes the average year start-ups stay in incubators. The survey results showed that most respondents answered 1-2 years for start-ups remaining in the incubator, 10 (71.4%) respondents. Followed by less than a year with 2 (14.3%) respondents. For 3-5 years and more than 5 years, the respondents received the same number of answers, namely 1 (7.1%). Most respondents answered that start-ups spend 1-2 years in the incubator due to several reasons, namely limited incubator facilities. In contrast, the incubator must accept new tenants every year due to the curriculum. Another reason is that it is related to the period for tenants to complete grants from start-up incubation programs by the government through universities.

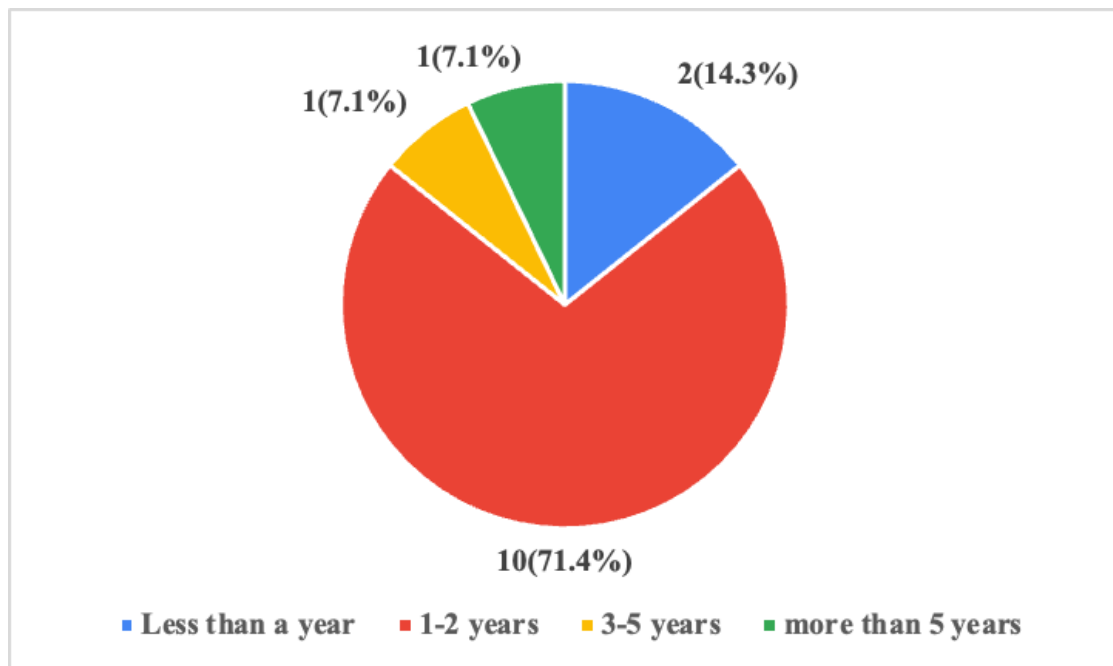


Figure 13: Average Start-ups Stay (Years) in Incubators

Source: author's compilation (2025)

The following information illustrates the number of university start-ups that have successfully exited, either through sale to investors or acquisition by other companies, in the past. The data indicates that one university has achieved the highest number of successful exits, totaling 70. Furthermore, five universities have not had any successful start-up exits. In total, there are 100 start-ups, representing 20.5% of those found in incubators, that have successfully exited, either by being sold to investors or acquired by other companies.

4.4.1.2 Patents and Licenses

The results of the survey show that UBIs have made the total patent applications over the last 3 years (2021-2023). Most universities have not applied for a patent in the last 3 years, namely 7 (50.0%) universities. Other data shows that 1 (7.1%) university has applied for 1 patent, 1 (7.1%) has applied for 2 patents, 1 (7.1%) for 3 patents and 1 (7.1%) has applied for 4 patents. The remaining 3 (21.4%) have applied for 5 patents in the last 3 years.

In addition, a survey was also carried out to find out how many patents have been granted to universities during the last 3 years (2021-2023). The results show that most universities, namely 8 (57.1%), have yet to receive a patent. A total of 1 (7.1%) university granted 1 patent, 3 (21.4%) granted 2 patents, and 1 (7.1%) granted 4 patents.

The total licenses that the university has granted to other organizations. The survey results indicate that most universities, specifically 10 (71.4%), still need to issue licenses to other organizations. In contrast, only 4 universities have successfully granted licenses. Among these, 2 universities (14.3%)

have provided 1 license each to another organization, 1 university has granted 3 licenses, and another university (7.1%) has issued 5 licenses to a different organization.

4.4.2 Resources of the University Business Incubators

4.4.2.1 Number of People Work in the Incubators

Based on the data, the number of people working in the incubators, including respondents, varies from 1 to 7. In total, 54 people work in the university business incubators in Bali Province, Indonesia. Fifty-seven percent (57%) of them are full-time staff. Additionally, the survey results indicate that university business incubators in Bali employ 142 external experts.

A noteworthy finding from the survey pertains to human resources, specifically the number of employees in start-ups founded at universities over the last three years (2021–2023). The data reveals that one UBI boasts the highest employee count, with 420 individuals working in the incubated start-up. Overall, there are a total of 1,249 employees across all start-ups founded at universities during this period.

4.4.2.2 Budget of the Incubators

The survey results regarding changes in annual budgets for university business incubator organizations in Bali Province, Indonesia, over the past three years (2021-2023) suggest a likely increase. Utilizing a Likert scale ranging from 1 to 5, where 1 indicates a significant decrease and 5 indicates a significant increase, most respondents, specifically 8 incubators (57.1%), selected a score of 3. Additionally, 5 respondents (35.7%) rated their experiences with a score of 4, while 1 respondent (7.1%) rated it a 5. These findings imply that university business incubators in Bali Province, Indonesia, have experienced varying degrees of budget increases over the last three years.

According to the findings from Figure 14, most university business incubators in Bali, Indonesia, specifically 7 out of 10 or 50.0%, allocate a significant portion of their annual budget towards developing sustainable and community-driven innovations. The survey indicates that most of these incubators allocate anywhere from 26-50% up to 76-100% of their budget, with only a tiny percentage of incubators allocating 1-25% or none. Overall, the data suggests a positive trend toward investing in sustainable and community-focused innovations within the university business incubators located in Bali Province.

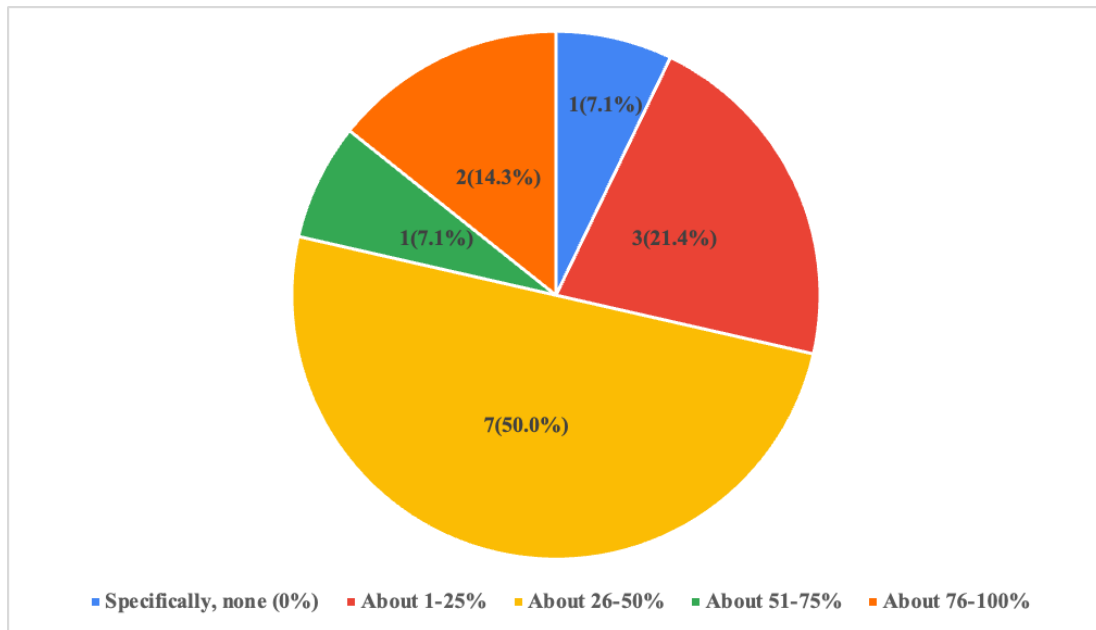


Figure 14: The Percentage of Annual Budget Allocation to Develop Innovations that Provide Sustainable/Community Benefits.

Source: author's compilation (2025)

4.4.2.3 Income Sources of the Incubators

Figure 15 explains the amount of income earned by UBIs in Bali Province, Indonesia, in the last 3 years (2021-2023) from various sources of income, namely Royalties (licensing fees), Revenues from TT services provided to the market, Profits (dividends) from spin-offs/start-ups, Income from the sale (exit) of a university start-up or spin-off company, Resources allocated from university budget, Laboratory services, measurement, certification, Leasing of assets (equipment, buildings, and inventory), Government funding/grants, and Other resources. Based on the survey results, most business incubators have not obtained a source of income from their operational results. Only 2 university business incubators have sources of income of more than one billion IDR, namely income originating from government funding/grants and other resources. Other facts show that their average income is less than 100 million IDR and 101-500 million IDR from various sources.

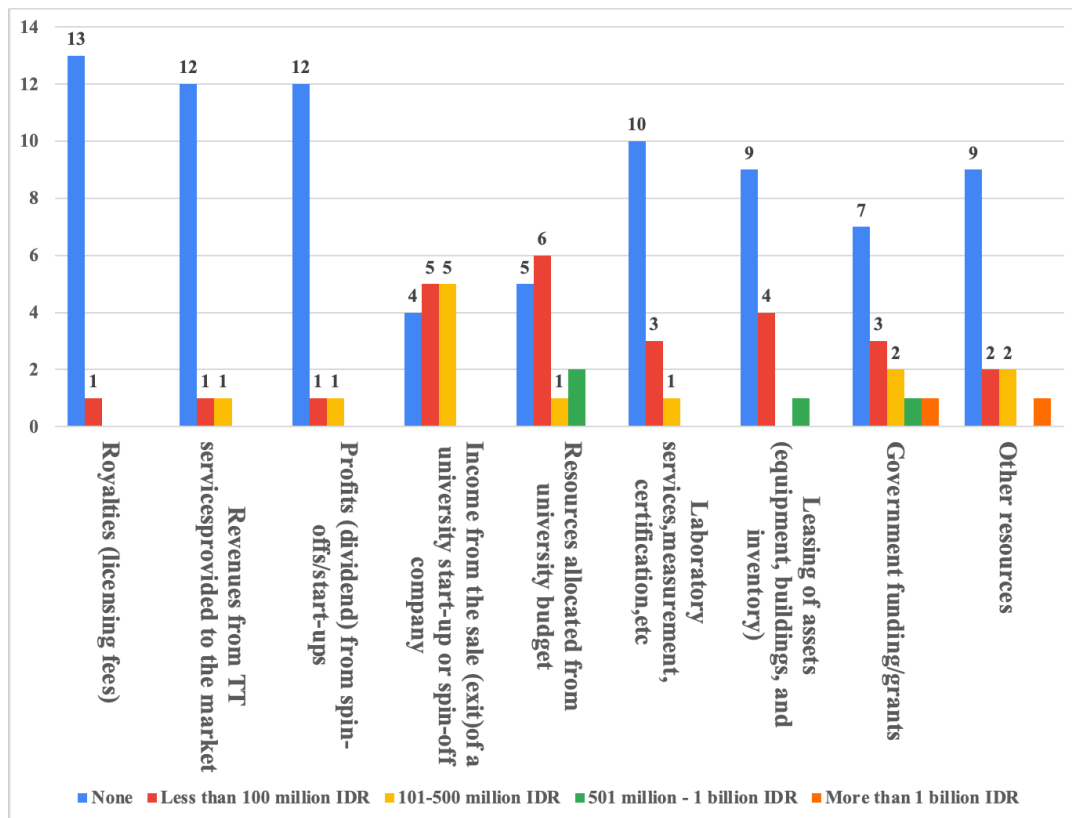


Figure 15: Income Sources (Indonesian Rupiah) of the University Business Incubators

Source: author's compilation (2025)

Note: The left axis is the number of income sources, right axis is the range (Indonesian Rupiah) of the total income sources.

4.4.3 Support Mechanism of the UBIs for Sustainable Start-up Development

Based on Figure 16, the incubator has implemented proactive measures to promote tenant success in achieving specific objectives. The survey results reveal that out of the 14 participants, 64.3% (9 respondents) reported that the incubator actively supports tenants in reducing the negative environmental or social impacts of their products and operations. Additionally, 14.3% (2 respondents) noted that the incubator encourages tenants to enhance their environmental or social performance by developing business ideas. Two other respondents (14.3%) provided different answers. One respondent (7.1%) preferred to avoid answering or was uncertain, while the remaining respondent did not choose any of the options provided.

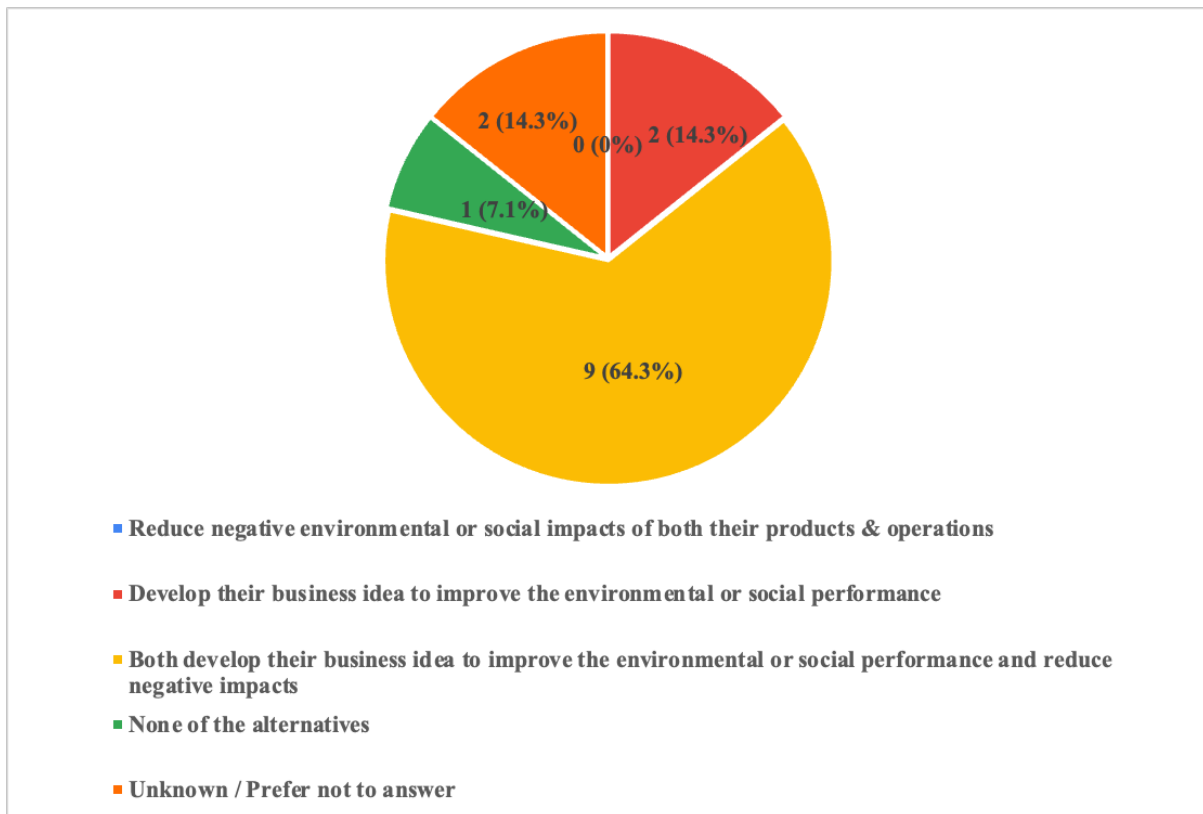


Figure 16: The Incubator's Efforts (%) to Actively Encourage Tenants to Achieve Specific Goals

Source: author's compilation (2025)

Figure 17 illustrates the incubator's continuous initiatives to support start-ups in realizing various economic, social, environmental, cultural, and other benefits. Based on the survey results, the consistent efforts made by the incubator in promoting start-ups to achieve these benefits (identified as "always") are as follows:

- Five incubators indicated economic benefits.
- Three incubators cited cultural benefits.
- Three incubators pointed to environmental benefits.
- Three incubators highlighted social benefits.
- One benefit was not included in any selections.

The findings reveal that UBIs in Bali Province, Indonesia, are particularly effective in encouraging start-ups to attain economic benefits.

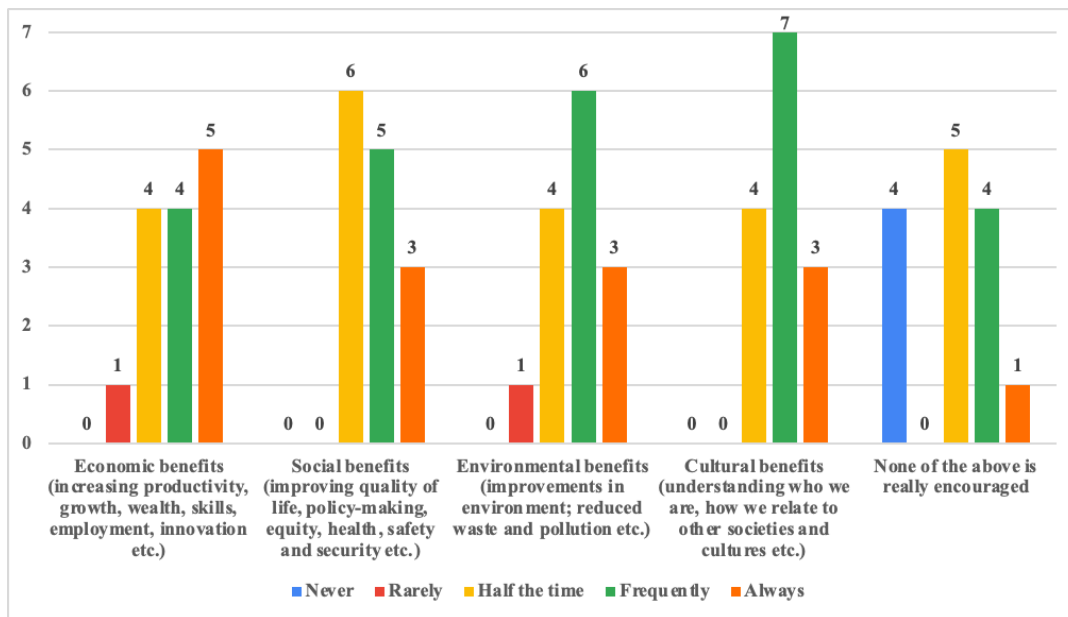


Figure 17: The Incubator's Activeness (Numbers) in Encouraging Start-ups to Achieve Benefits

Source: author's compilation (2025)

Note: The left axis is the number of university business incubators, right axis is the frequency of the incubator's activeness in encouraging start-ups to achieve one of the following benefits.

Figure 18 explains how important it is for incubators to consider economic, social, environmental, and cultural benefits when pursuing technology transfer projects and developing start-ups or spin-offs. According to survey results, respondents considered these benefits to be the most fundamental, with a score of 5 on the Likert scale. Economic benefits were the most popular choice, with 5 respondents (36%) choosing them, followed by social benefits with 4 respondents (28.6%), environmental benefits and cultural benefits with 3 respondents (21.4%) each. The survey also revealed that the most common score selected by respondents was 4 on the Likert scale, with social, environmental and cultural benefits being the highest, with 7 respondents (50.0%) each. Economic benefits were selected by 5 respondents (36%).

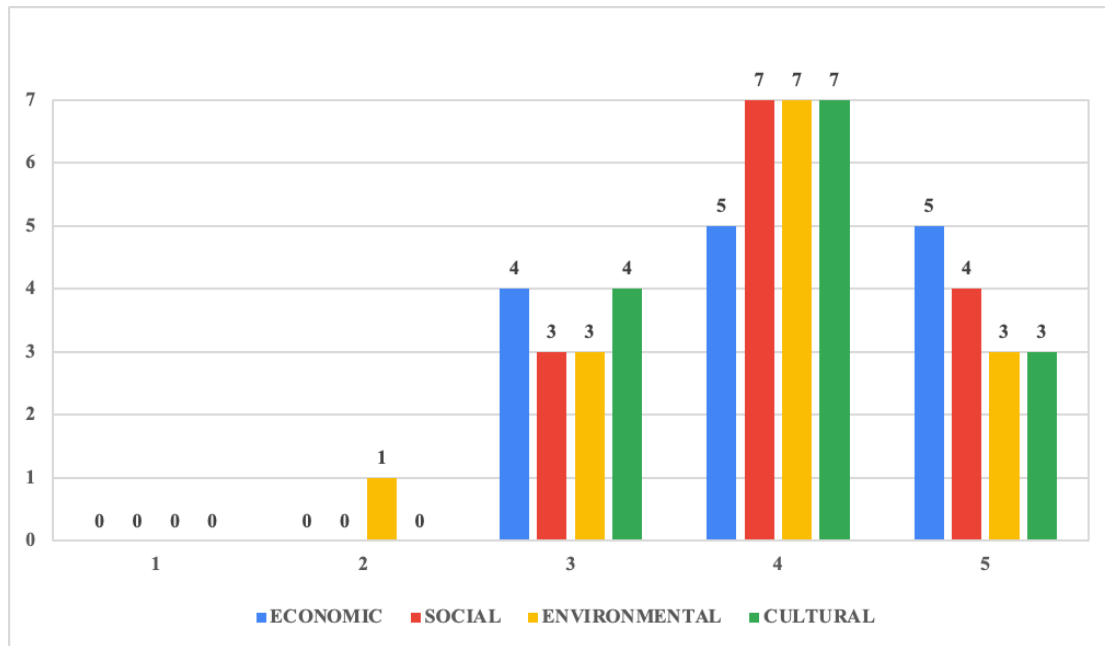


Figure 18: The Importance Level of Economic, Social, Environmental, and Cultural Benefits for Incubators

Source: author's compilation (2025)

Note: The left axis is the number of university business incubators, and the right axis is the importance of economic benefits, social benefits, environmental benefits, and cultural benefits for incubators in initiating technology transfer (TT) projects and developing start-ups/spinoffs in the Linkert scale 1-5: (1) Not important at all, (5) Very important

According to Figure 19, university business incubators in Bali Province, Indonesia, consider the impacts of firms with economic, social, environmental, cultural and growth benefits when selecting new tenants. The survey results indicate that these impacts are always considered, with "Firms with growth prospects" being the most chosen criteria by 5 university business incubators, followed by "Firms with economic benefits" selected by 4 incubators, and "Firms with social, environmental and culture benefits" selected by 2 incubators each. These findings suggest that while social, environmental and cultural impacts are considered, university business incubators in Bali Province prioritize companies with economic and growth prospects when selecting new tenants.

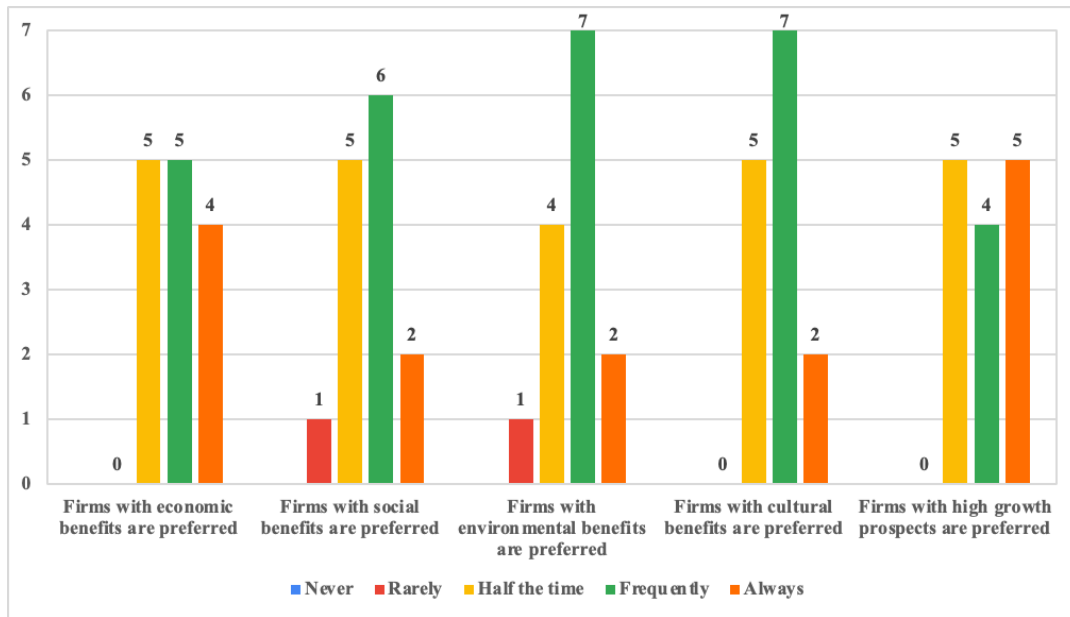


Figure 19: Frequency (Numbers) Considers the Impacts in the UBIs New Tenant Selection Criteria

Source: author's compilation (2025)

Note: The left axis is the number of university business incubators, right axis is the frequency that considers the following impacts in the university incubator's new tenant selection criteria.

4.4.4 The Successfulness of Sustainable Start-up Incubation

4.4.4.1 Number of Sustainable Start-up

According to the survey result, there were 14 respondents to a questionnaire regarding the number of incubator tenants with green, sustainable, or eco-friendly products/services as their core business in the last 3 years. In the past 3 years, from a total of 487 start-ups, there have been 55 (11.3%) tenants with green, sustainable, or environmentally friendly products/services as their core business across all university business incubators in Bali Province.

Moreover, 25 start-ups that have exited in the last three years from university business incubators in Bali Province, Indonesia, offer sustainable or societal benefits. It accounts for 6.6% of the total 487 start-ups. Further analysis reveals that one university start-up business incubator had two successful exits, four had two successful exits, one had three successful exits, one had four successful exits, and one incubator had ten successful exits.

According to Figure 20, among the start-ups established in the past three years, 81-100% aim to deliver economic, social, environmental, and cultural benefits through two incubators. Additionally, 61-80% of the start-ups launched in this period have a primary focus on providing economic benefits. Furthermore, three incubators are dedicated to social and environmental benefits, while two specifically target cultural benefits. Of the start-ups founded in the last three years, 41-60% do not

intend to provide economic benefits, with three aiming to offer social benefits, four focusing on environmental benefits, and three dedicated to cultural benefits through incubators.

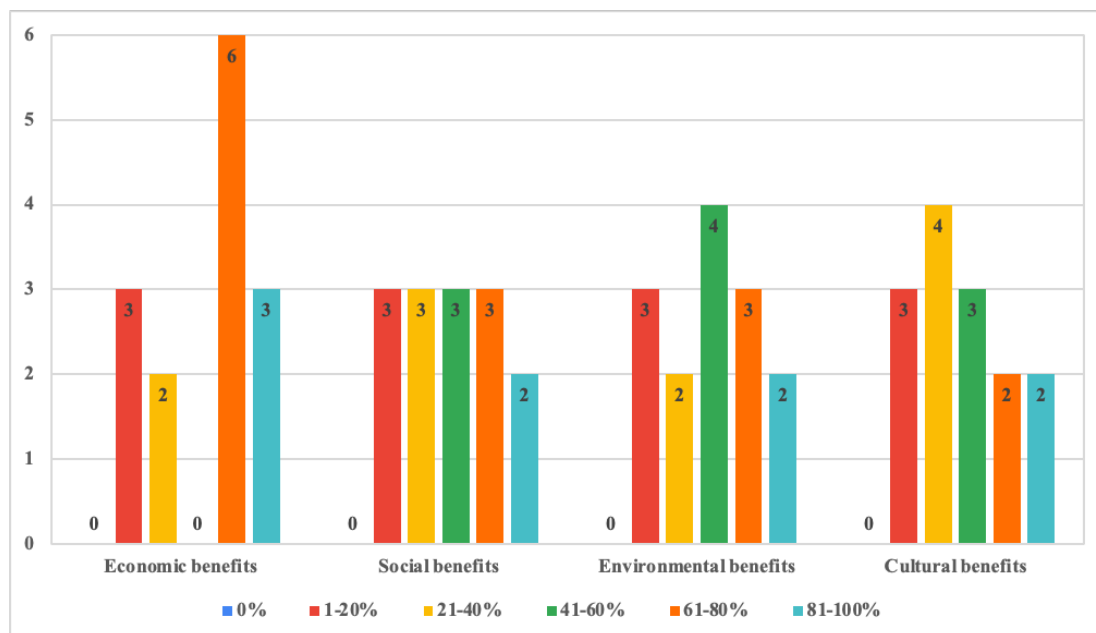


Figure 20: Percentage of Start-ups Founded in the last 3 years to Provide Sustainable/Societal Benefits

Source: author's compilation (2025)

Note: The left axis is the number of university business incubators, and the right axis is the percentage of start-ups founded in the last 3 years to provide sustainable/societal benefits

According to recent data, out of all the start-ups founded in the last three years, 21-40% aim to provide economic benefits, with two incubators focusing on this area. Social benefits are the main focus of 3 incubators; 2 incubators aim to provide environmental benefits, and 4 incubators focus on cultural benefits. Additionally, 1-20% of the start-ups founded in the last 3 years aim to provide economic benefits, with three incubators focusing on this area. The primary focus for 3 incubators is social benefits, 3 incubators aim to provide environmental benefits, and 3 incubators focus on cultural benefits. The results shows that start-ups in Bali Province, Indonesia, established in the last 3 years by university business incubators, predominantly provide economic benefits.

4.4.4.2 Societal Impacts of University Business Incubators

Figure 21 outlines the factors crucial for the incubator to achieve its main objectives. A total of 14 respondents participated in the survey. Regarding the primary objective of the incubator to generate profits for the owner, the results indicate differing perspectives among the universities surveyed. One university deemed profit generation unnecessary (scored 2), three universities held a neutral stance (scored 3), three universities considered it necessary (scored 4), and seven universities viewed it as essential (scored 5).

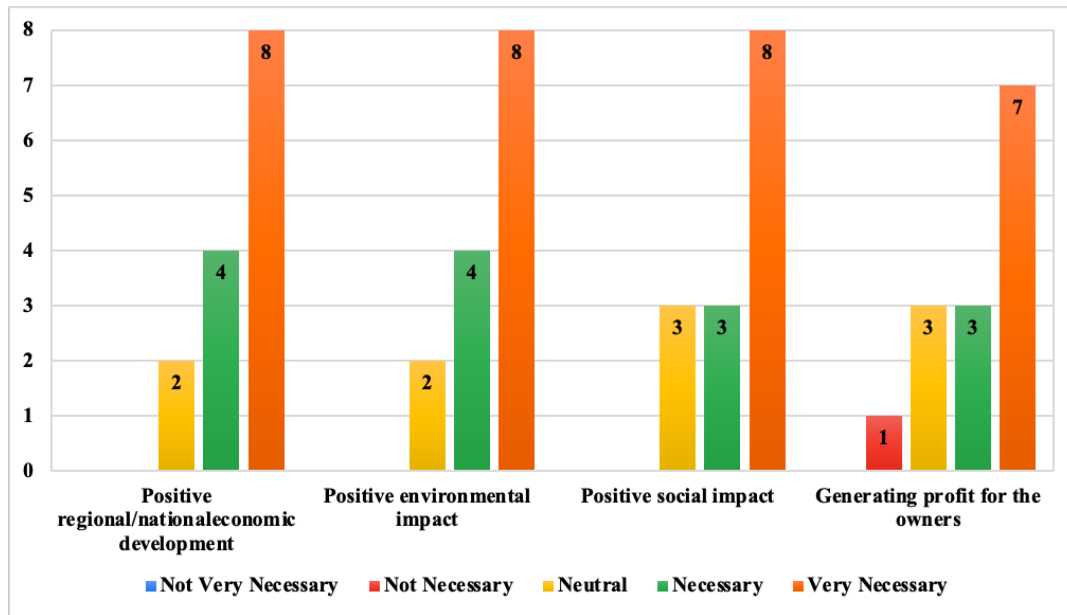


Figure 21: Aspects that are Necessary for the Primary Purpose of the Incubators (Numbers)

Source: author's compilation (2025)

Note: The left axis shows the number of university business incubators, while the right axis indicates necessary aspects for the incubator's main purpose on a Likert scale of 1-5 (1 = Not very necessary, 5 = Very necessary).

In terms of the incubator's goal to provide positive social impacts, the survey results revealed that three universities were neutral (scored 3), three deemed this goal necessary (scored 4), and eight universities regarded it as essential (scored 5). When evaluating the primary goal of delivering a positive environmental impact, the findings showed that two universities maintained a neutral position (scored 3), four considered it necessary (scored 4), and eight universities believed it was essential (scored 5). Concerning the incubator's objective to foster positive regional or national economic development, two universities were neutral (scored 3), four considered it necessary (scored 4), and eight universities perceived it as essential (scored 5).

While profit generation is certainly important, university business incubators in Bali Province, Indonesia, place a higher emphasis on achieving positive social and environmental impacts, as well as contributing to regional and national economic development. A significant number of these incubators have been rated as essential (score 5) in their primary missions. It is noteworthy that university business incubators in Bali Province demonstrate a clear commitment to sustainability and are making meaningful contributions to regional and national economic development.

4.4.5 Opinions Regarding Start-up Development on Sustainable/Social Benefits

This session presents the findings of a survey conducted to gauge the opinions of UBIs on the development of sustainable and community-focused start-ups (Figure 22). The survey comprised fifteen questions regarding the respondents' views on various aspects of developing such enterprises.

The questions covered various topics, including the skills necessary to develop start-ups with societal benefits, the difficulty of developing sustainable start-ups, and the challenges faced by start-ups with broad societal benefits.

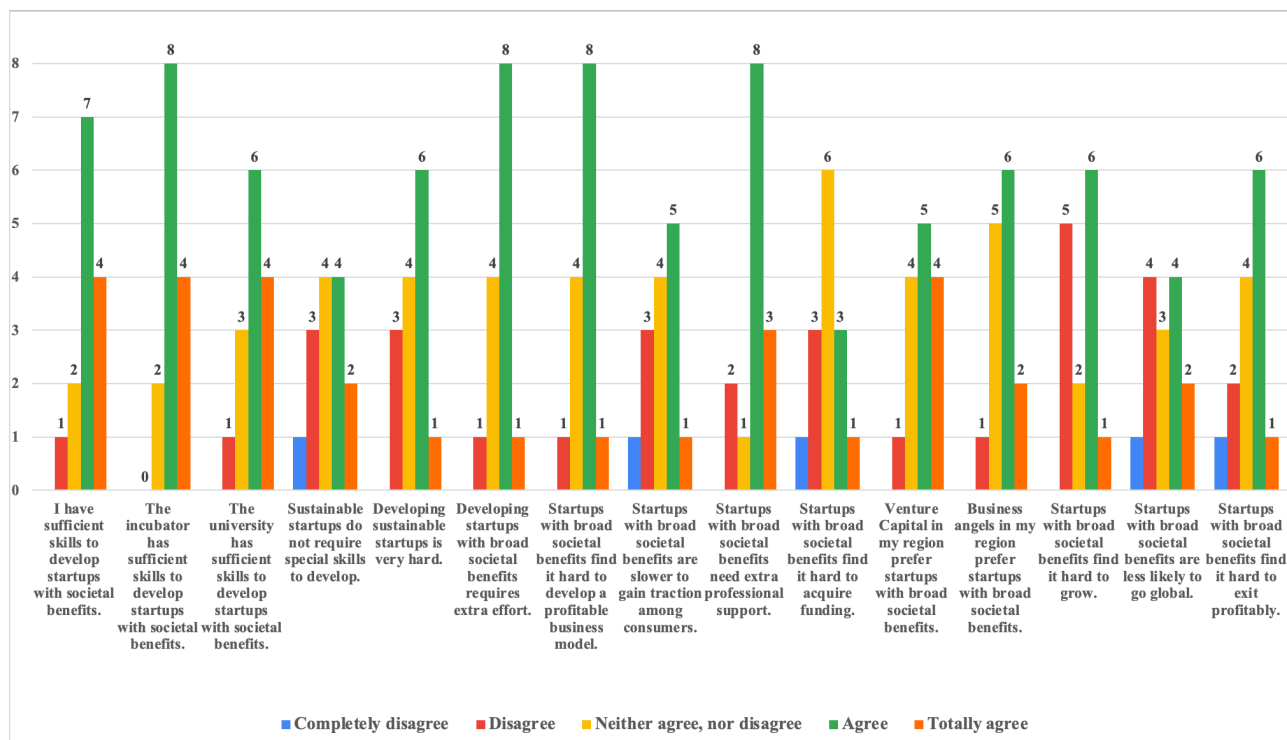


Figure 22: Agreement Opinions of Start-up Development on Sustainable/Social Benefits (Numbers)

Source: author’s compilation (2025)

Note: The left axis is the number of university business incubators, right axis is the opinions regarding start-up development that focuses on sustainable/social benefits.

Based on the survey results, most respondents agreed that the incubator has sufficient skills to develop start-ups with societal benefits. Eight respondents answered 'agree' to this opinion, while three answered 'totally agree.' Similarly, seven respondents agreed they have sufficient skills to develop start-ups with societal benefits, while four answered 'totally agree.' Furthermore, eight respondents agreed that developing start-ups with broad societal benefits requires extra effort, and the same number agreed that start-ups with broad societal benefits need extra professional support.

The survey also revealed that respondents believed that start-ups with broad societal benefits find it hard to develop a profitable business model, with eight respondents agreeing. Additionally, five respondents agreed that venture capitalists in their region prefer start-ups with broad societal benefits. Moreover, the same number agreed that business angels in their region prefer these start-ups. Other opinions, such as 'developing sustainable start-ups are tough' and 'start-ups with broad societal benefits are slower to gain traction among consumers,' also received agreement from many

respondents. However, opinions like 'start-ups with broad societal benefits find it hard to acquire funding' and 'start-ups with broad societal benefits are less likely to go global' were less commonly agreed upon, with three and four respondents agreeing, respectively. The survey results indicate that while challenges are associated with developing sustainable and community-focused start-ups, most respondents believe that the necessary skills and support are available to succeed in this area.

4.5 Conclusion

Research Part 1 aims to assess the effectiveness and potential of incubator support systems in developing sustainable start-ups. Additionally, the survey analysis explored the identification and transfer of best practices⁰. Drawing from the findings conducted among all UBIs in Bali Province, Indonesia, as detailed in the results above section draw the following conclusions:

- In Bali Province, Indonesia, UBIs are primarily owned by universities, with minor ownership from private investors and others.
- These incubators offer clients training through seminars and workshops and coaching in management, accounting, finance, and marketing.
- Incubators focus on industries or knowledge fields such as culture, creative industries, and arts, followed by information technology, software, big data, artificial intelligence (AI), telecommunications, cleantech, Greentech, renewable energy, environmental services, biotechnology, and life sciences. Incubators may also cater to all industries or those falling under miscellaneous or manufacturing and fintech categories.
- On average, start-ups spend 1-2 years in incubators. It is due to various factors, including limited incubator space and the need to accept new tenants yearly as per the curriculum. Additionally, tenants must complete government start-up incubation program grants through universities within a specific timeframe, contributing to this duration.
- UBIs have observed a positive trend in annual budget changes over the past three years (2021-2023). Despite the growth, many incubators continue to depend on income generated through their operations. Further research reveals that their average income remains below IDR 100 million and within the range of IDR 101-500 million.
- In the last 3 years (2021-2023), 487 start-ups/spin-offs were founded at UBIs. Of these, 115 start-ups have been sold to investors or other companies. Thus, Green, sustainable, or environmentally friendly products/services are the core business of all university business incubators. Most start-ups focus on providing economic benefits, with only 11.3% offering sustainable/societal benefits.

- The number of employees in university start-ups varies depending on the size of the incubator and the number of start-ups. Most employees do not have salaries tied to performance.
- UBIs prioritize social and environmental impacts and economic development. They have a clear vision of sustainable development goals (SDGs) and significantly contribute to regional/national and economic development.
- Incubators actively support tenants in achieving specific goals and reducing negative environmental and social impacts. The survey results showed that they have implemented proactive measures to encourage tenant success.

All in all, the UBIs in Bali, Indonesia must consider economic, social, environmental, and cultural benefits when fostering technology transfer projects and nurturing start-ups or spin-offs. The results showed that economic benefits were the most crucial, followed by social, environmental, and cultural benefits. We surveyed university business incubators on developing sustainable and community-focused start-ups. Most respondents agreed that the incubator has the necessary skills to develop start-ups with societal benefits. Most respondents agreed that developing start-ups with broad societal benefits requires extra effort and professional support. They also found developing a profitable business model challenging.

5. RESEARCH PART 2: SUSTAINABLE START-UP PERFORMANCE

5.1 Introduction of the Research Part 2

Embedding sustainability into the core identity of a start-up from its inception fosters stronger institutionalization of sustainable practices and decision-making processes (Carle & Rayna, 2023). "Born-sustainable start-ups," which are founded with an inherent commitment to the triple bottom line (TBL) from the very early stages of idea generation, tend to develop more robust tools and routines compared to "transitioned sustainable start-ups," which adopt the TBL framework at a later stage, typically during the prototype or validation phases (Carle & Rayna, 2023).

Entrepreneurs and start-ups play a crucial role in driving environmental innovation and advancing sustainability transitions (Fichter et al., 2023; Trautwein, 2021). Consequently, the analysis and prediction of the impact generated by entrepreneurial ventures have become central concerns in research on management and entrepreneurship. Over the past several years, the sustainability performance, value creation, and broader impacts of established firms as well as their products and services have been widely examined in business and sustainability-related literature. In contrast, the assessment of sustainability outcomes associated with new ventures, particularly start-ups, remains an underexplored area within academic research (Fichter et al., 2023; Trautwein, 2021).

Despite the recognition of start-ups as key actors in addressing sustainability challenges, there is a paucity of research on how to systematically assess their sustainability impact (Cho, 2024; Gionfriddo & Piccaluga, 2024), especially considering the high levels of uncertainty and resource limitations typically faced by early-stage ventures (Carle & Rayna, 2023; Trautwein, 2021).

This session aims to examine the influence of sustainable entrepreneurial ecosystems and sustainable entrepreneurial processes on start-up performance, with the latter operationalized through production and commercialization capabilities. The analysis is based on data derived from the sustainability impact assessment matrix (Carle & Rayna, 2023; Diepolder et al., 2024) which serves as the primary instrument for evaluating the extent to which sustainability principles are integrated into start-up activities. The field of Sustainable Impact Assessment (SIA) is relatively new and has only recently started to explore the context of sustainable start-ups. Recent scholarly contributions have primarily focused on developing more appropriate frameworks for SIA (Hornes, 2019) or analyzing the challenges that start-ups encounter while implementing SIA practices (Trautwein, 2021). However, there remains a significant gap in empirical research investigating how sustainable start-ups evaluate their contributions to sustainability throughout their entrepreneurial process.

This study contributes novel theoretical and practical insights into the evaluation of sustainability impacts within start-up ventures. By expanding the understanding of the distinct characteristics of

Sustainability Impact Assessment (SIA) in the decision-making context of start-ups, it enriches the field of sustainable entrepreneurship research and provides valuable implications for scholars and practitioners involved in sustainable entrepreneurship and impact assessment.

The objectives of Research Part 2 are outlined as follows:

1. To examine the impact of sustainable entrepreneurship ecosystems (SEE) on the sustainable entrepreneurship process (SEP), specifically during the idea generation, prototype development, and market validation stages.
2. To examine the impact of sustainable entrepreneurial process (SEP), specifically during the idea generation, prototype development, and market validation stages on production and commercialization.
3. To examine the impact of sustainable entrepreneurial process (SEP) on production and commercialization mediated by sustainable entrepreneurship process.

5.2 Literature Review of the Research Part 2

5.2.1 Sustainable Entrepreneurial Ecosystem

Entrepreneurial ecosystems are defined as the actors and factors that facilitate entrepreneurship (Leendertse et al., 2022). Kumar Jha and Pande (2024) propose a framework for the sustainable entrepreneurial ecosystem (SEE) that integrates the core components of a traditional entrepreneurial ecosystem with three additional sustainability-oriented elements. The traditional entrepreneurial ecosystem, as identified by (Leendertse et al., 2022; Stam & van de Ven, 2021) comprises key factors such as formal institutions, entrepreneurial culture, networks, physical infrastructure, access to finance, talent availability, leadership, generation of new knowledge, market demand, and intermediary services. The correlation coefficients between traditional ecosystem elements are significant and positive, thereby validating the systemic character of the entrepreneurial economy and underscoring the necessity for a comprehensive systems perspective (Leendertse et al., 2022). In addition to these foundational elements, this model introduces three sustainability-specific dimensions that enhance the ecosystem's capacity to support environmentally and socially responsible entrepreneurship. The three elements of sustainability are sustainability orientation, enabling cadence, and social metabolism.

In general, sustainable orientation refers to the degree of awareness, engagement, and attitudinal commitment toward sustainability (Kuckertz & Wagner, 2010; Zhang et al., 2022). A culture characterized by high sustainable orientation is likely to be more supportive of sustainable entrepreneurial ventures and more receptive to their innovative solutions. Consequently, such a cultural context may positively influence the market share and overall performance of companies

engaged in sustainable entrepreneurship. "Enabling Cadence" (EC), as a component of the Sustainable Entrepreneurship Ecosystem (SEE), refers to a continuous and structured rhythm or pattern of support, plays a crucial role in facilitating continuous support for sustainable entrepreneurship (SE) firms as they address challenges related to investment, legitimization, and materiality. EC involves the provision of consistent support mechanisms, including access to sustainability-oriented funding, formal recognition of sustainability initiatives and practices, and institutionalized transparency regarding material sustainability issues. These elements collectively contribute to creating a stable and supportive environment for SE firms to thrive (Kumar Jha & Pande, 2024). Social metabolism (SM), as conceptualized in this study, pertains to the socio-economic context of a country, encompassing key dimensions such as equality, social inclusion, and patterns of consumption. These socio-cultural conditions play a critical role in shaping the emergence and extent of entrepreneurial opportunities available for identification and exploitation. The nature and availability of such opportunities may vary significantly across countries, reflecting differences in social structures and developmental contexts. Likewise, the strategies and efforts employed by entrepreneurs to address and navigate prevailing social challenges are also influenced by the specific socio-metabolic characteristics of each national setting.

5.2.2 Sustainable Entrepreneurship Process

Sustainable entrepreneurship is conceptualized as the process of identifying, creating, and exploiting business opportunities to develop and effectively implement innovative products and services that generate value across environmental, social, and economic dimensions (Diepolder et al., 2024; Matzembacher et al., 2019; Nguyen et al., 2024). In process-oriented perspectives, sustainable entrepreneurship consistently encompasses three key stages: opportunity recognition (through discovery or creation), evaluation of the identified opportunities, and their subsequent exploitation aimed at advancing sustainable development (Nguyen et al., 2024; Preiss et al., 2023). As such, the identification of opportunities aligned with sustainability goals represents a foundational step in the sustainable entrepreneurial process (Nguyen et al., 2024; Preiss et al., 2023). The sustainable environmental entrepreneurial process is a multifaceted phenomenon that can take various forms, depending on the characteristics of the individual driving it, the motivations behind the business creation, the core value proposition of the company, and the contextual environment in which it develops (Dos Santos & Teixeira, 2021).

The sustainable entrepreneurship process consists of the following stages, as outlined the following sessions: Idea Generation, Prototype Development and Validation.

5.2.2.1 Idea Generation

Idea generation is closely associated with entrepreneurial motivation, prior knowledge and experience, as well as the competencies and capabilities of entrepreneurs (Carle & Rayna, 2023). Recent studies emphasize that the quality of the initial idea conception significantly influences subsequent entrepreneurial performance, suggesting that understanding this process in detail is crucial for predicting and enhancing start-up success (Matzembacher et al., 2019).

In the context of sustainability-oriented entrepreneurship, research indicates that entrepreneurial intentions are largely shaped by perceived desirability and a positive attitude toward sustainability (Nguyen et al., 2024). Preiss et al. (2023) further argue that heightened awareness or sensitivity to social and environmental issues plays a pivotal role in stimulating innovative ideas. Such ideas often stem from an individual's background, including factors such as formal education, professional experience, leisure activities, and family. These backgrounds contribute to the formation of entrepreneurial ideas that align with sustainable development goals (Matzembacher et al., 2019).

5.2.2.2 Prototype Development

The prototype stage is defined as the phase in which start-ups begin their initial studies on an innovative product and test potential features with a limited number of clients to identify what could become their minimum viable product (MVP). During this stage, the primary objective is to formulate hypotheses regarding the problems identified during the idea generation phase, laying the foundation for further development and validation (Carle & Rayna, 2023).

5.2.2.3 Validation

During the validation phase, start-ups seek to confirm the validity of hypotheses formulated in the prototype phase, including those related to market demand and customer interest. Additionally, start-ups typically gain access to increased financial resources through fundraising efforts, which enables them to enhance their operational and strategic capabilities (Carle & Rayna, 2023).

5.2.3 Production and Commercialization

In the production and commercialization phase, the proof of concept and underlying technology have been successfully validated, marking a transition to client engagement and market interaction (Carle & Rayna, 2023). As a result, the start-up and its team become more formalized and structured to manage business operations and customer relationships effectively.

5.2.4 Sustainable Impact Assessment (SIA) for Start-ups

Sustainability Impact Assessment (SIA) can be conceptualized as a structured process designed to support the achievement of sustainability objectives by rendering sustainability issues more concrete

and comprehensible (Carle & Rayna, 2023). It operates as a decision-support tool that facilitates the identification, organization, and evaluation of the sustainability impacts associated with past, present, or proposed actions. The assessment of the sustainability impact of start-ups poses a series of challenges, necessitating an adapted measurement approach (Trautwein, 2021). In the nascent stages of a start-up, the primary objective of the assessment is to predict, structure, and secure sustainability potential, defined as the capacity to contribute to the resolution of sustainability challenges.

5.3 Conceptual Framework and Hypotheses Development

Drawing upon the theoretical background discussed above, the following conceptual framework is proposed and illustrated in Figure 23. The conceptual framework is a foundation for understanding the relationships between the sustainable entrepreneurial ecosystem, the sustainable entrepreneurial process, and production and commercialization.

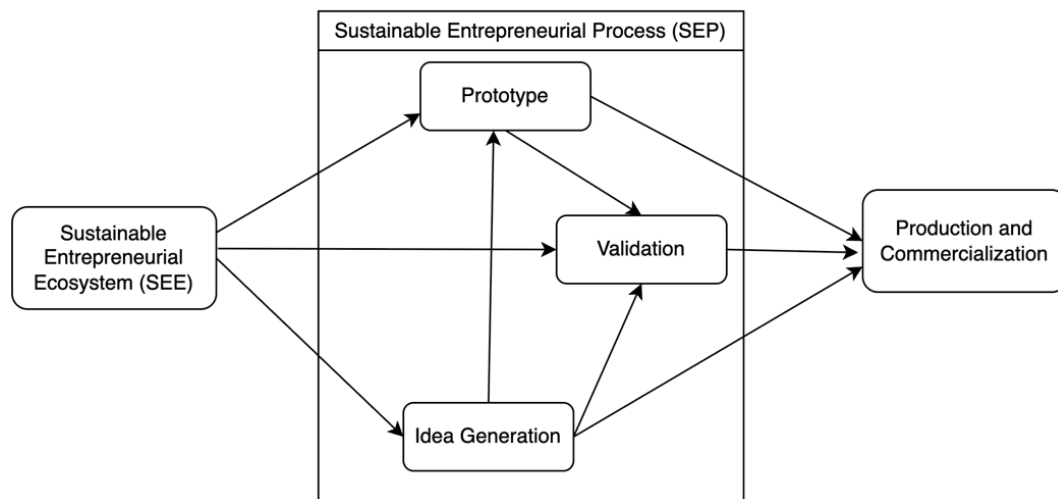


Figure 23: Proposed Conceptual Framework of Research Part-2

Source: author's compilation (2025)

A sustainable entrepreneurship ecosystem can be defined as a network of interconnected and collaborative stakeholders who provide sustainability-oriented support to entrepreneurs, with the aim of promoting entrepreneurial activities that simultaneously address economic, ecological, and social sustainability. Such ecosystems contribute to the transition toward a more sustainable regional economy (Theodoraki et al., 2022). The elements of the traditional entrepreneurial ecosystem exhibit strong positive correlations with one another, underscoring the systemic nature of the entrepreneurial economy and highlighting the importance of adopting a complex systems perspective (Leendertse et al., 2022). The analytical results further reveal that physical infrastructure, access to finance, formal institutions, and human capital occupy central positions within the network of interdependencies (Leendertse et al., 2022). This finding provides initial evidence that these factors constitute

foundational components of an effective entrepreneurial ecosystem. Consistent with the findings of (Kumar Jha & Pande, 2024), a strong Sustainable Entrepreneurial Ecosystem (SEE) fosters both the growth and performance of sustainable entrepreneurial ventures. The results of additional research demonstrate that social metabolism, a component of the sustainable entrepreneurship ecosystem (SEE) indicator, in conjunction with entrepreneurship orientation and enabling cadence, exerts a significant influence on entrepreneurial activity (Pacheco & Khoury, 2023; Qureshi et al., 2023).

In light of the findings from the literature review and the proposed conceptual framework, the subsequent hypothesis was formulated:

- *H1: Sustainable Entrepreneurial Ecosystem (SEE) positively and significantly impacts on a Sustainable Entrepreneurial Process (SEP).*
- *H1a: Sustainable Entrepreneurial Ecosystem (SEE) positively and significantly impacts on idea generation.*
- *H1b: Sustainable Entrepreneurial Ecosystem (SEE) positively and significantly impacts on prototype.*
- *H1c: Sustainable Entrepreneurial Ecosystem (SEE) positively and significantly impacts on validation.*
- *H2: Sustainable Entrepreneurial Process (SEP) positively and significantly impacts on production and commercialization.*
- *H2a: Idea generation positively and significantly impacts on production and commercialization.*
- *H2b: Prototype positively and significantly impacts on production and commercialization.*
- *H2c: Validation positively and significantly impacts on production and commercialization.*

Kumar Jha & Pande (2024) proposes and empirically examines three sustainability components that can be integrated with existing entrepreneurial ecosystem (EE) elements to foster the development of sustainable entrepreneurial ecosystems (SEEs). They indicate that two out of the three components of a sustainable entrepreneurial ecosystem, e.g., enabling cadence (EC) and social metabolism (SM) positively influence the performance of sustainable start-ups. In contrast, sustainability orientation (SO) produced findings that were inconsistent with the hypothesis and appeared counterintuitive. Specifically, while a higher level of SO was positively associated with the emergence of sustainable entrepreneurial (SE) firms, it showed a negative relationship with their performance. Overall, the findings related to the sustainable entrepreneurial ecosystem (SEE) align with theoretical expectations (Theodoraki et al., 2022). The thesis offers some empirical evidence that entrepreneurial orientation (EO), a component of a sustainable start-up ecosystem, exhibits a positive correlation with start-up performance (Vincent & Zakkariya, 2021).

- *H3: Sustainable Entrepreneurial Process mediates the effect of the Sustainable Entrepreneurial Ecosystem (SEE) on production and commercialization.*

5.4 Material and Methods of the Research Part 2

5.4.1 Research Instrument

The research instrument design was developed in accordance with a previously established research model and supported by relevant academic literature. The instrument was subsequently transformed into a questionnaire format, encompassing items pertaining to the respondent profile and inquiries aligned with the variables and indicators derived from the research conceptual framework. Prior to finalization, the preliminary version of the questionnaire was circulated among three experts, drawing from both theoretical and practical domains, for evaluation. These experts evaluated each item based on its alignment with academic theory and the practical context of start-up development in Indonesia. After the expert review, a readability and interpretation test were administered to evaluate the clarity and understanding of the survey from the respondent's (tenants) perspective. This process was implemented to ensure the validity and reliability of the data to be collected. The final research instrument is presented in Appendix 2. The subsequent section details the research variables and associated indicators, along with their respective references. These data are presented in Table 4 below.

Table 4: Sources and Abbreviations of Latent Variables and Indicators

Factors/Item	Descriptions	Abbreviation	Source
Sustainable Entrepreneurial Ecosystem (SEE)	How important is the physical infrastructure for your start-up?	SEE1	(Kumar Jha & Pande, 2024; Leendertse et al., 2022; Stam & van de Ven, 2021)
	How important is the demand for your start-up?	SEE2	
	How important is the intermediary services for your start-up?	SEE3	
	How important is the talent for your start-up?	SEE4	
	How important is the knowledge for your start-up?	SEE5	
	How important is the leadership for your start-up?	SEE6	
	How important is the finance for your start-up?	SEE7	
	How important are the formal institutions for your start-up?	SEE8	
	How important is the entrepreneurship culture for your start-up?	SEE9	
	How important are the networks for your start-up?	SEE10	

	How important is the sustainability orientation for your start-up?	SEE11	
	How important is the enabling cadence for your start-up?	SEE12	
	How important is the social metabolism for your start-up?	SEE13	
Idea Generation (IDEA)	How important is the extent of ambition to address environmental or social issues?	IDEA1	(Carle & Rayna, 2023)
	How important is the extent of a specific issue a cause for concern?	IDEA2	
	How important is it to ascertain whether key values have been defined in collaboration with co-founders?	IDEA3	
	How important is the ambitious to address an environmental or social issue without scarifying the other ?	IDEA4	
	How important is the deeply concern about both social and environmental issues ?	IDEA5	
	How important it it to conduct aligned stakeholder identification; align Business Model with social and/or environmental benefits?	IDEA6	
Prototype (PROTO)	How much do start-up resentment for green and social-washing?	PROTO1	(Carle & Rayna, 2023)
	How important it to conduct aligned business model (BM) with environmental or social benefits?	PROTO2	
	How important the first Key Performance Indicators (KPIs) for environmental or social benefits?	PROTO3	
	How much do start-up resentment for green and social-washing?	PROTO4	
	How important are “Normal” decisions made without (or against) economic benefits?	PROTO5	
	How important is the focus on internal/governance aspects and sustainability impact assessment (SIA) tools are identified?	PROTO6	
Validation (VALID)	How important the first ideas on who to integrate triple bottom line (TBL)?	VALID1	(Carle & Rayna, 2023)
	How important are the efforts to improve sustainability impact assessment (SIA) knowledge?	VALID2	
	How important is the fearful of stakeholder reaction?	VALID3	
	How important are techniques and tools for sustainability impact	VALID4	

	assessment (SIA) developed with dedicated resources?		
	How important are routines of sustainability impact assessment (SIA) with stakeholders, a dedicated person in charge of sustainability?	VALID5	
	How important are more structural/strategic choices for sustainability without (or against) economic benefits?	VALID6	
Production and Commercialization (PROCO)	How important is internal/governance aspects?	PROCO1	(Carle & Rayna, 2023)
	How important are decisions made without (or against) economic benefits?	PROCO2	
	How important is it to identify sustainability impact assessment (SIA) tools?	PROCO3	
	How important are the Iteration of SIA techniques and tools?	PROCO4	
	How important is the external communication?	PROCO5	

Source: author's compilation (2025)

5.4.2 Data Collection

The Research Part 2 utilizes a survey method, as a widely recognized primary data collection technique. The survey was administered through Google Forms, an online platform that facilitates the efficient dissemination of questionnaires. This study specifically targets start-up tenants from university business incubators that have been or are currently being incubated. The UBI management helps to distribute questionnaires in the form of Google Forms to each tenant. Data collection was conducted between September 2024 and March 2025.

5.4.3 Data Analysis Method

Data analysis in Research Part 2 employs a quantitative analysis method. A Partial Least Squares Structural Equation Modeling (PLS- SEM) analysis was performed.

5.4.3.1 Measurement Model Evaluation

Hair et al. (2019) recommend several steps to evaluate the model, including Indicator Loading, Internal Consistency Reliability, and Construct Validity. Indicator loading refers to the standardized regression coefficient that measures the strength of the relationship between a latent variable (construct) and its observed indicators (manifest variables). It represents the extent to which an observed variable is influenced by the latent variable it is intended to measure. Indicator loadings help assess the quality of measurement models by evaluating how well each observed variable reflects the underlying construct. The Outer Loading value was obtained above 0.700.

Internal consistency reliability is a measure of the degree to which items within a scale or construct are interrelated and consistently measure the same underlying construct. It assesses the homogeneity of the items that make up a latent variable. In SEM, internal consistency reliability is often assessed using Cronbach's Alpha (CA) or Composite Reliability (CR). These metrics provide an estimate of the extent to which all items in a construct are measuring the same underlying concept. Cronbach's Alpha, a commonly used statistic that ranges from 0 to 1, where values above 0.7 are generally considered acceptable, and values above 0.8 or 0.9 indicate high internal consistency. Another measure of internal consistency, composite reliability (CR), is calculated based on the squared factor loadings and error variances of the indicators. Values above 0.7 are typically considered acceptable. Ensuring high internal consistency reliability is crucial because it indicates that the items within a construct are measuring the same underlying dimension, thereby enhancing the validity of the measurement model.

Construct validity refers to the extent to which a set of observed indicators accurately measures the theoretical construct they are intended to represent. It ensures that the latent variables in the SEM model are valid representations of the constructs they purport to measure. This study uses average variance extracted (AVE) values to measure convergent validity and uses Fornell-Larcker criteria for discriminant validity. These concepts are critical for evaluating the quality of measurement models in SEM, as outlined by (Hair et al., 2019).

5.4.3.2 Structural Model Evaluation

Following the establishment of reliability and validity for the measurement model, the subsequent phase focuses on evaluating the structural model, as described by (Hair et al., 2019). This stage involves assessing three crucial metrics: e.g., path coefficients, effect size (f^2), and coefficient of determination (R^2). These metrics collectively provide insights necessary for hypothesis testing concerning the relationships among variables within the model.

Path coefficients in PLS-SEM represent the standardized regression weights that quantify the direct relationship between two latent variables or between a latent variable and its observed indicators. A path coefficient indicates the magnitude and direction of the effect of one latent variable on another. The value of the path coefficient ranges from -1 to +1, where: a positive value indicates a positive relationship (as one variable increases, the other also increases). A negative value indicates a negative relationship (as one variable increases, the other decreases). The absolute value reflects the strength of the relationship; larger absolute values indicate stronger effects. Statistical significance (e.g., p-values) is also assessed to determine whether the observed relationship is likely due to chance. Path coefficients help test hypotheses about the directional relationships between latent variables and provide evidence for causal inferences within the constraints of the model's assumptions.

Effect size (f^2) is a measure of the practical significance of a predictor variable in explaining variance in the dependent variable. It quantifies the proportion of variance in the dependent variable that is uniquely explained by a specific independent variable after accounting for other predictors in the model. Effect size (f^2) helps researchers to understand the substantive importance of relationships beyond statistical significance, ensuring that significant findings are also meaningful in real-world contexts.

The coefficient of determination (R^2) measures the proportion of variance in a dependent variable that is explained by the independent variables in the contextual model. R^2 is calculated for each endogenous latent variable (dependent variable) and represents the overall explanatory power of the model for that variable. The results provide an overall assessment of how well the model predicts the dependent variable. It helps evaluate the explanatory power of the structural model and identifies areas where additional predictors might improve the model's performance.

5.5 Results of the Research Part 2

5.5.1 Profile of Respondents

The profile of the respondents who completed the research questionnaire is presented as follows. The respondents in this study consist of start-ups that have either previously been incubated or are currently undergoing incubation at university-based business incubators in Bali Province. Out of the total 153 valid respondents, 30.1% ($n = 46$) of the start-ups were established in 2024, 20.3% ($n = 31$) in 2023, 5.9% ($n = 9$) in 2022, 7.2% ($n = 11$) in 2021, and 8.3% ($n = 13$) were founded in 2020. The remaining 24.8% ($n = 38$) of the start-ups were established prior to 2020, and 3.3% ($n = 5$) respondent respondents elected not to provide answers. The distribution of the start-up respondents across industrial sectors is as follows: 35.3% ($n = 54$) of the start-ups operate in the fields of culture, creative industries, and the arts; 14.4% ($n = 22$) are engaged in information technology, software development, big data, artificial intelligence, telecommunications, and technology-based education; 10.5% ($n = 16$) specialize in clean technology, environmentally friendly technologies, renewable energy, and environmental services; and 7.8% ($n = 12$) belong to the manufacturing sector. Additionally, 1.9% ($n = 3$) operate in the food and beverage sector and the education technology (edutech) sector, while 1.3% ($n = 2$) are involved in financial technology (fintech) and biotechnology or life sciences. The remaining 25.5% ($n = 39$) of the start-ups are distributed across various other industry sectors.

The following section presents additional information regarding the timeline of start-up incubation at UBIs. A total of 50 start-ups (32.7%) began their incubation process in 2024, 27 start-ups (17.6%) in 2023, 19 start-ups (12.4%) in 2022, 11 start-ups (7.2%) in 2021, 22 start-ups (14.4%) in 2021 or earlier, and 24 respondent (15.7%) did not provide answers. Among the start-ups that have completed or are currently undergoing incubation, 61 (39.9%) have successfully graduated from the program,

69 (45.1%) are still in the incubation phase, 20 (13.1%) have withdrawn or dropped out, and 3 (2.0%) have not yet reached graduation. In terms of duration, most start-ups, 87 in total (56.9%), underwent incubation for less than one year. Meanwhile, 38 start-ups (24.8%) were incubated for one year, 19 start-ups (12.4%) for two years, 6 start-ups (3.9%) for three years, and 3 start-ups (2.0%) remained in incubation for more than three years.

5.5.2 Measurement Model Evaluation

According to Hair et al. (2017), the initial phase of structural equation modelling (SEM) involves evaluating the measurement model. This evaluation encompasses the assessment of indicator loadings, internal consistency reliability, and construct validity. Based on the indicator loading analysis, invalid indicators were systematically removed. In consideration of the results of the analysis that have been presented in Table 5, this process yielded outer loadings exceeding 0.700 for 33 out of the initial 36 indicators. In order to further refine the saturated model (model fit) with an acceptable SRMR (standardized root mean square residual) value (<0.08), indicators with suboptimal factor loadings were systematically excluded. Resulting in a final set of 25 valid indicators. Specifically, 11 indicators were eliminated: SEE1, SEE2, SEE3, SEE8, SEE13, PROTO1, PROTO2, PROTO5, VALID3, PROCO1, and PROCO2. Furthermore, the variance inflation factor (VIF) serves as a diagnostic tool to evaluate multicollinearity in multiple regression models. All VIF values fall below the recommended threshold of 5 (Hair et al., 2017), indicating an absence of severe collinearity concerns.

Table 5: Descriptive Statistics, Factor Loadings, and Collinearity Statistics of the Items

Latent Variables	Manifest Variables	Mean/Median	Factor Loading before Exclusion*	Factor Loading after Exclusion*	VIF
Sustainable Entrepreneurial Ecosystem (SEE)	SEE1	4.000/4	0.737	-	-
	SEE2	4.288/5	0.798	-	-
	SEE3	3.993/4	0.665	-	-
	SEE4	4.229/4	0.808	0.807	2.385
	SEE5	4.255/5	0.840	0.860	3.592
	SEE6	4.346/5	0.869	0.878	3.997
	SEE7	4.314/5	0.812	0.838	2.713
	SEE8	3.935/4	0.682	-	-

	SEE9	4.229/4	0.861	0.870	3.233
	SEE10	4.392/5	0.773	0.807	2.447
	SEE11	4.235/4	0.792	0.817	2.689
	SEE12	4.118/4	0.825	0.818	2.562
	SEE13	4.144/4	0.776	-	-
Idea Generation (IDEA)	IDEA1	4.196/4	0.744	0.743	1.983
	IDEA2	4.137/4	0.827	0.828	2.443
	IDEA3	4.209/4	0.818	0.818	2.701
	IDEA4	4.275/5	0.841	0.841	2.579
	IDEA5	4.281/5	0.894	0.894	3.356
	IDEA6	4.235/4	0.853	0.854	2.673
Prototype (PROTO)	PROTO1	4.020/4	0.711	-	-
	PROTO2	4.268/5	0.703	-	-
	PROTO3	4.046/4	0.828	0.892	2.293
	PROTO4	3.967/4	0.828	0.851	1.922
	PROTO5	3.895/4	0.749	-	-
	PROTO6	4.078/4	0.841	0.896	2.227
Validation (VALID)	VALID1	4.078/4	0.823	0.841	2.436
	VALID2	4.163/4	0.846	0.847	2.385
	VALID3	3.915/4	0.760	-	-
	VALID4	4.026/4	0.835	0.833	2.482
	VALID5	4.052/4	0.900	0.895	3.898
	VALID6	4.013/4	0.836	0.856	2.969
Production and Commercialization (PROCO)	PROCO1	4.242/4	0.826	-	-
	PROCO2	3.908/4	0.669	-	-
	PROCO3	4.065/4	0.910	0.925	3.214
	PROCO4	4.065/4	0.888	0.916	2.905

	PROCO5	4.209/4	0.845	0.870	2.143
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Notes: *SEE1, SEE2, SEE3, SEE8, SEE13, PROTO1, PROTO2, PROTO5, VALID3, PROCO1, PROCO2 should be omitted from the final model due to low factor loadings.

Source: Author's compilation

The reliability and validity of the measurement model were evaluated based on the results presented in Table 6. Internal consistency reliability was assessed using Cronbach's Alpha (CA) and Composite Reliability (CR), both of which required values exceeding 0.700 to meet acceptance criteria. Construct validity was evaluated using the Average Variance Extracted (AVE), which must surpass 0.500 to demonstrate adequate convergent validity, as recommended by Hair et al. (2019). As indicated in Table 6, the proposed model successfully satisfies both reliability and validity benchmarks, confirming its psychometric integrity for further analysis.

Table 6: Measurement Model Evaluation Results

Latent Variables	Cronbach's alpha (CA)	Average variance extracted (AVE)	Composite reliability (CR)
SEE	0.939	0.701	0.949
IDEA	0.910	0.690	0.930
PROTO	0.854	0.774	0.911
VALID	0.908	0.731	0.931
PROCO	0.888)	0.817	0.930

Source: Author's compilation

Table 7 presents the outcomes of the Fornell-Larcker criterion analysis for assessing discriminant validity. This method compares the correlations between latent constructs with the square roots of their respective Average Variance Extracted (AVE) values. Adequate discriminant validity requires that each construct's AVE exceeds 0.50 and surpasses its correlations with other latent variables (Hair et al., 2017). As shown in the table, all AVE values exceeded the minimum threshold of 0.50, and each construct's AVE was significantly higher than its correlations with other latent variables, confirming discriminant validity. Notably, the highest inter-construct correlation observed was 0.904 between the Production and Commercialization (PROCO) latent variable.

Table 7: Fornell-Larcker Measures Discriminant Validity

Latent variables	IDEA	PROCO	PROTO	SEE	VALID

IDEA	0.831				
PROCO	0.761	0.904			
PROTO	0.722	0.761	0.880		
SEE	0.765	0.847	0.728	0.838	
VALID	0.758	0.855	0.781	0.796	0.855

Note: The primary diagonal of the matrix's numbered columns is highlighted in bold.

Source: Authors' compilation.

5.5.3 Structural Model Evaluation

After demonstrating the reliability and validity of the measurement model, the subsequent phase involves evaluating the structural model, as outlined by Hair et al. (2019). This stage entails assessing three critical metrics: path coefficients, effect size (f^2), and coefficient of determination (R^2), which collectively inform hypothesis testing regarding variable relationships within the model.

A significant advantage of PLS-SEM lies in its capability to differentiate between direct, indirect, and aggregate (total) effects on outcome variables related to production and commercialization (see Table 8). It becomes evident that IDEA exerts a substantial influence on PROCO both directly and indirectly, with a total effect of 0.483 (standard error [SE] = 0.082; t-statistics = 5.897; $p < 0.001$). In contrast, PROTO exhibits an indirect impact on PROCO, while its direct effect is statistically insignificant (total effect = 0.366; SE = 0.090; $t = 4.058$; $p < 0.001$). Furthermore, VALID demonstrates a significant direct influence on PROCO alone (total effect = 0.562; SE = 0.094; $t = 5.954$; $p < 0.001$). Among the factors influencing PROCO, VALID emerges as the strongest predictor, with the largest total effect (0.562; SE = 0.094; $t = 5.954$; $p < 0.001$), followed by IDEA (total effect = 0.483; SE = 0.082; $t = 5.897$; $p < 0.001$) and PROTO (total effect = 0.366; SE = 0.090; $t = 4.058$; $p < 0.001$).

Table 8: Total, Direct, and Indirect Effects of the Path Models

Relationships	Direct path coefficient	Indirect path coefficient	Total effects	Std. error	t statistics	p-values
IDEA-PROCO	0.214**	0.269***	0.483***	0.082	5.897	<0.001
IDEA-PROTO	0.400***	-	0.400***	0.104	3.830	<0.001
IDEA-VALID	0.219	0.141**	0.360**	0.108	3.334	0.001
PROTO-PROCO	0.168	0.198**	0.366***	0.090	4.058	<0.001

PROTO-VALID	0.353***	-	0.353***	0.100	3.536	<0.001
SEE-IDEA	0.765***	-	0.765***	0.042	18.054	<0.001
SEE-PROTO	0.422***	0.306***	0.728***	0.050	14.414	<0.001
SEE-VALID	0.371***	0.424***	0.796***	0.043	18.577	<0.001
VALID-PROCO	0.562***	-	0.562***	0.094	5.954	<0.001
SEE-PROCO	-	0.733***	0.733***			0.001

Note: **: p<0.05.***: p<0.001. Std.error were estimated using the bootstrap validation.

Source: authors' compilation

As indicated in Table 9, all the hypotheses were accepted based on statistical criteria, with t-statistics values exceeding 1,695 and p-values below 0.05, thereby confirming their significance at the 5% confidence level. Figure 24 presents the final model and coefficient estimates.

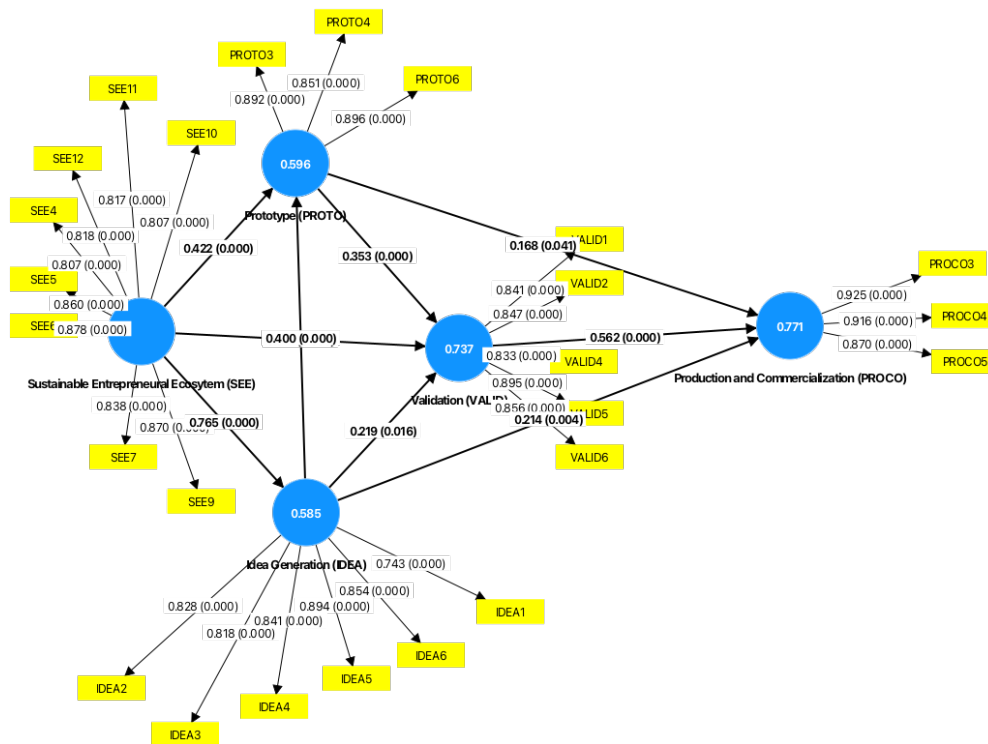


Figure 24: The Final Path Model and Coefficient Estimates

Note: **: p<0.05.***: p<0.001.

Source: authors' estimation

Subsequently, the specific indirect effect is evaluated, calculated by aggregating all indirect pathways between independent and dependent variables through a designated mediating construct, following

established methodologies. As presented in Table 9, three indirect relationships exhibit t-statistics values below the threshold of 1.695 and p-values exceeding the conventional alpha level of 0.05, failing to meet statistical significance criteria. Consequently, these findings indicate that the prototyping variable does not function as a mediator in linking independent and dependent constructs within the model.

Table 9: Specific Indirect Effects

Path	Indirect path coefficients	t statistics	p-values
IDEA-PROTO-VALID	0.141	2.419	0.016
SEE-PROTO-PROCO	0.071	1.610	0.108
SEE-IDEA-PROCO	0.164	2.733	0.006
SEE-IDEA-PROTO	0.306	3.956	0.000
SEE-PROTO-VALID	0.149	2.786	0.005
SEE-IDEA-VALID	0.167	2.459	0.014
IDEA-PROTO-VALID-PROCO	0.079	2.446	0.014
SEE-IDEA-PROTO-VALID	0.108	2.502	0.012
SEE-IDEA-PROTO-PROCO	0.051	1.935	0.053
SEE-PROTO-VALID-PROCO	0.084	2.758	0.006
SEE-IDEA-VALID-PROCO	0.094	2.289	0.022
IDEA-VALID-PROCO	0.123	2.263	0.024
IDEA-PROTO-PROCO	0.067	1.924	0.054
PROTO-VALID-PROCO	0.198	3.449	0.001
SEE-IDEA-PROTO-VALID-PROCO	0.061	2.516	0.012
SEE-VALID-PROCO	0.209	2.726	0.006

Source: authors' compilation

The explanatory power of the production and commercialization (PROCO) variable, as indicated by its adjusted R² value, is 0.766. This result suggests that approximately 76.6% of the variance in PROCO can be explained by the combined influence of all exogenous variables included in the model (see Table 10). Furthermore, the adjusted R² values for the three mediating variables, e.g., idea generation (IDEA), prototype (PROTO), and validation (VALID), are 0.582, 0.590, and 0.732,

respectively. These figures indicate that the exogenous variables account for 58.2%, 59.0%, and 73.2% of the variance in IDEA, PROTO, and VALID, respectively.

Predictive relevance was assessed using the Q² statistic for each endogenous variable, which evaluates the model's ability to predict the observed data for each latent construct. A Q² value greater than zero reflects good predictive relevance for the corresponding construct. In this study, all endogenous variables, e.g., IDEA, PROTO, VALID, and PROCO exhibit Q² values above zero, demonstrating that the model possesses adequate predictive power and effectively reconstructs the empirical data for these constructs

Table 10: Adjusted R² and Q²

	Adjusted R ²	Q ²
IDEA	0.582	0.398
PROCO	0.766	0.617
PROTO	0.590	0.451
VALID	0.732	0.524

Source: authors' compilation

Additionally, Hair et al. (2019) recommend evaluating the effect size (f²) to assess the practical significance of relationships within structural equation models. As shown in Table 11, the analysis revealed three paths with small effect sizes, four paths with medium effect sizes, and two paths demonstrating large effect sizes. Notably, the path from Sustainable Entrepreneurial Ecosystem (SEE) to Idea Generation (IDEA) exhibited a large effect size (f² > 0.35), underscoring the critical role of a robust entrepreneurial ecosystem in fostering sustainable business ideation. Similarly, the Validation (VALID) to Production and Commercialization (PROCO) path also displayed a large effect size, indicating that products undergoing rigorous validation processes significantly enhance the likelihood of achieving market-ready commercialization and competitive success.

Table 11: Effect Size (F²)

Path	Effect size (f ²)	Conclusion
IDEA – PROCO	0.076	Small effect
IDEA - PROTO	0.164	Medium effect
IDEA - VALID	0.065	Small effect
PROTO - PROCO	0.043	Small effect
PROTO - VALID	0.191	Medium effect

SEE - IDEA	1.409	Large effect
SEE - PROTO	0.183	Medium effect
SEE - VALID	0.184	Medium effect
VALID - PROCO	0.428	Large effect

Source: authors' compilation

The Standardized Root Mean Square Residual (SRMR) value of 0.059 for the research model falls below the commonly accepted threshold of 0.080, indicating that the model demonstrates adequate overall fit and a high degree of correspondence between the observed and predicted covariance matrices (Hu & Bentler, 1998; Sarstedt Marko and Ringle, 2022). The predictive accuracy of the model, as presented in Table 12, reveals that most Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) values in the PLS model are lower than those obtained from the linear model, with a few exceptions. Specifically, improvements in prediction accuracy were observed only for the items PROCO4, VALID4, VALID5, and VALID6 (in terms of RMSE), and PROCO3, PROCO4, PROCO5, VALID1, VALID2, and VALID6 (in terms of MAE). This result suggests that, overall, the PLS model exhibits relatively medium predictive performance compared to the linear model (Sarstedt Marko and Ringle, 2022).

Table 12: PLS-SEM Predictions

	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_RMSE
IDEA1	0.734	0.573	0.763	0.594
IDEA2	0.624	0.477	0.658	0.507
IDEA3	0.617	0.486	0.656	0.492
IDEA4	0.663	0.483	0.710	0.520
IDEA5	0.598	0.463	0.635	0.479
IDEA6	0.631	0.471	0.674	0.490
PROCO3	0.577	0.428	0.591	0.409
PROCO4	0.536	0.410	0.506	0.364
PROCO5	0.552	0.410	0.599	0.381
PROTO3	0.656	0.482	0.720	0.518
PROTO4	0.817	0.580	0.849	0.589
PROTO6	0.624	0.481	0.650	0.481
VALID1	0.644	0.490	0.645	0.476
VALID2	0.571	0.429	0.573	0.405
VALID4	0.698	0.510	0.689	0.512

VALID5	0.610	0.449	0.610	0.451
VALID6	0.587	0.447	0.585	0.420

Source: authors' compilation

5.6 Discussion of the Research Part 2

This study applies the Sustainability Impact Assessment (SIA) framework (Carle & Rayna, 2023) within the context of the sustainable entrepreneurship process, aiming to examine the extent to which the sustainable entrepreneurial ecosystem (Kumar Jha & Pande, 2024) and the sustainable entrepreneurship process influence the performance of sustainable start-ups. In this research, start-up performance is operationalized through production and commercialization capabilities, serving as proxy indicators of business effectiveness and scalability. The field of sustainable impact assessment (SIA) is nascent and has only recently begun to examine the case of sustainable start-ups. Recent contributions have focused on the development of more suitable frameworks (Hornes, 2019) or on the challenges faced by start-ups while providing SIA (Trautwein, 2021). However, there has been a lack of empirical research examining how sustainable start-ups assess their contributions to sustainability during their entrepreneurial process.

A deeper understanding of Sustainable Entrepreneurial Processes (SEPs) not only advances theoretical development but also holds significant potential for generating practical knowledge (Matzembacher et al., 2019). This knowledge can assist academics, policymakers, entrepreneurs, and practitioners in identifying strategies to foster win-win solutions through business initiatives that drive economic growth while simultaneously contributing to the realization of the United Nations' Sustainable Development Goals (SDGs). It has been demonstrated that start-ups with superior innovation capabilities, effective stakeholder engagement, access to resources, and a supportive regulatory framework are better positioned to contribute to the SDGs (Cho, 2024).

The results of the reliability and validity tests demonstrate that, of the three primary indicators of sustainability values in a sustainable entrepreneurial ecosystem (SEE), only two indicators are incorporated into the structural model evaluation. The two SEE indicators are sustainability orientation and enabling cadence. One indicator, social metabolism, was excluded from the analysis due to its low factor loading value. The social metabolism indicator was eliminated from the analysis model because the start-up was focused on product development and had not analyzed the broader impact of social metabolism on equity, inclusion, and consumption in its country. However, research shows that a country's social metabolism impacts entrepreneurial activity (Pacheco & Khoury, 2023; Qureshi et al., 2023). For the latent variables of production and commercialization, two indicators were also removed, namely internal aspects/governance and decisions made without (or contrary to) economic benefits. This result suggests that during the production and commercialization phases,

nascent enterprises prioritize product development and market reception over internal aspects/governance (Carle & Rayna, 2023).

Hypothesis 1, which suggests that the sustainable entrepreneurial ecosystem has a positive and significant influence on the sustainable entrepreneurial process, is supported by the findings. Hypothesis testing revealed that the dominant indicators of the sustainable entrepreneurship ecosystem (SEE) that influence the sustainable entrepreneurial process (SEP) based on the analysis results are talent, knowledge, leadership, finance, entrepreneurship culture, networks, sustainability orientation, and enabling cadence. The analysis excluded several indicators, including physical infrastructure, demand, intermediary services, formal institutions, and social metabolism. The results of this study corroborate the findings of (Pacheco & Khoury, 2023; Qureshi et al., 2023), which indicate that sustainable entrepreneurial s (SEE) exert a substantial influence on entrepreneurial activity.

Hypothesis 2, which posits that the sustainable entrepreneurial process has a positive and significant impact on production and commercialization, is supported by the findings. Hypothesis testing shows that all main variables in the structural model, which in this case are all stages of the sustainable entrepreneurship process (SEP), have a positive and significant effect on production and commercialization, which in this case indicates the performance of start-ups in the sustainable entrepreneurship process. Although some indicators of the latent variables of SEP were excluded from the analysis, such as resentment toward greenwashing and social washing, aligning the business model (BM) with environmental or social benefits, and "normal" decisions made without (or against) economic benefits for the latent variable prototype (PROTO); the indicator "fear of stakeholder reaction" for the latent variable "validation" (VALID). These findings align with previous studies that emphasize the importance of the sustainable entrepreneurial process in driving sustainable outcomes. For instance, Diepolder et al. (2024) highlight that each stage of the SEP contributes to enhancing the overall performance of sustainable ventures, particularly in terms of production and commercialization. Similarly, Matzembacher et al. (2019) argue that sustainable entrepreneurship processes not only focus on economic value but also on social and environmental value creation, thereby influencing the ability of start-ups to scale their operations effectively.

Furthermore, Nguyen et al. (2024) provide empirical evidence that the integration of sustainability into entrepreneurial processes leads to better alignment between innovation and market demand, ultimately improving production and commercialization capabilities. This is consistent with Carle and Rayna (2023), who found that start-ups that systematically incorporate sustainability into their SEP tend to achieve higher levels of operational efficiency and market acceptance.

Despite the exclusion of certain indicators, such as resentment toward greenwashing and social washing, the remaining variables still demonstrate strong support for Hypothesis 2. The inclusion of "fear of stakeholder reaction" as an indicator for validation underscores the critical role of stakeholder engagement in ensuring the success of sustainable ventures. This finding is further supported by Spigel and Harrison (2017), who emphasize that stakeholder buy-in is essential for the long-term viability of sustainable entrepreneurship initiatives.

It was also hypothesized that sustainable entrepreneurial processes mediate the influence of sustainable entrepreneurial ecosystems on production and commercialization. The results support this assumption, leading to the acceptance of Hypothesis 3. The study's findings, supported by Jha & Pande (2024) and Theodoraki et al. (2022), indicate that a robust Sustainable Entrepreneurial Ecosystem (SEE) enhances the growth and performance of sustainable entrepreneurial ventures. The present study offers empirical evidence that entrepreneurial orientation (EO), a component of a sustainable start-up ecosystem, exhibits a positive correlation with start-up performance (Vincent & Zakkariya, 2021).

5.7 Conclusion of the Research Part 2

Based on the findings of Research Part 2, all hypotheses proposed in this research are supported. The analytical results indicate that the sustainable entrepreneurial ecosystem (SEE) has a positive and statistically significant impact on the sustainable entrepreneurial process (SEP). Furthermore, the SEP demonstrates a positive and significant influence on production and commercialization. Additionally, the study confirms that the sustainable entrepreneurial process (SEP) mediates the relationship between the sustainable entrepreneurial ecosystem (SEE) and production and commercialization.

This thesis presents compelling evidence of the significant and positive influence of a sustainable entrepreneurial ecosystem on the sustainable entrepreneurial process, underscoring the necessity of structured support at every stage of development. The confirmed hypotheses provide valuable, actionable insights for a range of stakeholders, including universities, start-ups, government agencies, investors, and academic researchers. Nevertheless, recognizing the existing limitations offers important guidance for future research, enabling a more nuanced understanding and further refinement of sustainable entrepreneurship ecosystems. By building on these findings, stakeholders are better positioned to collectively create and sustain a conducive environment for the growth of sustainable start-ups not only in Bali but also in other regions with similar developmental goals.

6. DISCUSSION, IMPLICATION AND NOVELTY OF THE THESIS

6.1 Discussion of the Thesis

6.1.1 Introduction

This chapter provides a comprehensive discussion of the research findings presented throughout the thesis, with the aim of addressing and fulfilling the overarching objectives of the study. The discussion is constructed through the synthesis of results from both Research Part 1 and Research Part 2, offering an integrated perspective on the role of university business incubators in facilitating and supporting sustainable student start-ups. By combining bibliometric insights with empirical evidence, this chapter elaborates on how incubation frameworks can be aligned with sustainability principles to enhance start-up development and long-term viability. The integration of both parts allows for a multidimensional understanding of how incubation programs operate at the institutional level (Research Part 1) and how they impact start-up performance during and after incubation (Research Part 2). By combining bibliometric insights, structural equation modeling, and empirical data from the case of Bali, Indonesia, this discussion addresses the overarching objective of the thesis: to evaluate UBIs through the lens of sustainability-driven entrepreneurship and identify models that can enhance sustainable practices. The PLS-SEM results are analyzed with reference to the conceptual framework developed in research part 2, which integrates theories related to sustainable entrepreneurial ecosystems (SEE), sustainable entrepreneurial processes (SEP), production and commercialization stages, and sustainability impact assessment (SIA). The discussion also draws upon literature from previous studies such as (Asensio-Ciria et al., 2024; Mascarenhas et al., 2017; Matzembacher et al., 2019), which highlight the importance of aligning incubator strategies with long-term sustainability goals.

6.1.2 Literature Review Results of Sustainable Start-up Incubation

The literature review offers a foundational overview of start-up incubation, with a particular emphasis on sustainable business incubators and their operational frameworks. Through the application of bibliometric analysis and visualization techniques such as keyword co-occurrence mapping, the study identifies and maps key research domains related to start-up incubation, revealing prominent thematic trends including: the development of business incubation models (Asensio-Ciria et al., 2024, 2025; Pauwels et al., 2016), the growing integration of sustainability into entrepreneurial processes (Ahmić & Šahović, 2025; Carle & Rayna, 2023; Matzembacher et al., 2019; Nguyen et al., 2024; Spigel & Harrison, 2017), and the role of university-based incubators in fostering student led entrepreneurial ventures (Barbara Bernhofer & Li, 2014; Diepolder et al., 2024; Preiss et al., 2023; Sher et al., 2020; Wright et al., 2017; Zhang et al., 2022).

A significant finding from this section is the emergence of Sustainability-Based Incubators (SBIs) as a novel concept. Unlike traditional incubation models, SBIs incorporate sustainability principles throughout the entire lifecycle of a start-up, spanning from idea generation and prototype development to graduation and post-incubation support (Bărbulescu et al., 2021; Carle & Rayna, 2023; Cho, 2024; van Rijnsouwer, 2022). This approach ensures that environmental and social value creation are embedded at every stage of the incubation process, thereby contributing to the development of start-ups that are not only commercially viable but also aligned with long-term sustainable development goals (Blok, 2018; Diepolder et al., 2024; Dos Santos & Teixeira, 2021; Elkington, 1994; Kumar Jha & Pande, 2024; Lamine et al., 2016; Matzembacher et al., 2019; Sher et al., 2020).

6.1.3 The Role of University Business Incubators in Bali Province, Indonesia

The findings from Research Part 2 of the study, which empirically support all proposed hypotheses, lead to the conclusion that a sustainable start-up ecosystem exerts a significant influence on the sustainable entrepreneurial process, ultimately shaping the success of sustainable start-ups. This outcome can be attributed to the deliberate and resource-driven efforts undertaken by UBIs in Bali Province to cultivate an entrepreneurial ecosystem that aligns with sustainability objectives. These incubators leverage various available resources including financial capital, human capital, and physical infrastructure to establish an environment conducive to sustainable start-up development. Notably, Jha & Rajan (2024) emphasize that the availability of sustainable financial resources is a critical enabler in maintaining incubation processes that are both enduring and consistent with long-term ecological and social goals. Their insights underscore the role of financial sustainability as a foundational element for supporting continuous innovation and growth within the start-up lifecycle. Empirical research has demonstrated discrepancies in the level of support provided by universities for the fostering of entrepreneurship among female and male students (Becky-Nagy & Fazekas, 2025). It has been demonstrated that, in the case of women, university support is of greater importance in terms of the establishment of networks and the development of entrepreneurial skills than it is for men.

According to Dourado Freire et al. (2023), among the various resources provided by business incubators, physical resources are the most representative, particularly in the early stages of start-up development. While business incubators typically do not provide direct financial resources, they play a crucial role in facilitating access to funding through their networks with external stakeholders such as investors, financial institutions, and funding agencies. This highlights the significant role of business incubators as network brokers, underscoring the value of networking in supporting start-up growth and resource acquisition.

The findings from Research Part 2 revealed that the sustainable entrepreneurial process has a positive and statistically significant effect on production and commercialization outcomes. These results are closely related to those of Research Part 1. In the context of university business incubators and their role in facilitating sustainable incubation for start-up tenants, the results indicate that deliberate efforts are being made to support and promote sustainable start-up development across all stages of the entrepreneurial process. This is further supported by the survey data from the Research Part 1, which showed that UBIs actively encourage the generation of business ideas among start-up tenants that contribute to environmental improvement, social value creation, and the mitigation of negative ecological and societal impacts. These findings are consistent with the research conducted by Jha and Rajan (2024), which emphasizes that business incubators should aim to establish a sustainable start-up ecosystem. Such an ecosystem should not only offer comprehensive support services throughout the incubation process but also be capable of measuring its impact on the success of incubated sustainable start-ups. In particular, Jha & Rajan (2024) highlights the importance of securing sustainable financial resources as a critical enabler for maintaining long-term start-up incubation processes that align with sustainability goals.

In order to establish a sustainable start-up incubation framework, the tenant recruitment mechanism employed by UBIs in Bali Province takes into account the broader impact of prospective start-ups, particularly in terms of economic, social, environmental, cultural, and growth-related benefits. The tenant recruitment process represents the initial phase of start-up incubation within a business incubator, serving as a foundational step in selecting and onboarding start-ups that align with the incubator's objectives and support capabilities (Bank et al., 2017; Bank & Kanda, 2016). As indicated by the findings from Research Part 1, while social, environmental, and cultural impacts are acknowledged and considered during the selection process, economic viability and growth potential remain the dominant criteria used by incubators when choosing new tenant start-ups.

This finding is further contextualized by the results of Research Part 2, which demonstrate that the entire sustainable entrepreneurship process (SEP) exerts a positive influence on production and commercialization outcomes. Across each stage of the entrepreneurial lifecycle: idea generation, prototype development, and validation, sustainability impact assessments are systematically integrated, suggesting that over time, start-ups are increasingly oriented toward addressing social, environmental, and cultural dimensions as part of their development trajectory (Carle & Rayna, 2023). This gradual incorporation of sustainability considerations aligns with the long-term goals of fostering responsible and scalable ventures within the regional entrepreneurial ecosystem (Lamine et al., 2016; Wagner et al., 2021).

Another significant finding of this thesis that warrants further discussion is the role of intellectual property rights particularly patents, licenses and other legal frameworks in supporting the sustainability of start-up incubation, as highlighted in Research Part 1. In more developed economies, Technology Transfer Offices (TTOs) serve as pivotal intermediaries in managing intellectual property rights (IPR) arising from academic research and enabling their commercialization through structured licensing arrangements or spin-off initiatives (Etzkowitz & Klofsten, 2005; Fini et al., 2011). In contrast, the results from Research Part 1 reveal that within the context of UBIs in Indonesia particularly in Bali start-ups frequently lack systematic guidance on the legal protection of their innovations through instruments such as patents or trademarks. Empirical data indicate that half of universities have not applied for a patent in the last 3 years, namely 7 (50.0%) universities during the incubation process. Fazekas & Becsky-Nagy (2026) have examined the role of innovation performance as measured by patent activity. The studies yielded results that contradicted expectations, in that the patent variable was not found to significantly affect the start-up exit.

As part of an ongoing investigation into the role of university-based incubators in fostering sustainable entrepreneurship in Indonesia, Máté et al. (2025) examine whether University Business Incubators (UBIs) that prioritise societal and community-oriented contributions achieve superior innovation performance and economic outcomes. The study utilises a data set comprising 31 UBIs across Indonesia, employing a Heteroscedasticity and Autocorrelation Consistent (HAC) corrected linear regression analysis to examine the association between incubator resource allocation towards socially oriented start-ups and two pivotal outcome dimensions: The performance of innovation can be measured in a number of ways. Firstly, it can be measured by the number of licences granted, patent applications filed, and patents awarded. Secondly, it can be measured by the number of successful exits, defined as acquisitions by investors or established firms. The findings indicate that a greater proportion of an incubator's annual budget allocated to societal or sustainability-driven innovations is positively associated with increased patenting activity among tenant start-ups, specifically a greater number of patent applications and granted patents. Conversely, the mere count of socially oriented tenants (e.g., green or sustainable start-ups) does not consistently enhance innovation outputs; however, it demonstrates a statistically significant and positive relationship with the number of successful exits. The study's analytical framework integrates three foundational theoretical perspectives (Máté et al., 2025) : Firstly, the Resource-Based View (RBV) is predicated on the premise that unique, valuable and inimitable resources, including sustainability-targeted budgets and dedicated full-time staff, generate competitive advantage. Secondly, Human Capital Theory (HCT) is a body of thought that places significant emphasis on the pivotal role of incubator personnel and external experts as crucial intellectual assets that are instrumental in propelling innovation and commercialisation. Thirdly, the Sustainable Innovation Theory posits that strategic

investments in sustainability-oriented ventures have the capacity to engender economic value and a positive societal impact in a simultaneous manner. Máté et al. (2025) propose a contextual framework (see Figure 25) that links incubator-level inputs to four innovation and commercialisation outcomes.

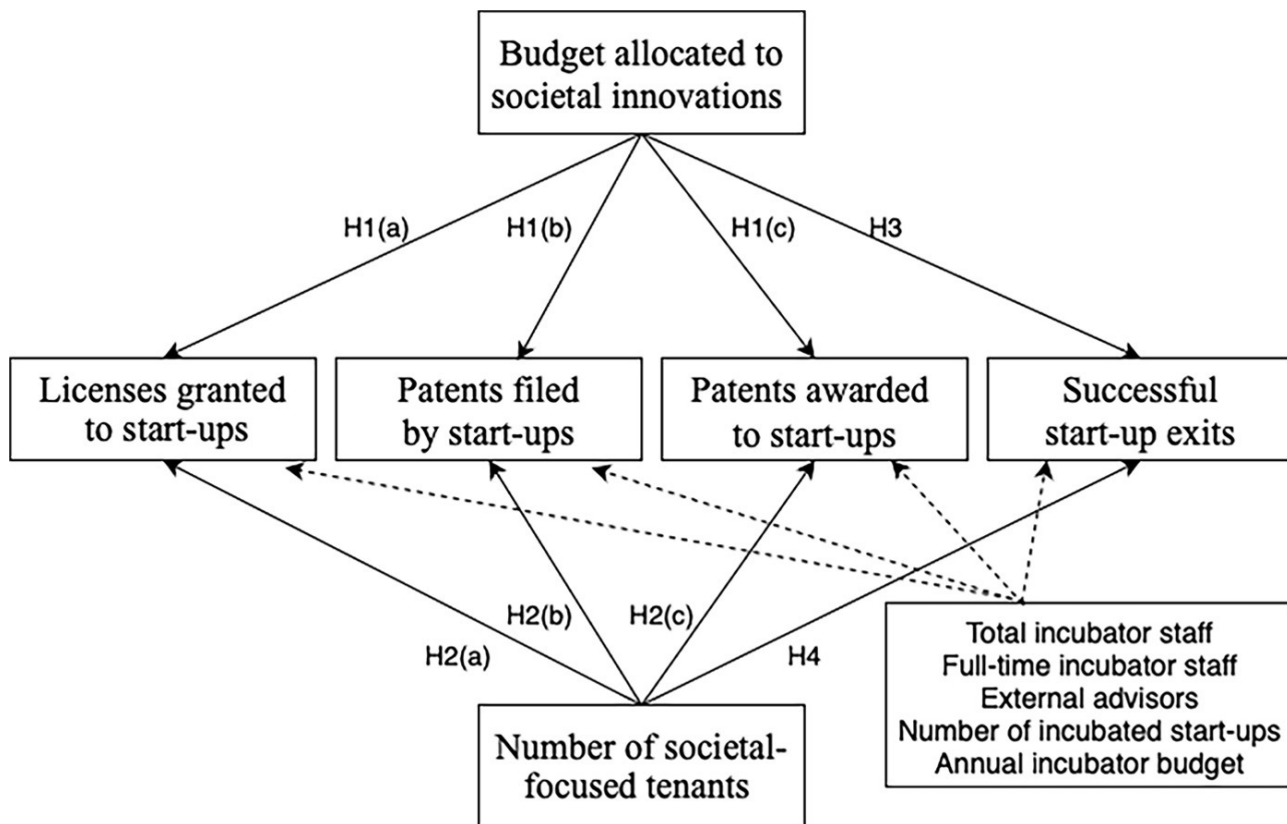


Figure 25: Contextual framework of University Business Incubators in Indonesia

Source: Máté et al. (2025)

The empirical results provide robust evidence that a societal orientation in incubation does not compromise commercial viability; rather, it enhances both innovation and market success, particularly when supported by strategic resource allocation and consistent expert mentorship.

The majority of university incubators do not maintain formal partnerships with patent offices or legal experts specializing in intellectual property, thereby limiting access to essential services for student entrepreneurs. These findings point to a significant gap in the current operational framework of university business incubators in Bali, where the legal infrastructure for innovation protection remains underdeveloped, despite the growing number of technologies driven and creative start-ups undergoing incubation. To address this gap, higher education institutions should actively establish collaborations with national regulatory bodies such as the Ministry of Law and Human Rights and the Directorate General of Intellectual Property. Such strategic partnerships would enable the provision of targeted legal guidance and institutional support for start-up tenants, ensuring that their innovations are adequately protected and positioned for long-term commercial and societal impact (Norman & Eisenkot, 2017).

6.1.4 Critical Evaluation of Current Incubation Program

A critical evaluation of the limitations of current incubation programs is imperative. The tendency to prioritize short-term success over long-term sustainability must be identified and analyzed. The findings from Research Part 2, underpinned by the conceptual framework established in Research Part 1, indicate that a majority of UBIs in Bali Province demonstrate a pronounced inclination toward prioritizing short-term success over long-term sustainability within their incubation programs. This tendency is observable across several critical dimensions:

- **Emphasis on Graduation Rates as Primary Key Performance Indicators (KPIs)**

University-based incubators frequently utilize graduation rates, defined as the number of start-ups successfully completing the incubation process as a central metric for assessing program effectiveness. While this indicator reflects operational efficiency and program output, it does not adequately capture post-incubation outcomes, such as: Whether the start-ups remain active and viable after exiting the incubator. The extent to which they continue to implement sustainable practices or generate measurable social impact beyond the incubation period.

This pattern is consistent with the observations of Mascarenhas et al. (Mascarenhas et al., 2017), who assert that many incubation initiatives rely on output-oriented metrics, rather than comprehensive outcome- or impact-based indicators. Consequently, start-ups may be incentivized to graduate prematurely, even if they lack the full readiness for independent operation or sustainable development.

- **Lack of Emphasis on Sustainability Metrics**

Despite growing global awareness and momentum toward sustainable entrepreneurship, most UBIs in Bali, Indonesia have yet to formally integrate Sustainability Impact Assessment (SIA) into their selection, mentoring, and graduation criteria. Based on survey results (Research Part 1), only a small proportion of incubators use environmental or social indicators in their start-up evaluations. Factors such as ecological sustainability, social impact, and local community inclusion are rarely key parameters in decision-making or tenant selection. This confirms the observation by Baldassarre et al. (2017, 2020), who stated that business incubators often fail to measure start-ups' contributions to sustainable development goals (SDGs). Instead, they focus more on early achievements such as: Product validation, Market access, Initial funding.

- **Insufficient Post-Incubation Support**

A further critical limitation identified in this study is the absence of structured post-incubation support systems. Upon completing the incubation process, start-ups frequently lose access to essential resources such as mentorship, funding networks, and shared infrastructure. In many instances, this can abrupt disengagement contributes to high failure rates or early-stage discontinuation among

graduated start-ups. The Research Part 1 findings reveal that 24.4% of the surveyed start-ups were established before 2020, yet not all of them received ongoing assistance after graduation from the incubator. This indicates a prevailing tendency among UBIs to discontinue engagement with start-ups once the formal incubation period ends, without implementing monitoring mechanisms or offering continued support during the post-incubation phase. This observation aligns with Alvarez and Busenitz (2001) who emphasize that many incubators overlook the significance of the transitional stage for start-ups after exiting the incubation environment. The lack of follow-up support may hinder long-term sustainability, commercialization and market readiness, especially for start-ups that are still in their developmental stages upon graduation.

- **Short-Term Funding and Resource Allocation**

A significant limitation identified in this study is that many UBIs in Bali, Indonesia operate under financial constraints and time-bound funding mechanisms, which consequently encourage a focus on short-term outcomes rather than long-term sustainability. As a result of these limitations, incubators often prioritize start-ups that demonstrate early market traction, rapid development cycles, and quick validation, at the expense of those pursuing more complex, long-term sustainable development goals. Empirical evidence from Research Part 1 supports this observation, revealing that 14.3% of start-ups were incubated for less than one year and 71.45% were incubated for 1-2 years. This relatively short incubation period suggests that start-ups are incentivized to pursue immediate solutions to achieve market readiness, rather than investing time in building robust and sustainable business models. As noted by Yetisen et al. (2015), incubators facing resource and time constraints tend to adopt a "quick win" strategy in start-up development. While this approach may yield early successes, it can ultimately limit opportunities for deeper innovation and reduce the potential for meaningful social or environmental impact.

- **Underdeveloped Sustainability Orientation**

As discussed in Research Part 2, sustainability orientation refers to the degree to which an organization incorporates environmental, social, and economic considerations into its strategic decision-making processes. The findings indicate that many university business incubators in Bali exhibit only a moderate level of sustainability orientation, as demonstrated by:

- A limited focus on green or environmentally friendly initiatives.
- Minimal integration of ESG (Environmental, Social, and Governance) principles into incubation frameworks.
- Infrequent evaluation of start-ups based on their contributions to social or ecological value creation.

These observations are supported by the results from Research Part 1, which reveal that 21.4% of start-ups operating in non-creative and non-technology sectors show low diversification in the application of sustainability principles. This aligns with Wagner et al. (2021) who argue that business incubators in developing regions often fall short in fostering sustainability awareness and competencies among emerging entrepreneurs. Their findings also suggest that without a strong sustainability orientation within incubators, start-ups may not fully internalize long-term sustainable practices, limiting their potential impact on broader societal and environmental goals.

- **Insufficient Mentorship for Sustainable Business Models**

Mentorship constitutes a core service provided by UBIs, playing a critical role in guiding start-ups through the entrepreneurial process. However, the findings from path analysis and hypothesis testing (H1–H3) indicate that the mentorship offered within the incubation programs in Bali predominantly emphasizes technical and technological aspects, rather than strategies related to sustainable business models or social and environmental risk management. For instance, key variables such as "trust" and "social influence", which have been identified as significant factors in the adoption and development of sustainable start-ups (Dhir et al., 2021; Todeschini et al., 2017), are not systematically integrated into the design or delivery of mentorship programs. This suggests a policy gap in aligning incubation strategies with the principles of sustainable entrepreneurship, limiting the extent to which start-ups receive guidance on embedding sustainability into their business operations.

6.1.5 Recommendations for a New Incubation Model for Indonesian Universities

The results of the two parts of the study provided the foundation for recommendations concerning a new incubation model. This model is intended not only for implementation in Indonesian universities. The primary aim of this implementation is to strengthen the role of UBIs in supporting the Sustainable Development Goals (SDGs) and regional development strategies.

One of the key limitations identified in the study is the lack of structured post-incubation monitoring and support systems. The results show that university business incubators in Bali Province do not actively track the performance of start-ups after graduation, which limits the ability to assess long-term viability and sustainability beyond the formal incubation period.

Providing start-ups with additional time to mature their business models and ensure they are ready for independent operations. Moreover, establishment of ongoing mentorship, networking opportunities, and access to resources even after graduation to support start-ups during the critical transition phase. According to Jha & Rajan (2024), successful incubators often adopt a "long-term nurturing" approach by providing continuous support beyond graduation. This recommendation

aligns with the findings of Research Part 2, which emphasize the importance of sustained support throughout the entrepreneurial lifecycle.

Another limitation highlighted in the study is the insufficient integration of industry partners and external stakeholders in the incubation process. Current incubators in Bali, Province primarily focus on internal resources without leveraging broader networks effectively. Development of partnerships with local businesses, government agencies, and nonprofit organizations is recommended to expand access to sustainable resources such as funding, mentorship, and market opportunities. Moreover, the Sign Memorandums of Understanding (MOUs) with industry leaders can facilitate knowledge exchange and resource sharing. Grimaldi & Grandi (2005) argue that strong university-industry collaboration enhances innovation commercialization and start-up success rates. By integrating industry networks, incubators can provide start-ups with real-world insights and practical guidance, bridging the gap between academic research and market readiness.

The study reveals that many incubators in Bali prioritize short-term economic outcomes over long-term sustainability goals. It is crucial to embed sustainability principles into every stage of the incubation process to address this imbalance. Integration of sustainability variables are recommended to include environmental, social, and governance (ESG) metrics in all phases of the incubation process, from tenant selection to graduation and post-incubation support. The development of Sustainability Impact Assessments (SIAs) systematic evaluations and implementations are needed to measure the ecological and societal impact of start-ups, ensuring alignment with SDGs. Asensio-Ciria et al. (2025) emphasize the need for sustainability-oriented frameworks in start-up incubation to foster responsible entrepreneurship. By embedding sustainability considerations early on incubators can guide start-ups toward developing scalable and socially impactful ventures (Surana et al., 2020).

Currently, university incubators in Bali, Province tend to prioritize economic viability and growth potential over sustainability factors. The selection criteria and process must be revisited to promote more inclusive and sustainable start-up ecosystems. Incorporate environmental and social indicators and metrics can be included such as carbon footprint (CO₂) reduction, job creation for marginalized communities, and community engagement. Combination of quantitative data, for instance financial projections with qualitative assessments (social impact statements) ensure a balanced evaluation. Mascarenhas et al. (2017) highlight the importance of considering both economic and social dimensions in start-up selection to foster long-term sustainability. By prioritizing start-ups with clear sustainability objectives, incubators can contribute to regional development and SDG achievement.

The study identifies a significant gap in Intellectual Property (IP) protection and licensing support provided by UBIs in Bali, Indonesia. Start-ups often graduate without adequate legal protection for their innovations. Providing IP training and advisory services, e.g., workshops, consultations, and

partnerships with patent offices or legal advisors are suggested to assist start-ups in securing patents, trademarks, and other forms of IP protection. Thus, the inclusion of modules on intellectual property rights within the incubation program to educate tenants enhance the importance of protecting their innovations. Etzkowitz & Klofsten (2005) also stress the role of technology transfer offices (TTOs) in managing IP generated from academic research. Nevertheless, the proper IP protection ensures start-ups can compete effectively in the market and attract investors, thereby enhancing their long-term viability.

Mentorship remains focused on technical and operational aspects rather than sustainable business strategies or social-environmental risk management. Training of mentors are recommended to provide guidance on sustainable business models, green technologies, and social impact measurement. Thus, invitation of sustainability experts, environmental consultants, and social entrepreneurs are suggested to conduct workshops and coaching sessions. Dhir et al. (2021) emphasize the importance of trust and social influence in the adoption of sustainable start-ups. By broadening mentorship to include sustainability principles, incubators can better prepare start-ups for long-term success.

Current UBIs rely heavily on graduation rates and initial traction, neglecting long-term outcomes. To address this phenomenon, new metrics should be developed. Monitoring start-ups performance over several years post-graduation using standardized metrics can develop composite indices. Creating an index that combines financial, social, and environmental performance indicators to evaluate overall sustainability call for additional developments. Sun et al. (2025) highlight the importance of market orientation and dynamic capabilities in start-up performance. Comprehensive metrics will enable incubators to assess the true impact of their programs and refine support strategies accordingly.

Specifically, the following section delineates the manner in which the incubation process can be sustainable for universities:

- **Diversify Revenue Streams Beyond Government Grants**

Relying solely on volatile annual government funding is a primary cause of institutional fragility. UBIs must develop diversified, self-generated income models:

- **Equity Stakes & Royalty Agreements:** Negotiate small equity stakes (e.g., 2–5%) or royalty agreements with high-potential start-ups.
- **Fee-for-Service Models:** Offer specialized services to external clients: IP management, market validation, prototyping labs, or executive education for local SMEs. This leverages university expertise as a revenue source (Dourado Freire et al., 2023; Grimaldi & Grandi, 2005).

- Facility Leasing & Co-Working Spaces: Rent out underutilized incubator space, labs, or meeting rooms to external entrepreneurs or corporate R&D teams during off-peak hours.
- Corporate Sponsorship & Naming Rights: Partner with corporations for sponsored programs, labs, or challenge competitions. This provides funding and real-world market access for start-ups.

“Business incubators should not be viewed as cost centers but as strategic investment vehicles for the university”(Jha & Rajan, 2024).

- Embed the incubator into core academic and research missions
 - Academic credit and curriculum integration: Offer formal academic credit for student participation in incubator programs. Integrate real start-up challenges into capstone projects, MBA courses, or engineering design studios (Wagner et al., 2021).
 - Faculty engagement and applied research: Incentivize faculty to supervise incubator projects or co-develop research with start-ups. Count incubator outcomes (patents, spin-offs, community impact) as part of faculty performance evaluation (Mascarenhas et al., 2017).
 - Alumni and student fee contributions: Establish a small “innovation fee” from all students, with transparency on how funds support peer start-ups. Engage successful alumni as donors or mentors.
- Build strategic, long term partnership

Move beyond ad-hoc collaborations to institutionalized partnerships:

- Formal MoUs with industry and impact investors: Establish multi year agreements with corporations and impact investors for co-funding, mentorship, and pilot project opportunities. This de-risks start-up development and provides stable external support (Bank & Kanda, 2016).
- Government Co-Funding Models: Advocate for “matching fund” schemes where government grants require 50% co-funding from private partners, ensuring shared accountability and diversified funding.
- Cross-University Networks: Form consortia with other UBIs to share best practices, pool resources for joint events, and negotiate better terms with service providers.
- Implement Longitudinal Impact Tracking & Alumni Engagement

Data is power. Tracking long-term outcomes demonstrates value and attracts future funding:

- Alumni tracking system: Develop a customer relationship management (CRM) to track graduated start-ups for 5–10 years (jobs created, revenue generated, funding raised, SDG

contributions). Use this data for annual impact reports to university leadership and funders (Cho, 2024).

- Success based funding: Negotiate with the university to allocate a percentage of alumni start-up success back into the incubator fund.
 - “Give Back” Culture: Encourage successful alumni to mentor new cohorts or contribute seed funding, creating a virtuous cycle.
- Invest in professional capacity and adaptive governance

Sustainability requires skilled human capital and flexible structures:

- Professionalize incubator staff: Treat incubator managers as strategic assets. Provide training in impact measurement, ESG integration, investor relations, and advanced mentorship. Offer competitive salaries tied to KPIs (e.g., start-up survival rate, jobs created, SDG alignment) (Pattanasak et al., 2022).
- Advisory board with external stakeholders: Establish a board including industry leaders, investors, and alumni to provide strategic guidance and open doors to resources.
- Dynamic Performance Metrics: Move beyond “number of start-ups graduated” to metrics such as:
 - Percentage of start-ups still operating after 3 years
 - Average jobs created per start-up
 - Total external funding attracted
 - SDG alignment score (using SIA framework).

This matters for Indonesian Universities. In the Indonesian context, where public funding is often project-based and short-term (as confirmed in Research Part 1, where 71.4% of UBIs rely on government grants), these strategies are not optional, they are essential for survival. Bali’s UBIs, with their strong cultural emphasis on community and harmony, are uniquely positioned to lead in this area by framing incubator sustainability as a form of institutional responsibility ensuring that the engine of innovation continues to serve students, the economy, and society for decades to come. This approach transforms the UBI from a temporary program into a permanent, value-generating pillar of the university aligning perfectly with Indonesia’s national goals for innovation, SDG achievement, and economic resilience.

6.2. Implications of the Thesis

This dissertation based on the analysis of UBIs in the case of Bali, Province, Indonesia, with a focus on sustainable entrepreneurship ecosystems and their impact on the entrepreneurial process, has significant implications for various stakeholders involved in promoting start-up growth. This thesis

carries theoretical and practical ramifications. The subsequent section delineates the implications for each stakeholder group.

Universities and Business Incubators

- **Strengthening Support Systems**

The findings confirm that a sustainable entrepreneurial ecosystem positively impacts all stages of the sustainable entrepreneurial process, including idea generation, prototyping, validation, production, and commercialization. Universities and business incubators can use this information to enhance their support systems by focusing on sustainability as a core component of their programs. For example:

- Incorporating sustainability modules can integrate sustainability training, workshops, and resources into existing incubator programs to help start-ups develop eco-friendly and socially responsible solutions.
- Sustainability focused mentorship can recruit mentors who specialize in sustainable practices to guide start-ups through the entrepreneurial journey.
- Green funding opportunities can develop or increase partnerships with the funding sources that prioritize sustainable start-ups, such as green venture capital funds or government grants focused on sustainability.

- **Enhancing Mediation Role**

The mediation role of the sustainable entrepreneurial process (SEP) between the ecosystem and production/commercialization highlights the importance of structured support at each stage of incubation. Incubators should ensure that their programs provide continuous guidance and resources throughout the entire lifecycle of a start-ups, from ideation to market entry. This includes:

- Stage-specific and design tailored programs for each phase (e.g., idea generation workshops, prototype development labs, validation testing facilities).
- Feedback loops can establish mechanisms for regular feedback and adjustment to ensure start-ups are well-prepared for production and commercialization.

Start-ups and Entrepreneurs

- **Adopting Sustainable Practices**

Start-ups can leverage the positive influence of the sustainable entrepreneurial ecosystem by actively engaging with incubators and adopting sustainable practices in their operations. Focus on developing products or services that address environmental or social challenges aligns with the growing demand for sustainable offerings. The implementation of resource-efficient processes during prototyping and validation to reduce costs and environmental impact and/or sustainability credentials in marketing and communication strategies can build trust with environmentally conscious consumers.

Government and Policymakers

The results emphasize the critical role of a supportive ecosystem in driving and promoting sustainable entrepreneurship policies. Governments can play a pivotal role by developing policies that incentivize sustainable start-ups, such as tax breaks, subsidies, or streamlined regulations for eco-friendly businesses. Nevertheless, funding initiatives can allocate budgets for sustainable innovation hubs or grants specifically targeting start-ups working on sustainability projects. Launching public campaigns can raise awareness about the benefits of sustainable entrepreneurship and encourage investment in this sector.

Policymakers can collaborate with universities to expand the reach of sustainable entrepreneurship programs. Joint initiatives and partnerships can be involved with incubators to create regional or national networks of sustainable entrepreneurship centers. The usage of such research findings is implied to inform policy decisions and track the impact of sustainable entrepreneurship initiatives over time.

Investors and Funders

Investors can benefit from the study's findings by prioritizing start-ups that demonstrate a commitment to sustainability. For instance, (1) focus on ventures that not only generate financial returns but also deliver positive environmental and social outcomes. (2) Incorporate sustainability metrics into due diligence processes to identify start-ups with long-term viability and scalability. (3) Investors can support UBIs by providing funding or resources to enhance their capacity to nurture sustainable start-ups with seed fundings to start-ups emerging from incubators. (4) Collaboration with incubators to co-create programs that bridge the gap between ideation and commercialization.

Academics and Researchers

Academics can build upon these findings by exploring additional aspects and further research opportunities: of sustainable entrepreneurship ecosystems. The cross-cultural comparisons can investigate how sustainable entrepreneurship ecosystems function in different cultural/social contexts, particularly in other regions of Indonesia, Hungary or globally. Exploration of the role of technologies (e.g., AI, blockchain) can enhance the sustainability of entrepreneurial processes.

This study contributes to the theoretical framework of sustainable entrepreneurship by confirming the mediating role of the entrepreneurial process. Future researchers can refine these theories by expanding regressor variables such as regulatory environment, cultural factors, or technological readiness. The combination quantitative and qualitative methods and longitudinal approaches can gain deeper insights into the nuances of sustainable entrepreneurship.

6.3 Novelty of the Thesis

This thesis has several novelties. These will be explained and summarized further in this section. This study contributes to both theoretical development and practical application in the field of sustainable entrepreneurship and start-up incubation. This research also adopts an ecosystem perspective. Research Part I is focused on the profile of university business incubators that carry out the start-up incubation process. Research Part 2 analyzes the performance of start-ups resulting from the incubation process at the universities.

The thesis introduces a novel conceptual framework that integrates the Sustainable Entrepreneurial Ecosystem (SEE) with the Sustainable Entrepreneurial Process (SEP), offering a multidimensional perspective on how UBIs support student led start-ups throughout their development lifecycle.

A crucial innovation lies in the empirical validation of the relationships between SEE and SEP, particularly in the context of Indonesian universities, with a specific focus on Bali as a regional case study. By employing a structural equation modeling (PLS-SEM) approach, this research demonstrates the mediating role of SEP between SEE and the production and commercialization outcomes of start-ups providing one of the pioneer quantitative confirmations of this relationship within an Indonesian setting.

Moreover, the thesis incorporates a bibliometric analysis and visualization of global literature on start-ups incubation, using tools such as VOSviewer to map research trends, keyword evolution, and theory development. This systematic approach not only identifies emerging themes and research gaps but also provides a foundation for future studies on sustainable business incubation.

The introduction of Sustainability-driven Business Incubations (SBIs) as a new model represents a significant contribution to the current practices in university-based incubation programs. Unlike traditional models that emphasize short-term success and graduation rates, SBIs embed sustainability principles into every stage of the entrepreneurial process, from idea generation to post-incubation performance assessment.

Additionally, this research proposes the use of Sustainable Impact Assessment (SIA) as a tool for evaluating start-ups viability and long-term social and environmental impact. This expands the scope of conventional incubator evaluation criteria by integrating ecological and societal metrics alongside economic indicators.

Finally, these contributions offer valuable insights for academics, policymakers, and incubator managers seeking to build resilient and socially responsible entrepreneurial ecosystems in Indonesia and beyond. The novelty of the thesis is summarized in Table 13.

Table 13: Summary of Research Novelty

<p>(1) A Novel Conceptual framework of Sustainable Business Incubation</p>	<ul style="list-style-type: none"> • The thesis introduces a novel conceptual framework that integrates the Sustainable Entrepreneurial Ecosystem (SEE) with the Sustainable Entrepreneurial Process (SEP). • Offering a multidimensional perspective and a PLS-SEM model on how university-based incubators support student led start-ups throughout their development lifecycle.
<p>(2) Validation of the mediating role of SEP between SEE, production and commercialization.</p>	<ul style="list-style-type: none"> • This research demonstrates the mediating role of SEP between SEE and the production and commercialization outcomes of start-ups providing one of the first quantitative confirmations of this relationship within an Indonesian setting.
<p>(3) A bibliometric analysis and visualization of global literature on sustainable start-ups incubation.</p>	<ul style="list-style-type: none"> • Using bibliometric tools such as VOSviewer to map research trends, keyword evolution, and theory development. This systematic approach not only identifies emerging themes and research gaps but also provides a foundation for future studies on sustainable business incubation.
<p>(4) Implementation of Sustainable Impact Assessment (SIA) in a University Business Ecosystem</p>	<ul style="list-style-type: none"> • This research proposes the use of Sustainable Impact Assessment (SIA) as a tool for evaluating start-up viability and long-term social and environmental impact. • This research also adopts an ecosystem perspective. Research Part I is focused on the profile of university business incubators that carry out the start-up incubation process. Research Part 2 analyzes the performance of start-ups resulting from the incubation process at the universities.

7. CONCLUSION, CONTRIBUTIONS AND LIMITATIONS OF THE THESIS

7.1 Conclusion

This doctoral dissertation, titled "Sustainable Start-Up Incubation: An Indonesian Case", contributes significantly to the academic discourse on entrepreneurial ecosystems, business incubation processes, and sustainable development in the context of higher education institutions. By integrating theoretical foundations with empirical findings, this research explores how university-based business incubators (UBIs) support student-led start-ups throughout their development lifecycle, particularly focusing on sustainability-oriented initiatives in Indonesia.

The first research part of the thesis provides a comprehensive overview of the characteristics and performance of UBIs in Indonesia. Utilizing a descriptive analysis approach, this section outlines the current state of university-based incubators, including their operational models, service offerings, funding sources, and alignment with national and global sustainability goals.

Key findings indicate that while most UBIs in Indonesia are still in their developmental stages, they demonstrate strong potential in supporting early-stage ventures, especially those with sustainability objectives. However, several challenges persist, such as limited access to capital, lack of professional mentorship, and insufficient integration with regional innovation systems.

A critical insight from this research is the importance of institutional support and strategic partnerships in enhancing the effectiveness of UBIs. The findings align with previous literature emphasizing the role of Technology Transfer Offices (TTOs), academic-industry collaboration, and policy frameworks in fostering a conducive environment for sustainable entrepreneurship.

The second research part of the thesis focused on sustainable entrepreneurial process by examining how students conceptualize, develop, and sustain environmentally and socially responsible business ideas. A novel conceptual framework was developed by integrating the Sustainable Entrepreneurial Ecosystem (SEE) with the Sustainable Entrepreneurial Process (SEP). This conceptual model offers a multidimensional perspective on how university-based incubators facilitate sustainable start-up creation. Quantitative data were collected through structured surveys targeting student entrepreneurs and incubator managers across selected universities in Bali, Indonesia. Using Partial Least Squares Structural Equation Modelling (PLS-SEM), the study tested various hypotheses related to the influence of incubation services, entrepreneurial motivation, and ecosystem dynamics on sustainable venture creation. The results reveal that incubators play a pivotal role in shaping sustainable entrepreneurial intentions and outcomes. Key factors influencing successful sustainable start-up formation are included as: Access to tailored mentorship and coaching; Availability of green finance and sustainability-focused training programs; Strong alignment between personal values of student entrepreneurs and institutional missions promoting sustainability. Moreover, the study highlights the

mediating effect of entrepreneurial self-efficacy and the moderating role of institutional support in transforming entrepreneurial intentions into actual sustainable ventures.

This study not only confirm the theoretical framework of the Sustainable Entrepreneurial Ecosystem (SEE) proposed by Kumar Jha and Pande (2024), but also extends it. While the model under discussion was developed in a global context, the present research provides the first empirical validation of the SEE–SEP–Performance linkage within an emerging economy, thereby addressing a critical gap that has been identified in the literature (Carle & Rayna, 2023; Wagner et al., 2021). Specifically, the strong mediating role of the Sustainable Entrepreneurial Process (SEP) particularly the validation stage in translating ecosystem support into commercial outcomes offers a nuanced understanding of how sustainability is operationalised in resource-constrained settings. This finding calls into question the assumptions derived from Western incubation models that prioritise rapid scaling over reflective, impact-oriented development (Bank & Kanda, 2016).

Furthermore, the introduction of the concept of Sustainability-Driven Business Incubations (SBIs) contributes to the theoretical evolution of university incubation beyond traditional performance metrics (e.g. graduation rates, funding raised) towards a triple bottom line evaluation paradigm. This approach is consistent with, but also further develops, the Sustainable Impact Assessment (SIA) framework (Carle & Rayna, 2023) by integrating sustainability considerations into all phases of the incubation lifecycle, from the selection of tenants to post graduation monitoring. The study provides a response to calls for context sensitive models of sustainable entrepreneurship (van Rijnsoever, 2022) and also contributes to the economic theoretical discourse on how institutional actors (e.g., UBIs) can internalise SDG-oriented value creation within entrepreneurial ecosystems.

7.2 Contributions of the Thesis

This dissertation makes both theoretical and practical contributions to the field of management and business administration.

Theoretical Contributions

Development of a novel conceptual framework that integrates the Sustainable Entrepreneurial Ecosystem (SEE) and the Sustainable Entrepreneurial Process (SEP). Expansion of the traditional Theory of Planned Behavior (TPB) by incorporating sustainability specific constructs such as environmental awareness and social impact orientation. Empirical validation of the role of university business incubators in facilitating sustainable start-up creation, contributing to the growing body of knowledge on sustainable entrepreneurship.

Practical Contributions

Provision of actionable insights for policymakers and university administrators aiming to enhance the capacity of business incubators to support sustainable ventures. Identification of key success factors and performance indicators for university-based incubators, which can be used as benchmarks for quality improvement. Recommendations for integrating innovative technologies like blockchain and digital twins into incubation processes to improve decision-making, accountability, and long-term viability of sustainable start-ups.

7.3 Limitations of the Thesis

Despite the valuable contributions of this study, it is important to acknowledge its limitations to guide future research and practical applications:

1. Sample Limitations

- The study focuses solely on university business incubators in Bali, Indonesia. While this provides valuable insights into the local context, generalizing the findings to other regions may be challenging.

2. Methodological Considerations

- Data collected from tenant start-ups may be subject to self-report bias, as respondents might overstate the impact of the incubator or underreport challenges.
- The study uses cross-sectional data, which limits the ability to establish causal relationships. Longitudinal studies could provide stronger evidence of the impact of the ecosystem over time.

3. Measurement Tools

- Measurement of constructs like "sustainable entrepreneurial ecosystem" and "entrepreneurial process" relies on specific indicators. Using alternative measures or scales could yield different results. For instance, the study does not explicitly account for cultural factors that may influence perceptions of sustainability or entrepreneurship. Further research could explore how cultural values shape the effectiveness of sustainable entrepreneurship ecosystems.

4. Generalizability

- Findings may not be directly applicable to other provinces or countries with different economic, social, or regulatory environments. Future studies should replicate the research in diverse settings to enhance generalizability.

7.4 Recommendations for Future Research

To build upon the findings of this dissertation, the following areas are recommended for future investigation. Replicating this research in different cultural and economic contexts will help assess the universality or specificity of the proposed framework. Longitudinal analysis of incubated start-ups are recommended by tracking incubated ventures over time to evaluate survival rates, growth trajectories, and sustainability impacts. Integration of Artificial Intelligence (AI) and Big Data can optimize resource allocation and mentorship within incubation environments.

7.5 Final Remarks

This dissertation successfully fulfills its objective of exploring the mechanisms through which university business incubators contribute to sustainable start-up creation in Indonesia. It offers a fresh perspective on the interplay between entrepreneurial ecosystems and individual entrepreneurial processes, supported by robust methodologies and validated instruments.

By combining bibliometric analysis with primary survey data, this research bridges theoretical gaps and provides practical recommendations for stakeholders involved in entrepreneurship education and incubation. It is hoped that this work will inspire further scholarly inquiry and policy development aimed at strengthening sustainable entrepreneurship ecosystems globally.

SUMMARY

This doctoral dissertation, titled "Sustainable Start-Up Incubation: An Indonesian Case," presents a comprehensive investigation into the mechanisms and effectiveness of University Business Incubators (UBIs) in fostering sustainable student-led start-ups within the Indonesian context, with a specific focus on Bali Province. The research is driven by the objective of exploring how UBIs contribute to the creation of start-ups that not only achieve commercial viability but also generate social, environmental, and cultural value, aligning with broader sustainable development goals. The study adopts an ecosystem perspective, examining both the institutional environment provided by UBIs and the individual entrepreneurial processes of the start-ups they nurture. By doing so, it aims to contribute novel insights to the fields of sustainable entrepreneurship and business incubation theory and practice.

The dissertation begins with a thorough Literature Review (Chapter 2) designed to establish the theoretical foundation and identify research gaps. It employs a rigorous two-phase approach: first, a Systematic Literature Review (SLR) following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. This phase systematically identified and selected 168 relevant peer-reviewed articles published between 2016 and 2025 from databases like Scopus and Web of Science, focusing on topics related to sustainable start-up incubation. Second, it conducts a Bibliographic Network Analysis and Visualization using tools like VOSviewer. This analysis, particularly focusing on author keyword co-occurrence networks, maps the intellectual structure of the field, revealing dominant themes (e.g., business incubators, entrepreneurship, sustainable development), emerging trends, and key theoretical linkages (e.g., between entrepreneurial ecosystems and sustainable entrepreneurship). The review consolidates theories related to general entrepreneurship, the function and performance of business incubators and start-up incubation processes, and the specific domain of sustainable entrepreneurship, setting the stage for the empirical investigations.

The Materials and Methods (Chapter 3) section outlines the research design and analytical procedures. The study adopts a quantitative research approach, suitable for measuring phenomena statistically and providing an objective perspective on UBI support for start-up sustainability. The overall research design is structured into three main components: the SLR (discussed above), Research Part 1, and Research Part 2. Data collection for the empirical parts was conducted primarily through surveys distributed via Google Forms between September 2024 and March 2025. Data analysis methods differ between the parts: Research Part 1 uses descriptive quantitative analysis to profile incubators and analyze their performance metrics. Research Part 2 employs Partial Least Squares Structural Equation Modeling (PLS-SEM), a multivariate statistical technique ideal for

complex models with latent variables, to analyze the relationships between key constructs related to the sustainable entrepreneurial process and start-up performance. The chapter details the geographical scope (Bali Province, Indonesia), population (UBIs and their tenant start-ups), sampling procedures (census for Part 1, targeted sampling for Part 2), and the rigorous development and validation processes for the survey instruments used in both parts.

Research Part 1: University Business Incubator Profile and Performance (Chapter 4) focuses on characterizing the UBIs themselves within the study context. Its primary objective is to provide a detailed profile of these incubators and evaluate their performance, particularly concerning their support for sustainable start-ups. The literature review for this part delves into the nature of UBIs, the concept of sustainable business incubators, and their potential role in regional development. The methodology involves a census survey of all 14 university business incubators in Bali. The key findings reveal crucial details about the profile and operations of these UBIs:

- **Ownership & Structure:** They are predominantly university-owned, indicating a strong institutional commitment but potentially limited private sector integration.
- **Services & Targeting:** UBIs offer diverse services and often strategically target specific industries or knowledge fields aligned with their parent universities.
- **Resources & Support:** The study details income sources, budget allocations, and support mechanisms. It specifically highlights the percentage of annual budgets allocated towards developing innovations with sustainable or community benefits, indicating varying levels of institutional prioritization of sustainability.
- **Performance Metrics:** Analysis includes metrics such as the average tenure of start-ups within the incubators. It also gauges the opinions of UBI managers regarding the importance of developing start-ups with societal benefits and the challenges associated with it, such as the need for extra effort and professional support, and the difficulty of achieving profitability.

This part concludes that UBIs in Bali play a significant role in the start-up ecosystem, providing essential infrastructure and support, with a growing recognition of the importance of incorporating sustainability into their mission.

Research Part 2: Sustainable Start-Up Performance (Chapter 5) shifts the focus to the outcomes and experiences of the start-ups incubated within these UBIs. Its objective is to analyze the performance of these sustainable start-ups and identify the critical factors influencing their success, particularly through the stages of the entrepreneurial process. The literature review for this part explores the concepts of the Sustainable Entrepreneurial Ecosystem (SEE), the Sustainable Entrepreneurship Process (SEP) (including stages like Idea Generation, Prototyping, Validation, and Production & Commercialization), and the potential application of Sustainable Impact Assessment (SIA) for

evaluating start-up viability. The methodology involves surveying start-up tenants, using a questionnaire rigorously developed and validated through expert review and pretesting. Data analysis employs PLS-SEM.

The key findings from this part are significant:

- **Model Validity:** The measurement model (assessing the reliability and validity of constructs) and the structural model (testing the hypothesized relationships) demonstrated acceptable psychometric properties.
- **Impact of SEE & SEP on Performance:** The analysis confirms that both the Sustainable Entrepreneurial Ecosystem (SEE) (the supportive environment provided by the UBI) and the Sustainable Entrepreneurship Process (SEP) stages have a positive and statistically significant impact on the final outcome construct, Production and Commercialization (PROCO). This validates the theoretical framework linking the environment and the process to start-up success.
- **Specific Process Impacts:** Individual stages of the SEP, specifically Idea Generation, Prototyping, and Validation, were found to positively influence the subsequent Production & Commercialization stage. This highlights the importance of effective support during the early phases of start-up development within the incubator.
- **Sustainability Orientation:** The findings suggest that the incubation process in Bali increasingly orients start-ups towards addressing broader societal dimensions (social, environmental, cultural) as part of their development journey.
- **Challenges Faced:** Consistent with Part 1 findings from the UBI perspective, start-up respondents also acknowledged that developing ventures with significant societal benefits requires substantial effort and professional support. They also confirmed the challenge of creating a simultaneously profitable and sustainable business model.

This part concludes that the incubation process significantly influences start-up performance, particularly when the ecosystem supports and the process effectively guides ventures through the critical early stages, with sustainability being an integrated, albeit challenging, aspect.

Overall Conclusion

Synthesizing the findings from the literature review, Research Part 1, and Research Part 2, this dissertation provides a holistic understanding of sustainable start-up incubation in Bali, Indonesia. It demonstrates that UBIs serve as crucial nodes in the entrepreneurial ecosystem, providing resources and structure (Part 1), which directly impact the performance and development trajectory of the student start-ups they incubate (Part 2). The research validates the interconnection between the

supportive ecosystem (SEE) and the internal entrepreneurial process (SEP) in driving sustainable start-up commercialization. By empirically testing and confirming these relationships using PLS-SEM, the study contributes significantly to the theoretical understanding of sustainable entrepreneurship dynamics within a university context. Practically, it critically evaluates the current state of UBI programs, highlighting both their strengths and areas for improvement, particularly regarding the integration and support of sustainability goals. The thesis proposes recommendations for a new, potentially more sustained incubation model tailored for Indonesian universities and advocates for the integration of Sustainable Impact Assessment (SIA) alongside traditional metrics. Its novelty lies in its specific focus on sustainability within the Indonesian UBI context, the empirical validation of the SEE-SEP-Performance link, and the proposal of a structured framework for enhancing sustainable start-up creation. The research successfully fulfills its objective, offering valuable insights for academics, policymakers, and practitioners involved in fostering sustainable entrepreneurship through university-based incubation programs.

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APPENDICES

Appendix 1. Survey of Research Part 1 - Questions and References

NO	QUESTION	REFERENCES
Survey section 1- Characteristics of university business incubators		
1	Email*	
2	To which university is your incubator affiliated? (Please enter the full name of the university.) *	(Pattanasak et al., 2022)
3	When was the incubator established? Please enter year only "YYYY".	(Pattanasak et al., 2022)
4.	What is your position in the incubator? *	(Pattanasak et al., 2022)
5	<p>What entities make up the incubator's ownership? Mark only one oval per row.</p> <p>Row:</p> <ul style="list-style-type: none"> - Private investor - University - Government institutions (federal, regional or local) - Other <p>Column:</p> <ul style="list-style-type: none"> - 0-24% - 25-49% - 50-74% - 75-100% 	<p>(Brantnell & Baraldi, 2022) (Grimaldi & Grandi, 2005)</p>
6	<p>Besides the incubator, what other innovation / technology transfer units/organisations are operating at your university? Check all that apply.</p> <ul style="list-style-type: none"> a. Technology Transfer Office b. Science/technology park c. Research centre d. Intellectual Property protection/management unit e. Accelerator f. Student innovation/entrepreneurship hub g. University venture fund h. Proof of concept fund g. Other: 	<p>(Sohail et al., 2023) (Brantnell & Baraldi, 2022)</p>
7	<p>What type of services does your incubator provide to clients?*</p> <ul style="list-style-type: none"> a. Office space b. Shared resources (e.g. reception, meeting rooms, parking) c. Scientific equipment and materials, laboratories d. Coaching (e.g. management, accounting, finance, marketing) e. Training (seminars and workshops) f. Access to professional services (patent attorneys, legal counselling, strategy consulting) g. Access to finance (loans, business angels, seed and venture capital) h. Other: 	<p>(Sohail et al., 2023)</p>
8	<p>Which industry or knowledge area is the incubator specifically aimed at? (Several alternatives possible)</p> <ul style="list-style-type: none"> a. No particular industry (all industry) b. Biotech, life sciences c. Fintech d. Manufacturing 	<p>(Klofsten & Bank, 2016)</p>

	<p>e. IT, softwares, Big data, AI, telecommunications</p> <p>f. Cleantech, Greentech, renewable energy, environmental services</p> <p>g. Culture, creative industries, arts</p> <p>h. Other</p>	
9	<p>On average, how many years do start-ups stay at your incubator? *</p> <p>Mark only one oval.</p> <ul style="list-style-type: none"> · Less than a year · 1-2 years · 3-5 years · more than 5 years 	(Pattanasak et al., 2022)
10	How many start-up/spinoffs have been founded at your university in the last 3 years?	(Pattanasak et al., 2022)
11	How many start-ups at your university had a successful exit (start-up sold to investors or another company) in the past?	(Pattanasak et al., 2022)
12	How many patent applications have been made at your university over the last 3 years (2021-2023)?	(Brantnell & Baraldi, 2022)
13	How many patents have been awarded to your university over the last 3 years (2021-2023)?	(Brantnell & Baraldi, 2022)
14	How many licenses have your university granted to other organisations over the last 3 years (2021-2023)?	(Brantnell & Baraldi, 2022)
15	How many people - including yourself - work at the incubator (Please enter only one number in the answer field)*	(Brantnell & Baraldi, 2022)
16	How many of them are full-time staff? (Please enter only one number in the answer field)*	(Brantnell & Baraldi, 2022)
17	How many external experts help the work of the incubator? (Please enter only one number in the answer field!) *	(Brantnell & Baraldi, 2022)
18	Approximately, how many employees work for the start-up/spinoff firms created at your university in the last 3 years (2021-2023)?	(Pattanasak et al., 2022)
19	<p>How has the annual budget in your organisation changed over the last 3 years (2021-2023)? *</p> <p>Likert scale 1-5</p> <p>(1) Decreased significantly</p> <p>(2) Increased significantly</p>	(Brantnell & Baraldi, 2022)
20	<p>Approximately, what percent of the annual budget of the organisation has been allocated to developing innovations with sustainable/societal benefits? *</p> <ul style="list-style-type: none"> - Specifically, none (0%) - About 1-25% - About 26-50% - About 51-75% - About 76-100% 	(Brantnell & Baraldi, 2022)
21	<p>How much money have you made from the following income sources in the past 3 years (2021-2023)?</p> <p>Row:</p> <ul style="list-style-type: none"> - Royalties (licensing fees) - Revenues from TT services provided to the market - Profits (dividend) from spin-offs/start-ups 	(Brantnell & Baraldi, 2022)

	<ul style="list-style-type: none"> - Income from the sale (exit) of a university start-up or spin-off company - Resources allocated from university budget - laboratory, measurement, certification, etc. - Leasing of assets (equipment, buildings, and inventory) - Government funding/grants - Other resources <p>Column:</p> <ul style="list-style-type: none"> - None - Less than 100 million IDR - 101-500 million IDR - 501 million- 1 billion IDR - More than 1 billion IDR 	
Survey section 2- Societal impact of university business incubators		
22	<p>Does the incubator actively encourage tenants to achieve any of the following? (only one alternative possible) Mark only one oval.</p> <ul style="list-style-type: none"> a. Reduce negative environmental or social impacts of both their products & operations b. Developed their business idea to improve the environmental or social performance c. Both develop their business idea to improve the environmental or social performance and reduce negative impacts d. None of the alternatives <p>Unknown / Prefer not to answer</p>	(Klofsten & Bank, 2016)
23	<p>Does your incubator actively encourage start-ups to achieve any of the following benefits? (Multiple answers are possible) Rows:</p> <ul style="list-style-type: none"> a. Economic benefits (increasing productivity, growth, wealth, skills, employment, innovation etc.) b. Social benefits (improving quality of life, policy-making, equity, health, safety and security etc.) c. Environmental benefits (improvements in environment; reduced waste and pollution etc.) d. Cultural benefits (understanding who we are, how we relate to other societies and cultures etc.) e. None of the above is really encouraged <p>Column:</p> <ul style="list-style-type: none"> • Never • Rarely • Half the time • Frequently • Always 	(Klofsten & Bank, 2016)
24	<p>How important are economic benefits to your incubator when you start technology transfer (TT) project and develop start-ups/spinoffs? Economic benefits include: improved productivity; economic growth and wealth creation; enhancing the skills base; increased employment; reduced costs; increased innovation capability and global competitiveness; improvements in service delivery. *</p> <p>Likert scale 1-5 (1) Not important at all (5) Very important</p>	(Donovan, 2008)

25	<p>How important are social benefits to your incubator when you start technology transfer (TT) projects and develop start-ups or spinoffs?</p> <p>Social benefits include: improving quality of life; stimulating new approaches to social issues; changes in community attitudes; informed public debate and improved policy-making; improved equity; and improvements in health, safety and security. *</p> <p>Likert scale 1-5 (1) Not important at all (5) Very important</p>	(Donovan, 2008)
26	<p>How important are environmental benefits to your incubator when you start technology transfer (TT) projects and develop start-ups or spinoffs?</p> <p>Environmental benefits include: Improvements in environment; reduced waste and pollution; improved management of natural resources; reduced consumption of fossil fuels; uptake of recycling techniques; reduced environmental risk; preservation initiatives; conservation of biodiversity; adaptation to climate change. *</p> <p>Likert scale 1-5 (1) Not important at all (5) Very important</p>	(Donovan, 2008)
27	<p>How important are culture benefits to your incubator when you start technology transfer (TT) projects and develop startups/spinoffs?</p> <p>Cultural benefits include: Supporting greater understanding of who we are as a nation and society; understanding how we relate to other societies and cultures; stimulating creativity within the community; contributing to cultural preservation and enrichment; and bringing new ideas and new modes of experience to the nation. *</p> <p>Likert scale 1-5 (1) Not important at all (2) Very important</p>	(Donovan, 2008)
28	<p>How often are the following impacts taken into account within the selection criteria for new tenants of the university incubator?</p> <p>Mark only one oval per row.</p> <p>Rows:</p> <ul style="list-style-type: none"> • Firms with economic benefits are preferred • Firms with social benefits are preferred • Firms with environmental benefits are preferred • Firms with cultural benefits are preferred • Firms with high growth prospects are preferred <p>Column:</p> <ul style="list-style-type: none"> • Never • Rarely • Half the time • Frequently • Always 	(Klofsten & Bank, 2016)
29	<p>Approximately, how many tenants of the incubator (regarding the last 3 years) have green, sustainable or environmental products/services as their core business? (Please, give a number).</p>	(Klofsten & Bank, 2016)

30	<p>Approximately, what percentage of the start-ups established in the past 3 years (aim to) provide any sustainable/societal benefits?* Mark only one oval per row.</p> <p>Rows:</p> <ul style="list-style-type: none"> - Economic benefits - Social benefits - Environmental benefits - Cultural benefits <p>Column</p> <ul style="list-style-type: none"> - 0% - 1-20% - 21-40% - 41-60% - 61-80% - 81-100% 	(Klofsten & Bank, 2016)
31	<p>How many of the start-ups with successful exit (start-up sold to investors or another company) in the past 3 years offers sustainable/societal benefits?</p>	(Klofsten & Bank, 2016)
32	<p>How necessary the following aspects to the main aim of the incubator? Mark only one oval per raw</p> <p>Raw:</p> <ul style="list-style-type: none"> ● Positive Regional or national economic development ● Positive environmental impact ● Positive social impact ● Generating profit for the owners <p>Column:</p> <p>Not Very Necessary Not necessary Neutral Necessary Very necessary</p>	(Klofsten & Bank, 2016)
39	<p>What do you think about the development of start-ups with a focus on sustainable/societal benefits? *</p> <p>Rows:</p> <ol style="list-style-type: none"> 1) I have sufficient skills to develop startups with societal benefits 2) The incubator has sufficient skills to develop start-ups with societal benefits. 3) The university has sufficient skills to develop start-ups with societal benefits. 4) Sustainable start-ups do not require special skills to develop. 5) Developing sustainable start-ups is very hard. 6) Developing start-ups with broad societal benefits requires extra effort. 7) Start-ups with broad societal benefits find it hard to develop a profitable business model. 8) Start-ups with broad societal benefits are slower to gain traction among consumers. 9) Start-ups with broad societal benefits need extra professional support. 10) Start-ups with broad societal benefits find it hard to acquire funding. 11) VCs in my region prefer start-ups with broad societal benefits. 	(Brantnell & Baraldi, 2022; Klofsten & Bank, 2016; Pattanasak et al., 2022)

	<p>12) Business angels in my region prefer start-ups with broad societal benefits.</p> <p>13) Start-ups with broad societal benefits find it hard to grow.</p> <p>14) Start-ups with broad societal benefits are less likely to go global.</p> <p>15) Start-ups with broad societal benefits find it hard to exit profitably.</p> <p>Column:</p> <ul style="list-style-type: none">- Completely disagree- Disagree- Neither agree, nor disagree- Agree- Totally agree	
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Appendix 2: Survey of Research Part 2 - Questions and References

NO	QUESTION	REFERENCE	
1	Please indicate which university business incubator your start-up was incubated in. Please provide the full name of the university in question.	(Wagner et al., 2021)	
2	Please state the name of your start-up.		
3	Please state the year in which your start-up was established. Please enter the year in the format "YYYY".		
4	Please state the business address/office of your start-up.		
5	<p>Please indicate the industry or field of knowledge in which your start-up business is specifically situated.</p> <p>a. Biotech, life sciences</p> <p>b. Fintech</p> <p>c. Manufacturing</p> <p>d. IT, software, big data, AI, telecommunications</p> <p>e. Cleantech, greentech, renewable energy, environmental services</p> <p>f. Culture, creative industries, arts</p>	(Bank et al., 2017)	
6	Please indicate the year in which your start-up commenced incubation at the university's business incubator. Please enter the year in the format "YYYY".		
7	<p>Has your start-up graduated from an incubator university?</p> <p>. Have graduated</p> <p>. Have not graduated</p>		
8	<p>Please state the length of time that your start-up has been in the incubation phase.</p> <p>. Less than 1 years</p> <p>. 1 year</p> <p>. 2 years</p> <p>. 3 years</p> <p>. More than 3 years</p>		
9	<p>Please select the type of the start-up:</p> <p>. Triple bottom line (TBL)</p> <p>. Double bottom line (DBL)</p> <p>Note:</p> <p>1) The Triple Bottom Line (TBL) is a business framework that expands the traditional measure of success profit to include two additional dimensions: social and environmental impact. This concept encourages organizations to focus not just on financial outcomes but also on their broader responsibilities to people and the planet.</p> <p>2) Tripple bottom line (TBL) start-ups or ‘born-sustainable startups’ are start-ups that have adopted the concept of sustainability from born. They integrated the TBL since idea generation.</p> <p>3) Double bottom line (DBL) start-ups are transitioned sustainable startups. They started integrating TBL after the prototype/validation phase.</p>		(Carle & Rayna, 2023)
10	How important is the extent of ambition to address environmental or social issues?		

	<p>1) Not important at all (5) Very important</p>	
11	<p>How important is the extent of a specific issue a cause for concern? 1) Not important at all (5) Very important</p>	
12	<p>How important is it to ascertain whether key values have been defined in collaboration with co- founders. 1) Not important at all (5) Very important Note: The key values of a startup are the foundational principles and beliefs that guide its operations, decision-making, and culture. These values are crucial for shaping the identity of the startup, motivating the team, and driving long-term success. Here are some of the key values commonly embraced by startups: Innovation, Agility, Customer-Centricity, Collaboration, Resilience, Transparency, Risk-Taking, Efficiency, Purpose-Driven, Learning and Growth, Scalability, Community and Social Impact,</p>	
13	<p>How important is the ambitious to address an environmental or social issue without scarifying the other? 1) Not important at all (5) Very important</p>	
14	<p>How important is the deeply concern about both social and environmental issues? 1) Not important at all (5) Very important</p>	
15	<p>How important it it to conduct aligned stakeholder identification; align Business Model with social and/or environmental benefits? 1) Not important at all (5) Very important</p>	
16	<p>How much do start-up resentment for green and social-washing? 1) Not important at all (5) Very important Note: Greenwashing is a misleading marketing or communication practice in which a company or product claims to be environmentally friendly or sustainable when it is not. This tactic is used to build a false green image to attract environmentally concerned consumers. The goal is to increase sales or company image without making any real changes to their environmental impact. This practice is dangerous as it can deceive consumers and hinder real progress in environmental sustainability.</p>	
17	<p>How important it to conduct aligned business model (BM) with environmental or social benefits? 1) Not important at all (5) Very important</p>	
18	<p>How important the first Key Performance Indicators (KPIs) for environmental or social benefits? 1) Not important at all (5) Very important Note: The first Key Performance Indicators (KPIs) for a sustainable startup are metrics that help assess the startup's performance in achieving its</p>	

	<p>environmental, social, and economic goals. These KPIs provide insight into how well the startup is aligning with its sustainability mission while also ensuring financial viability. Here are some of the initial KPIs that a sustainable startup might focus on: Environmental Impact KPIs, Social Impact KPIs, Economic and Financial KPIs, Product/Service Impact KPIs, Governance and Ethical KPIs, Stakeholder Engagement KPIs.</p>	
19	<p>How much do start-up resentment for green and social-washing? 1) Not important at all (5) Very important Note: Greenwashing is a marketing or communications strategy to make something appear sustainable. Greenwashing and social washing are deceptive practices used by companies to create a false impression of environmental or social responsibility. These tactics are often employed to attract customers, investors, or other stakeholders who prioritize sustainability or ethical practices, without the company making substantial or genuine efforts in these areas.</p>	
20	<p>How important are “Normal” decisions made without (or against) economic benefits? 1) Not important at all (5) Very important Note: "Normal" decisions refers to choices or actions that are typical, expected, or standard within the framework of how people or businesses operate, even when they don't necessarily lead to immediate or obvious economic benefits. These decisions may be guided by factors like ethics, sustainability, social responsibility, or long-term vision rather than short-term financial gain.</p>	
21	<p>How important is the focus on internal/governance aspects and sustainability impact assessment (SIA) tools are identified? 1) Not important at all (5) Very important</p>	
22	<p>How important the first ideas on who to integrate double bottom line (TBL)? 1) Not important at all (5) Very important</p>	
23	<p>How important are the efforts to improve sustainability impact assessment (SIA) knowledge? 1) Not important at all (5) Very important</p>	
24	<p>How important is the fearful of stakeholder reaction? 1) Not important at all (5) Very important</p>	
25	<p>How important are techniques and tools for sustainability impact assessment (SIA) developed with dedicated resources? 1) Not important at all (5) Very important note: In the context of a startup, "dedicated resources" refer to assets, personnel, or tools that are specifically allocated to certain tasks, projects, or areas of the business to ensure their success. These resources</p>	

	are committed full-time or on a consistent basis to particular functions or goals, rather than being shared across multiple projects or responsibilities. Dedicated resources are crucial in the early stages of a startup, as they help focus efforts and optimize performance in key areas.	
26	How important are routines of sustainability impact assessment (SIA) with stakeholders, a dedicated person in charge of sustainability? 1) Not important at all (5) Very important	
27	How important are more structural/strategic choices for sustainability without (or against) economic benefits? 1) Not important at all (5) Very important	
28	How important is internal/governance aspects? 1) Not important at all (5) Very important	
29	How important are decisions made without (or against) economic benefits? 1) Not important at all (5) Very important	
30	How important is it to identify sustainability impact assessment (SIA) tools? 1) Not important at all (5) Very important	
31	How important are the Iteration of SIA techniques and tools? 1) Not important at all (5) Very important Note: Iteration in the context of business, especially in startups and product development, refers to the process of repeatedly refining and improving a product, service, process, or strategy based on feedback, testing, and analysis. Each cycle or "iteration" involves making adjustments or enhancements, followed by reassessment to see how those changes affect the overall outcome.	
32	How important is the external communication 1) Not important at all (5) Very important Note: External communication in a startup company refers to the process of exchanging information and messages with individuals, organizations, and audiences outside of the company. This includes interactions with customers, investors, partners, suppliers, media, regulators, and the general public. Effective external communication is crucial for building the startup's brand, attracting investment, acquiring customers, and establishing partnerships.	
33	How important is the physical infrastructure for your start-up? 1) Not important at all (5) Very important	(Kumar Jha & Pande, 2024; Leendertse et al., 2022; Stam & van de Ven, 2021)
34	How important is the demand for your start-up? 1) Not important at all (5) Very important	

35	<p>How important is the intermediary services for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Intermediary services are organizations and services that support entrepreneurs by providing resources, advice, and connections. These include incubators, accelerators, co-working spaces, and business development agencies.</p>	
36	<p>How important is the talent for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Talent is the availability of skilled labor and expertise required to start and grow a business.</p>	
37	<p>How important is the knowledge for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: New knowledge are the creation and dissemination of new ideas, technologies, and innovations that can lead to the development of new products, services, and business model</p>	
38	<p>How important is the leadership for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Leadership is the presence of visionary individuals or organizations that guide, inspire, and support entrepreneurial activities within the ecosystem.</p>	
39	<p>How important is the finance for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Finance is the availability of financial resources, including venture capital, angel investors, loans, grants, and other forms of funding.</p>	
40	<p>How important are the formal institutions for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Formal institutions are the legal, regulatory, and governmental structures that create the framework within which businesses operate</p>	
41	<p>How important is the entrepreneurship culture for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note: Entrepreneurship Culture are the set of shared attitudes, values, goals, and practices that characterize a community or society's approach to entrepreneurship.</p>	
42	<p>How important are the networks for your start-up?</p> <p>1) Not important at all (5) Very important</p> <p>Note:</p>	

	<p>Networks are the web of relationships among entrepreneurs, investors, customers, suppliers, mentors, and other stakeholders.</p>	
43	<p>How important is the sustainability orientation for your start-up? 1) Not important at all (5) Very important Note: Sustainability orientation (SO) indicates the level of awareness of, engagement with, and intention and attitude toward sustainability (Kuckertz and Wagner, 2010; Xia et al., 2023).</p>	
44	<p>How important is the enabling cadence for your start-up? 1) Not important at all (5) Very important Note: ‘Enabling Cadence’ (EC) as a SEE element that facilitates the flow of support for SE firms in tackling investment, legitimization, and materiality challenges. EC would thus entail the availability of regular support through sustainability-based investment, accreditation of sustainability initiatives and measures, and institutionalized transparency in materiality issues.</p>	
45	<p>How important is the social metabolism for your start-up? 1) Not important at all (5) Very important Note: Social metabolism (SM) is the state of its societal equity, inclusion, and consumption – may influence the existence and scope of entrepreneurial opportunities available for discovery and subsequent exploitation. The availability of these opportunities may vary from one nation to the other, and so would the entrepreneurial entry attempting to solve social challenges. For example, social inequality based on gender and caste is prominent in rural India (Bhatt et al., 2022), which is likely to be different in most of the developed and high-income nations. As another example, an estimated 770 million people live without access to electricity globally, 77 percent of whom reside in sub-Saharan Africa (IEA, 2022). As a result, SE firms in India and sub-Saharan Africa may have greater access to exploitable opportunities vis-` a-vis SE firms working in developed economies.</p>	