Green Technopreneurship Model for Digital Startups Among Gen-Z

Riskia Putra [1*], Fauzan[2], N. W. Islami Rahayu[3]

[1,2,3] Faculty of Islamic Economics and Business, Kiai Haji Achmad Siddiq University, Jember, Indonesia
Corresponding Author: riskia@lecturer.uinkhas.ac.id

Abstract

This study aims to explore how Gen-Z digital startup founders interpret the concept of green technopreneurship, identify its driving and inhibiting factors, and develop a conceptual model tailored to their context. A qualitative method with a phenomenological approach was employed, involving five Gen-Z founders in Indonesia who run environmentally oriented digital businesses. Thematic analysis revealed key themes such as green values as a business identity, digital technology as a sustainability accelerator, and distinct Gen-Z values such as authenticity and impact-driven work. The study proposes a conceptual model that integrates green values, digital innovation, and youth characteristics as the foundation for developing sustainable startups.

Keywords: green technopreneurship, digital startups, Gen Z, sustainability, green innovation

1. Introduction

The current global environmental crisis is no longer a mere discourse but a tangible threat to the sustainability of human life and the planet. The IPCC (2023) report confirms that the Earth's temperature has increased by approximately 1.2°C since pre-industrial times and may surpass the 1.5°C threshold before mid-century if mitigation efforts are not intensified. The consequences of global warming extend across social, economic, and ecological dimensions, demanding a fundamental transformation in development and business paradigms. One emerging strategic approach is the adoption of the green economy model, which places sustainability at the core of production and consumption activities.

In parallel, the digital transformation offers vast opportunities for creating adaptive and efficient business innovations, particularly in the digital startup sector. Startups, as new business entities driven by technology and innovation, possess the capacity to become pioneers of change. A study by Serio et al. (2020) found that startups integrating environmental sustainability principles into their business processes have a higher chance of survival, as they are better equipped to respond to regulatory pressures and increasingly eco-conscious market preferences.

In Indonesia, the growth of digital startups is among the fastest in Southeast Asia. Data from StartupRanking (2023) shows that there are over 2,500 active startups in the country, the majority of which are driven by Generation Z (Gen Z)—individuals born between 1997 and 2012. Gen Z is known for being highly adaptable to technology, creatively driven, and increasingly concerned with social and environmental issues (Valendia & Purwanegara, 2022). However, despite this potential, the development of sustainability-oriented technopreneurship among Gen Z still faces various challenges, including limited access, uneven digital and environmental literacy, and the absence of a supporting conceptual model.

This study aims to address this conceptual gap by exploring in depth the perceptions, motivations, and obstacles faced by Gen Z startup founders in implementing green technopreneurship. The research focuses on five Indonesian digital startups affiliated with a business incubation community. The study subjects are limited to Gen Z founders who are actively involved in strategic planning and decision-making processes. A qualitative approach is employed through in-depth interviews to gain contextual and exploratory understanding of the green technopreneurship practices developed by these young entrepreneurs.

Specifically, this study aims to:
a. Explore Gen Z startup founders' perceptions and interpretations of the green technopreneurship concept.
b. Identify the driving and inhibiting factors influencing the development of green digital startups.

c. Develop a conceptual model of green technopreneurship suited to the characteristics and experiences of Gen Z founders in Indonesia.

Green Technopreneurship

Green technopreneurship is a multidimensional concept that merges two disciplines: technopreneurship (technology-based entrepreneurship) and green entrepreneurship (entrepreneurship that prioritizes environmental sustainability). According to Singh et al. (2021), green technopreneurship refers to entrepreneurial activities that utilize technology to create environmentally friendly business solutions that are resource-efficient and capable of reducing carbon emissions.

Key characteristics of green technopreneurship include:

Green innovation driven by technology

Orientation toward energy and resource efficiency

Circular and regenerative business models

Commitment to creating ecological and social value

Awareness of climate change issues and environmental ethics

Dissanayake & Sivarajah (2022) emphasize that green technopreneurs tend to exhibit high social consciousness and possess the skills to leverage digital technologies to achieve business goals that are not only economic but also contribute to ecological balance.

The Role of Technology in Supporting Sustainable Business

Technology serves as a key enabler in supporting green business practices. Digital innovations such as Artificial Intelligence (AI), the Internet of Things (IoT), Big Data, and Blockchain enable real-time monitoring of environmental impacts, operational efficiency, and supply chain transparency. Rao & Holt (2020) argue that integrating technology with eco-innovation principles is a critical strategy for companies aiming to adopt sustainable practices.

In the context of digital startups, technology also facilitates direct engagement with consumers to raise environmental awareness and education. Startups can use social media, mobile applications, and e-commerce platforms to market green products and build communities of customers who are loyal to sustainability values.

Previous Studies on Green Technopreneurship

Several prior studies have explored various aspects of green technopreneurship:

1. Serio et al. (2020) found that green startups demonstrate greater business resilience and stronger ESG (Environmental, Social, Governance) values.
2. Umus Aini (2024) discovered that Gen Z in Central Java are highly motivated to establish sustainable businesses that reflect social and environmental values.
3. Tanesia et al. (2024) asserted that entrepreneurial capacity and self-efficacy are significant factors in driving Gen Z's intention to engage in green entrepreneurship.

However, these studies remain fragmented and have yet to offer an integrative conceptual framework that holistically combines sustainability, digital technology, and the demographic profile of Gen Z—particularly in the context of Indonesia.

Digital Startups
Characteristics and Challenges

Digital startups are early-stage businesses that utilize digital technology as the foundation of their operations and value creation. According to Blank & Dorf (2012), digital startups are characterized by flexible business models, the potential for exponential growth, and the ability to create disruptive innovations that can transform industry landscapes. However, the failure rate for startups remains high, particularly within the first three years of operation (Startup Genome, 2023).

Digital startups in Indonesia face a range of challenges, including limited access to funding, low levels of digital literacy, and gaps in developing innovative human resources (Andriyani et al., 2021). These challenges are especially significant for young founders, such as those from Gen Z, who require a more inclusive and adaptive support ecosystem that aligns with their generational values and working styles.

The Role of Digitalization in Sustainable Innovation

Digitalization plays a crucial role in driving the transformation toward more sustainable business practices. Technology enables resource savings, supply chain efficiency, and the creation of

products or services based on circular economy principles. Rachinger et al. (2019) argue that digitalization supports the integration of ESG principles into the core strategies of startups.

In practice, many startups leverage digital platforms to:
1. Provide sharing economy-based services (e.g., green transportation or digital agriculture)
2. Deliver interactive environmental education and campaigns
3. Access niche markets with preferences for sustainable products

The Dynamics of Gen Z Startup Development

Generation Z brings fresh energy to the startup landscape. They are known as tech-savvy individuals, responsive to social issues, and increasingly view entrepreneurship as a form of self-actualization (Putri & Salamah, 2023). However, they also face challenges such as a lack of practical experience, limited access to mentorship, and inadequate startup-friendly regulations.

Rizqi et al. (2023) found that although Gen Z is highly interested in building green startups, they require tailored support models that differ from those designed for previous generations. This highlights the need for policy approaches and ecosystem development strategies that are more specific and aligned with the needs of younger generations.

Initial Framework Linking Green Values, Digital Innovation, and Gen Z Founders' Characteristics

The theoretical framework of this study is constructed at the intersection of three core concepts: green values, digital innovation, and the unique characteristics of Generation Z as key players in digital startups. These three components are considered crucial theoretical foundations for developing a relevant and applicable model of green technopreneurship in the Indonesian context.

a. Green Values

Green values refer to sustainability-oriented principles, including environmental concern, social responsibility, and ethical decision-making in business. Chen et al. (2020) explain that integrating green values into organizational culture not only enhances corporate image but also strengthens long-term relationships with customers and communities. In digital startups, green values serve as essential parameters in shaping product strategies, marketing approaches, and environmentally responsible operations.
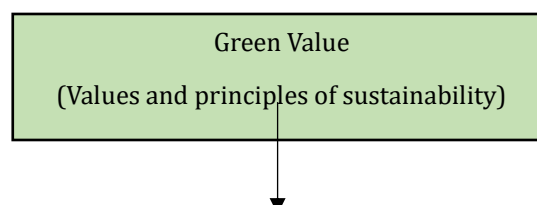
b. Digital Innovation

Digital innovation plays a vital role in accelerating the transition toward green business practices. Technologies such as cloud computing, artificial intelligence, IoT, and big data analytics enable energy efficiency, carbon footprint monitoring, and environmentally friendly process automation (Rachinger et al., 2019; Rao & Holt, 2020). Within this framework, technology is not merely a tool but also a paradigm-shifting force that enables scalable sustainable solutions.

c. Characteristics of Gen Z Founders

Generation Z differs significantly from previous generations. Growing up in the digital era, they are accustomed to multitasking, rapid thinking, and are deeply engaged with global issues such as climate change and social justice (Putri & Salamah, 2023; Williams et al., 2020). Many studies indicate that Gen Z prefers to build businesses that are not only economically profitable but also socially and ecologically meaningful (Arifin & Purba, 2022). Therefore, their characteristics form a key component in shaping a future-oriented and green technopreneurship model.

Theoretical Synthesis and Conceptual Model

Based on the integration of the three elements above, a conceptual model is developed to illustrate how green values, digital innovation, and Gen Z characteristics synergistically form the foundation of green technopreneurship. This model represents the interaction between value-driven motivation (green), technological capability (digital), and generational identity (Gen Z) in formulating sustainable business solutions.
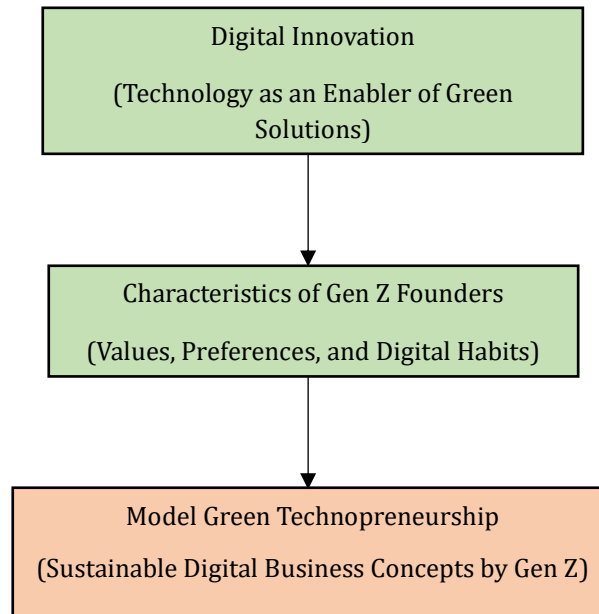
Green Value
(Values and principles of sustainability)

```
┌─────────────────────────────────────┐
│         Digital Innovation           │
│                                      │
│   (Technology as an Enabler of Green │
│            Solutions)                │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│    Characteristics of Gen Z Founders │
│                                      │
│  (Values, Preferences, and Digital   │
│             Habits)                  │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│     Model Green Technopreneurship    │
│                                      │
│ (Sustainable Digital Business        │
│        Concepts by Gen Z)            │
└─────────────────────────────────────┘
```

Figure 1.1 Conceptual Framework

Conceptual Framework Diagram Description
The conceptual framework illustrates that:
a. Green values serve as the ethical and motivational foundation.
b. Digital innovation acts as the strategic enabler.
c. Gen Z characteristics function as the primary driver and direction shaper.

2. Methods

This study employed an exploratory qualitative approach using a phenomenological design, aimed at gaining an in-depth understanding of the subjective experiences, interpretations, and perceptions of Gen Z founders toward green technopreneurship. This approach was selected due to its relevance for examining new and complex topics, with an emphasis on narrative understanding and contextual insight from the participants' perspectives (Creswell, 2013; Moustakas, 1994).

The research was conducted within a community of Indonesian digital startups actively involved in technology-based entrepreneurship and environmental initiatives. The study subjects were five digital startup founders aged 18–27 (Generation Z), who play active roles in managing their startups and are oriented toward sustainability.

Inclusion criteria for participants:
a. Active founder or co-founder
b. Digital-based startup (application/platform)
c. Focused on environmentally friendly practices

Participants were selected using a purposive sampling technique (Miles et al., 2014), based on their relevance and level of engagement with the research context.

Primary data were collected through semi-structured in-depth interviews with the five founders. This method allowed for flexibility and depth in exploring emerging themes, with an interview guide developed in alignment with the research questions.

The research steps included:
1. Developing the interview guide
2. Selecting participants
3. Conducting online/offline interviews (60–90 minutes per session)
4. Recording and transcribing the interviews
5. Noting non-verbal expressions (for in-person sessions)

The purpose of the interviews was to understand perceptions, practices, motivations, challenges, and strategies related to green entrepreneurship from the Gen Z perspective.

The data were analyzed using thematic analysis following Braun & Clarke (2006), consisting of the following stages:

1. Transcribing the interviews
2. Initial coding of meaningful data
3. Identifying initial themes and grouping sub-themes
4. Mapping the relationships between themes to identify patterns and structures of meaning
5. Constructing a conceptual model of green technopreneurship based on the analysis

This approach was chosen for its ability to capture the depth of meaning in participants' narratives and to generate a conceptual understanding of the phenomenon being studied.

To ensure data validity and trustworthiness, the researcher applied the following strategies (Lincoln & Guba, 1985):
1. Source triangulation – Comparing interview data with supporting documents (startup profiles, social media, community reports)
2. Member checking – Confirming findings or quotes with participants to ensure interpretative accuracy
3. Researcher reflexivity – Documenting potential biases through reflective journals, peer discussions, and self-evaluation following each interview session

3. Results and Discussion

General Description of Informants and Startups

This study involved five informants who are founders of digital startups and belong to Generation Z (aged 18–27). All participants focus on environmental sustainability (green entrepreneurship) and were selected based on participatory criteria, alignment of business focus with green values, and active engagement with digital technologies as their primary business development medium.

Each startup operates in a different sector but contributes to the broader sustainable development agenda. Below is a narrative description summarizing the profiles of the informants and their respective startups.

R1 – Nadya A. Putri (Founder of EcoTrove)

Nadya (22) is an active Communication Studies student at a public university in Yogyakarta. She founded EcoTrove, an Instagram- and web-based e-commerce platform selling reusable products such as stainless steel straws, recycled tote bags, and organic soaps.

EcoTrove emerged from her concern over plastic waste on campus. Its core vision is to promote lifestyle change through affordable and accessible green consumption. Nadya leverages digital tools like marketplaces, payment gateways, and chatbots to increase customer reach.

R2 – Rafi M. Hidayat (Founder of GreenLearn ID)

Rafi (21), an Environmental Engineering student in Bandung, founded GreenLearn ID, a digital education platform focused on environmental literacy for youth. The platform offers interactive quizzes, infographics, and short videos on climate change, green living, and the circular economy.

GreenLearn ID uses platforms like Moodle (open-source LMS), Canva, Notion, and Zoom. Its collaborative model involves cross-disciplinary teams regularly producing educational content. This initiative positions GreenLearn ID as a form of digital environmental technopreneurship.

R3 – Sarah Wulandari (Founder of SayurIn)

Sarah (23), an Agribusiness student in Surabaya, launched SayurIn, a simple digital service connecting local urban farmers to consumers via WhatsApp and a website. The main products include hydroponic vegetables and organic herbs sourced from community gardens.

SayurIn aims to shorten the food supply chain, reduce logistics-related carbon footprints, and generate added economic value for urban farming communities. Sarah uses a WordPress-based website and Google Maps to match consumers with distribution points.

R4 – Alvin Prakoso (Founder of Re-Cycle ID)

Alvin (24), a student of Information Systems in Jakarta, founded Re-Cycle ID, a web-based digital platform that connects owners of inorganic waste (such as plastic bottles, used paper, and small electronics) with campus waste banks and recycling communities.

The platform utilizes online forms, cloud databases (Google Sheets), and a digital points incentive system to encourage user participation. This innovation supports circular economy principles and offers digital motivation for youth to engage in recycling activities.

R5 – Amalia F. Ramadhan (Founder of Upcraft Studio)

Amalia (22), a Product Design student in Bandung, founded Upcraft Studio, a creative startup that transforms textile waste into new fashion items such as bags, pouches, and accessories. The business operates via Instagram, Shopee, and TikTok Shop with a visual storytelling marketing strategy.

Upcraft Studio was inspired by Amalia's concern about fashion waste and fast fashion culture. Through an upcycling approach, she demonstrates the economic and aesthetic potential of textile waste. The initiative also educates the public about sustainable fashion consumption.

Kode	Nama Founder	Usia	Startup	Fokus Usaha	Platform Digital
R1	Nadya A. Putri	22	EcoTrove	Produk reusable, e-commerce hijau	Instagram, chatbot, marketplace
R2	Rafi M.Hidayat	21	*Green*Learn ID	Edukasi lingkungan digital	Moodle, Canva, Notion, Zoom
R3	SarahWulandari	23	SayurIn	Distribusi hasil urban farming	WordPress, WhatsApp, Google Maps
R4	Alvin Prakoso	24	Re-Cycle ID	Layanan daur ulang berbasis digital	Web form, Google Sheets, sistem poin
R5	Amalia F. Ramadhan	22	Upcraft Studio	Fashion daur ulang, kreatif digital	Instagram Shop, TikTok, Shopee

Table 4.1. Characteristics of Informants and Startups

Research Findings

The findings in this study are based on in-depth interviews with five Gen-Z digital startup founders who adopt sustainability concepts. Thematic analysis techniques were used to identify the main themes that emerged from the data. Each theme is elaborated on in the following subsections, accompanied by direct quotes from informants and the researcher's interpretation, supported by documentation from the respective startups.

Gen-Z Founders' Perception of Green Technopreneurship

Initial findings from in-depth interviews show that the perceptions of Gen-Z founders toward the concept of green technopreneurship are diverse but generally positive. Most informants associate green technopreneurship not only with environmentally friendly practices but also as part of a broader social responsibility.

"For me, a green startup is not just about being environmentally friendly, but also about social responsibility." (R3 – Sarah, Founder of SayurIn)

This statement reflects that some founders view green values as part of their personal identity and the foundation of their business values. Green is not merely a product attribute but part of the social mission the startup seeks to elevate.

1. Green as Personal Identity and Business Values.
   Some informants emphasized that their involvement in green business stems from personal values and environmentally conscious lifestyles. For example:
   "I've been using reusable products for a long time, so starting EcoTrove was like extending my lifestyle into business." (R1 – Nadya, EcoTrove)
   This shows alignment between individual values and business vision. The researcher interprets that this approach strengthens business legitimacy and builds customer trust.
2. Green as a Globally Relevant Branding Strategy.
   On the other hand, some informants acknowledged that the green label has market appeal, especially among environmentally conscious youth.
   "If we use the green angle, people are more interested. Especially now that many are concerned about climate change." (R5 – Amalia, Upcraft Studio)
   This opinion indicates strategic awareness in using green identity as a unique selling proposition (USP). In other words, green technopreneurship is not only idealism but also an adaptive strategy toward global trend shifts.

3. Differences in Understanding: From Idealistic to Pragmatic.
   Although there is a common thread regarding green values, perceptions among founders show a diverse spectrum—from idealistic (value-based) to pragmatic (market- and technology-based).
   "Green is very broad. For me, I'm just being realistic. What matters is that our business makes a small impact first, no need to go big right away." (R4 – Alvin, Re-Cycle ID)
   This indicates that green technopreneurship among Gen-Z cannot be interpreted as a singular concept. The researcher observes a shift in understanding from moral values to functional and gradual approaches, aligned with limited resources and their early-stage business conditions.

Enabling and Inhibiting Factors for Digital Green Startups
   Interview results show that the success and challenges of developing green technopreneurship-based digital startups among Gen-Z are influenced by several internal and external factors. These factors can be classified into two main categories: enabling and inhibiting factors.

a. Enabling Factors
1. Access to Digital Information and Environmentally Conscious Communities
   Most founders mentioned that the internet and digital communities serve as a major source of inspiration and learning tools for understanding and running environmentally conscious businesses.
   "I've learned a lot from YouTube content and communities like Climate Rangers. Tons of insights on sustainability and green business." (R2 – Dito, GreenLearn ID)
   Broad access to information enables founders to gain global insight without geographical limitations. Digital communities also serve as spaces for idea validation and inter-startup collaboration.
2. Sustainability-Oriented Values Among Gen-Z
   Some founders stated that they feel a "generational responsibility" to contribute to the environment, not merely for economic gain.
   "For Gen-Z like us, sustainability isn't a trend, it's a life value. So it makes sense that our businesses should align with that too." (R5 – Amalia, Upcraft Studio)
   This confirms that sustainability values are embedded in Gen-Z's social identity, making green business not only a market opportunity but also a moral calling.
3. Support from Specific Incubation Ecosystems
   Incubation programs from universities or institutions like Indigo and 1000 Startup were also mentioned as important factors that help refine business ideas and provide initial funding access.
   "During the startup bootcamp from campus, we were helped by mentors to validate our ideas. They also encouraged us to include sustainability aspects." (R1 – Nadya, EcoTrove)
   Documentation from EcoTrove's profile shows their involvement in environmental-based startup training organized by a university entrepreneurship program.

b. Inhibiting Factors
1. Lack of Incentives from Public Policy
   Founders stated they have not felt concrete support from government policies in the form of tax incentives, research assistance, or special treatment for green businesses.
   "Building a green business is already costly, plus there's no policy support. It's tough in the beginning." (R3 – Sarah, SayurIn)
   The researcher interprets that the lack of policy incentives is a structural barrier that slows the adoption of sustainable business models.
2. High Costs of Green Technology
   Supporting technologies such as biodegradable packaging, renewable energy, or environmentally friendly production tools are still considered unaffordable for early-stage startups.
   "We tried looking for eco-friendly packaging, but the price was twice that of regular plastic." (R4 – Alvin, Re-Cycle ID)
   This constraint forces some founders to compromise between idealism and operational realities.
3. Price-Sensitive Consumers and Low Awareness
   Indonesia's relatively price-sensitive market means most consumers are not yet ready to pay more for green products.
   "Even though we sell recycled products, people still compare them with cheaper alternatives on the market." (R5 – Amalia, Upcraft Studio)

This reflects a gap between the values carried by startups and actual consumer behavior, which can be a barrier to business expansion.

The Role of Digitalization in Supporting Green Innovation

One key finding in this study is that digital transformation plays a central role in facilitating and accelerating green technopreneurship initiatives among Gen-Z startups. Founders utilize various digital tools and platforms to educate consumers, distribute green products, and build transparency in their value chains.

a. Digital Platforms as Mediums for Green Education and Awareness
Startups such as GreenLearn ID and Re-Cycle ID use digital media not just for promotion, but as effective environmental education tools. Interactive content like infographics, quizzes, and short videos are the main channels for delivering sustainability messages.
"We design educational content like quizzes and videos on Instagram so young people can relate more to environmental issues." (R2 – Dito, GreenLearn ID)
This initiative shows how digitalization fosters environmental literacy among young generations through familiar and easily accessible media.

b. Digitalization in Green Product Distribution
Founders also use digital channels like e-commerce, marketplaces, and social media to distribute eco-friendly products to consumers. EcoTrove and Upcraft Studio, for example, rely on Instagram Shop, Shopee, and simple chatbots to serve customers.
"Without platforms like Shopee and IG Shop, our product reach would be super limited. Digitalization lets everyone access green products, not just those in big cities." (R1 – Nadya, EcoTrove)
Digitalization has proven to expand distribution reach and open new markets for small startups without needing to build physical stores.

c. Transparency and Technological Innovation for Sustainability
Some founders expressed interest in adopting advanced technologies such as blockchain for supply chain transparency or even basic IoT for waste or production monitoring.
"We're exploring using QR codes for recycled material transparency. So consumers know where it came from." (R4 – Alvin, Re-Cycle ID)
Although not all startups have adopted advanced technology, awareness of digital tools' potential to drive transparency and accountability is increasing.

d. Technology as a Sustainability Accelerator
Digitalization not only facilitates operations but also opens paths to sustainable innovation. Technologies mentioned by founders as the future of green startups include:
1. IoT (Internet of Things): For automatic measurement of waste or energy consumption.
2. Blockchain: For tracking green supply chains.
3. AI and Data Analytics: For demand prediction, green product personalization, and logistics efficiency.
"AI can help us analyze green consumption patterns, so we can develop better strategies." (R5 – Amalia, Upcraft Studio)
However, limited technical knowledge and costs are reasons why some founders have not fully implemented these technologies.

Gen-Z's Style and Values in Technopreneurship

Interviews with five Gen-Z founders reveal that their approach to technopreneurship is heavily influenced by distinct generational characteristics, especially in leadership style, core values, and entrepreneurial motivation.

a. Collaborative and Horizontal Leadership Style
Most informants stated they prefer non-hierarchical organizational structures. Their leadership style is collaborative, discussion-based, and emphasizes teamwork. This aligns with Gen-Z's tendency to thrive in flexible, participative work environments.
"We're more like a project team than boss and subordinates. Everyone can give ideas and freely discuss." (R2 – Dito, GreenLearn ID)
This model allows innovation processes to flow more openly and adaptively to change.

b. Values: Authenticity, Transparency, and Social Impact
Founders emphasized the importance of personal and social values in building their businesses. They do not only pursue profit but also want their products and brands to reflect authenticity and transparency.

"I want a business I can personally be proud of, not just something that makes money. The impact has to be clear." (R3 – Aldi, SayurIn)
In the context of green technopreneurship, transparency means openly sharing information about raw material sources, production processes, and environmental impacts of the products.

c. Tendency Toward Purpose-Driven Entrepreneurship
All informants expressed that they were driven to start their startups because they wanted to contribute socially and environmentally, not just seek market opportunities. Their main motivation is purpose, not just profit.
"Honestly, this isn't just a business for me. It's a way to get people to live more environmentally aware." (R1 – Nadya, EcoTrove)
This finding supports previous research by Seemiller & Grace (2016) and Goh & Lee (2020), which show that Gen-Z tends to prioritize meaningful work and personal values.

Discussion
This section discusses how the field findings interact with the literature and theories presented in Chapter II. The analysis aims to see whether the research results reinforce, expand, or diverge from previous studies.

1. Gen-Z Founders' Perception of Green Technopreneurship
The finding that Gen-Z founders view green technopreneurship not just as an environmentally oriented business but also as an expression of social responsibility aligns with Schaper's (2016) concept of green entrepreneurship, which asserts that green ventures arise from ethical motivations and personal values.
This also aligns with Ghosh's (2018) study, which found that young generations often see business as a form of social and environmental activism, not merely economic vehicles. The perception spectrum from idealistic to pragmatic shows that green can be both strategic and ideological, as described in the green branding literature (Chen, 2010).

2. Enabling and Inhibiting Factors of Digital Green Startups
Enabling factors such as digital literacy, community ecosystems, and Gen-Z value orientation are consistent with PwC's (2022) study, which states that Gen-Z has high awareness of climate change and leverages digital technology for social solutions.
However, barriers such as the lack of policy incentives, high green tech costs, and local market resistance to premium pricing affirm Hasan et al.'s (2021) findings that green startups in developing countries often face structural systemic barriers. This indicates the need for more supportive policies for early-stage green ventures and collaborative approaches among government, academia, and the private sector.

3. The Role of Digitalization in Green Innovation
The use of digital platforms, online education, transparency systems, and digital marketing to support environmental goals supports the digital sustainability theory (Dwivedi et al., 2020), which highlights the use of digital technology to enhance sustainability.
Cases such as SayurIn and GreenLearn ID demonstrate how the integration of simple technologies (WhatsApp, web builders, interactive infographics) can support green goals through local, low-cost approaches, reinforcing Hilty & Aebischer's (2015) findings on low-threshold digital innovation.

4. Gen-Z's Values and Entrepreneurial Style
Gen-Z traits such as collaboration, openness, and purpose-driven motivation are consistent with findings by Seemiller & Grace (2016) and Goh & Lee (2020), who identified that Gen-Z prefers building meaningful businesses over merely pursuing profit.
This also aligns with the concept of authentic entrepreneurship (Moroz & Hindle, 2012), which emphasizes that successful young entrepreneurs are often motivated by the desire to live a life aligned with their personal values.

5. Research Contribution to Literature
This research enriches the discourse on green technopreneurship in the Indonesian context, focusing on small-scale digital startups driven by students. The resulting conceptual model shows that the integration of green values, simple digital technology, and Gen-Z characteristics produces a distinctive form of technopreneurship that is adaptive to resource constraints.

Discussion Conclusion
In general, the research findings support previous theories and studies, particularly in terms of the role of technology and generational values in promoting green entrepreneurship. However, this

study also contributes a new perspective by showing that digitalization enables the creation of small yet impactful green startups, even without large infrastructure support, as long as the founders are committed to their values.

Conceptual Model of Gen-Z Green Technopreneurship
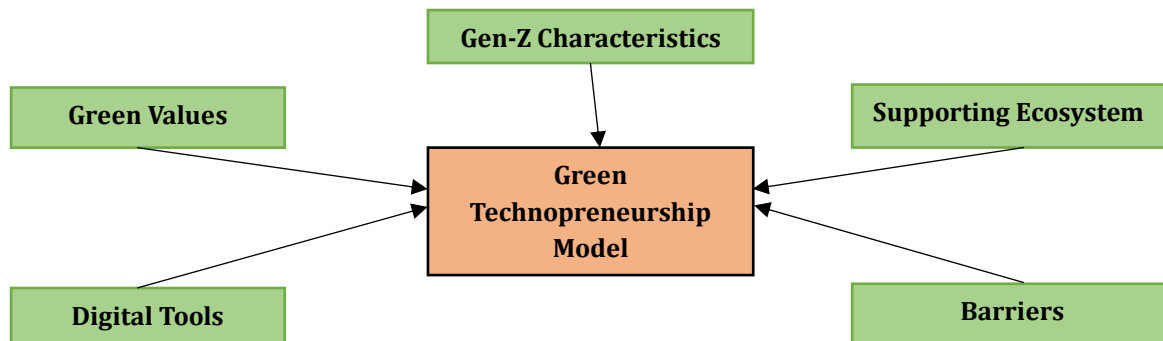
Key Components of the Model:
1. Green Values
   Represents sustainability values and environmental concern as the core motivation.
2. Digital Tools
   Digital technologies utilized as mediums and accelerators in building green solutions (platforms, social media, e-commerce, etc.).
3. Gen-Z Characteristics
   Distinct Gen-Z traits such as collaborative leadership, authenticity, purpose-driven work, and high digital literacy.
4. Supporting Ecosystem
   Incubators, startup communities, digital learning access, and academic collaboration.
5. Barriers
   Challenges such as lack of policy incentives, expensive green technology, and an unawareness among consumers.

Conceptual Model of Gen-Z Green Technopreneurship
Based on the findings of this research, a conceptual model of green technopreneurship relevant to Gen-Z-driven digital startups can be formulated. This model is built from the synthesis of the main analyzed themes while considering the empirical context and characteristics of the research subjects.
1. Gen-Z Values and Technology Access → Drivers of Sustainable Digital Innovation
   From interviews with Gen-Z founders, values such as sustainability, authenticity, and social purpose were found to be crucial foundations in building green startups. These values are reinforced by Gen-Z's closeness to digital technologies, including social media, e-commerce platforms, and apps for green product education and distribution. The combination of sustainability idealism and digital literacy forms the seed of sustainable digital innovation. As stated by informant R3:
   "Green startup isn't just a business, but an expression of my life values."
   This aligns with prior literature stating that Gen-Z is more aware of environmental issues and seeks meaningful work (Francis & Hoefel, 2018; Putri et al., 2020).
2. Drivers and Barriers → Determinants of Green Startup Success
   However, the success of green technopreneurship is also highly influenced by ecosystem conditions. On one hand, factors such as environmentally aware communities, campus incubator support, and access to digital knowledge drive green startup growth. On the other hand, challenges such as high green tech costs, low market awareness, and limited policy incentives serve as major obstacles.
   This shows that the green technopreneurship model for Gen-Z cannot be separated from wider systemic support, as also argued in Setiawan & Wijaya (2021) that ecosystem readiness is the key to startup sustainability.
3. Outcome: A Conceptual Model Based on Perception & Real-World Practice

The constructed model is a conceptual representation based on real-life experiences of Gen-Z founders in building and managing environmentally conscious digital startups. This model places Green Values, Digital Tools, and Gen-Z Characteristics as core elements that interact with each other, surrounded by Supporting Ecosystem and Barriers as influencing factors.

The previously presented diagram shows the flow of relationships between components and how they synergize to form a Gen-Z-specific pattern of green technopreneurship. Thus, this model reflects not only the idealistic tendencies of young generations but also the realistic challenges they face in the world of digital entrepreneurship.

Summary of Findings

Based on thematic analysis of interview data from five Gen-Z digital startup founders, several key points were identified as the foundation for formulating the conceptual model of green technopreneurship. These findings reflect the perspectives, challenges, and strategies applied by Gen-Z in developing sustainability-based digital startups:

1. Green startups are positioned as strategic advantages.
    Gen-Z founders do not merely perceive green technopreneurship as environmental concern, but also as a unique and valuable business identity. Sustainability values become differentiators in building emotional connections with consumers and communities.
2. A gap exists between idealism and market reality.
    Despite having strong environmental motivation, many founders face practical challenges such as high operational costs, lack of policy support, and low consumer awareness of green products. This creates dilemmas in maintaining principles without compromising business sustainability.
3. Digital technology is a key enabler.
    Digital platforms such as Instagram, WhatsApp, web applications, and LMS are creatively used to deliver environmental education, sell eco-friendly products, and build community networks. Technology not only simplifies operations but also amplifies sustainability value dissemination.
4. Gen-Z characteristics drive new approaches to technopreneurship.
    Collaborative leadership, intensive social media use, and a tendency toward meaningful work differentiate their business patterns from previous generations. They seek not only profit, but also impactful purpose.
5. The green technopreneurship model developed is contextual and adaptive.
    The conceptual model formulated in this research is adjusted to the social realities, personal values, and technological capacity of Gen-Z. It reflects a synthesis between ideal values, digital innovation, and field realities.

4. Conclusion

The findings show that Gen-Z founders view green technopreneurship as a form of social responsibility and competitive advantage—not merely a trend. Sustainability values are seen as part of personal and business identity, with implementation ranging from idealistic to pragmatic.

Key enabling factors include community support, digital literacy, and environmental awareness. Meanwhile, barriers include a lack of government incentives, costly green technologies, and low consumer awareness.

The resulting conceptual model combines three core elements: green values, digital tools, and distinct Gen-Z characteristics (social orientation, collaboration, and digital nativeness). The model emphasizes the importance of adaptation to the ecosystem, external challenges, and youth dynamics. Implications

Theoretical Development : Contributes to green technopreneurship literature by incorporating digital generation perspectives and expands the framework of youth entrepreneurship through a new conceptual model. Practical Implementation : Provides strategic guidance for startup communities, incubators, educational institutions, and policymakers in building a sustainable digital entrepreneurship ecosystem. Public Policy : Highlights the need for affirmative regulations and incentives that support youth-led environmentally friendly startups.

Future Research Directions: 1) Broader Informant Scope: Involving more informants from various startup sectors and geographic regions to broaden perspectives. 2) Mixed-Method Approach: Combining interviews with quantitative surveys to empirically test and validate the proposed model. 3) Longitudinal Study: Tracking the development of Gen-Z green startups over time to understand sustainable practice dynamics and challenges in real-world settings.

Conclusions explain the findings of the study that are relevant to the research question and research objectives without using statistical data. The conclusion section includes the implications of further research and research.

References

Andriyani, M., Syamsul, H., & Nasution, R. (2021). Challenges of digital startups in Indonesia: A qualitative study of the new business ecosystem. Journal of Technology Management, 20(3), 151–163.

Arifin, Z., & Purba, J. (2022). Determinants of entrepreneurial behavior among Gen-Z in Indonesia: Role of campus ecosystem and digital mindset. *International Journal of Entrepreneurship, 26*(4), 122–134.

Blank, S., & Dorf, B. (2012). *The startup owner's manual: The step-by-step guide for building a great company*. K&S Ranch Press.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Chen, Y. S., Lin, M. J. J., & Chang, C. H. (2020). The influence of green innovation on business sustainability: A study of Taiwanese SMEs. *Journal of Business Ethics, 104*(3), 361–370.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publications.

Deloitte. (2023). *2023 Gen Z and Millennial survey: The cost of inaction*. https://www2.deloitte.com Dissanayake, D., & Sivarajah, U. (2022). Towards green Technopreneurship: A multi-levelapproach to sustainability. *Journal of Cleaner Production, 356*, 131857.

Isma, A., Dewantara, H., Alisyahbana, A. N. Q., & Diarra, S. (2023). Digital literacy, environmental awareness, and e-commerce in entrepreneurial intentions. *QEMS Journal, 4*(2), 45–59.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications. Marpaung, C. R., Tsabit, I. A. Z., & Pangestuti, I. R. D. (2024). The role of Gen-Z in green economy towards Golden Indonesia 2045. *Research Horizon, 3*(1), 56–67.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.

Moleong, L. J. (2018). *Qualitative research methodology*. Remaja Rosdakarya.

Moustakas, C. (1994). *Phenomenological research methods*. SAGE Publications.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods, 16*(1), 1–13

Obschonka, M., & Audretsch, D. B. (2019). Artificial intelligence and big data in entrepreneurship. *arXiv preprint*. https://arxiv.org/abs/1906.00553

Patton, M. Q. (2015). *Qualitative research & evaluation methods* (4th ed.). SAGE Publications.

Pew Research Center. (2020). *Defining generations: Where Millennials end and Generation Z begins*. https://www.pewresearch.org

Pihie, Z. A. L., & Bagheri, A. (2013). Self-efficacy and entrepreneurial intention: The mediating role of self-regulation. *Vocations and Learning, 6*(3), 385–401.

Pratiwi, A., & Anjarwati, D. (2020). Digital natives and environmental concerns: The role of Gen-Z in social innovation. *Journal of Psychology & Behavior, 9*(1), 33–45.

Putri, D. Y., & Salamah, U. (2023). Gen-Z profile as young technopreneurs: Between innovation and sustainability. *Journal of Industrial and Organizational Psychology, 11*(1), 1–12.

Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2019). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management, 30*(8), 1143–1160.

Rao, P., & Holt, D. (2020). Technology and sustainable development: The role of innovation in environmental management. *Technological Forecasting & Social Change, 157*, 120065.

Rizqi, H. F., Maulana, F., & Febrianti, I. (2023). Readiness of Gen-Z in developing environmentally-based startups in the digital era. *Journal of Entrepreneurship and Creative Economy, 5*(2), 88–100.

Saraswati, N. P., Hakim, R., & Dewi, A. (2022). Digital technology for sustainable startups: A study on agritech and renewable energy startups. *Green Technology Journal, 7*(2), 43–57.

Serio, R. G., Giuliani, D., & Espa, G. (2020). Green production as a factor of survival for innovative startups. *arXiv preprint*. https://arxiv.org/abs/2005.12102

Singh, A., Kumar, P., & Srivastava, A. (2021). Green entrepreneurship and sustainable development: A conceptual framework. *International Journal of Entrepreneurship, 25*(1).

Sugiyono. (2019). *Qualitative, quantitative, and R&D research methods*. Bandung: Alfabeta.

Suyanti, T., Hidayat, D., & Dewi, A. (2022). Gen Z's tendency in choosing the entrepreneurial path: A quantitative study in higher education. *Journal of Economics and Entrepreneurship, 6*(2), 112–123.

Umus Aini, M. (2024). The motivation of Gen Z towards creating a sustainable business. *Justek: Journal of Science and Technology, 9*(1), 23–31.

Valendia, I. A. S., & Purwanegara, M. S. (2022). Greenwash online marketing and Gen Z's repurchase intention. *Indonesian Journal of Business and Entrepreneurship*.

Williams, K. C., Page, R. A., Petrosky, A. R., & Hernandez, E. H. (2020). Multi-generational marketing: Descriptions, characteristics, lifestyles, and attitudes. *Journal of Applied Business and Economics, 22*(1), 23–38.