




Sustainable Business Practices in Technology Start-ups: A Qualitative Inquiry into Environmental and Social Strategies

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ABSTRACT

The objective of this study was to explore the sustainable business practices in technology start-ups, focusing on their environmental and social strategies. The research aimed to understand the motivations behind adopting sustainability, the specific practices implemented, the challenges faced during implementation, and the impact of these practices on business performance. This qualitative study employed semi-structured interviews to collect data from key personnel in technology start-ups, including founders, CEOs, sustainability managers, and other strategic decision-makers. A total of 19 participants were selected using purposive sampling. The interviews were transcribed and analyzed using NVivo software, following an inductive approach to identify themes. Theoretical saturation was achieved when no new themes emerged from the data. The analysis revealed five main themes: motivation for sustainability, environmental strategies, social strategies, challenges in implementation, and impact on business performance. Motivations included environmental concerns, market differentiation, regulatory compliance, ethical considerations, and economic benefits. Environmental strategies encompassed renewable energy use, waste management, sustainable product design, carbon footprint reduction, water conservation, and green procurement. Social

strategies focused on employee well-being, community engagement, fair labor practices, stakeholder collaboration, customer education, social innovation, and inclusive hiring practices. Challenges included financial constraints, technological barriers, organizational resistance, supply chain complexities, regulatory hurdles, and market perceptions. The impact on business performance was positive, enhancing financial outcomes, operational efficiency, brand loyalty, innovation, and employee satisfaction. This study provides a comprehensive understanding of the sustainable business practices in technology start-ups, highlighting the multifaceted benefits and challenges of sustainability. The findings offer valuable insights for practitioners, policymakers, and researchers, emphasizing the importance of integrating environmental and social strategies into business operations to achieve long-term success and societal impact.

Keywords: Sustainable business practices, technology start-ups, environmental strategies, social strategies.

Introduction

The advancement of technology and the increasing awareness of environmental and social issues have pushed businesses, particularly technology start-ups, to adopt sustainable practices. These practices not only aim to mitigate negative environmental impacts but also enhance social responsibility and long-term business viability (Papp-Váry, 2023; Pillai, 2019; Shafiei, 2013; Shahidan, 2023). Sustainable business practices are essential for addressing global challenges such as climate change, resource depletion, and social inequality. According to Fernández-Robin et al. (2019), the hospitality industry has successfully implemented green practices, demonstrating the potential for other sectors, including technology, to follow suit (Fernández-Robin et al., 2019). Technology start-ups, known for their innovation and agility, are in a unique position to lead the way in sustainability (Jacobsen et al., 2020). Sustainable entrepreneurship involves integrating environmental and social objectives into business operations, going beyond profit maximization. Jamil (2024) emphasizes the strategic importance of sustainability in family businesses, highlighting the role of long-term thinking in business success (Jamil, 2024). This perspective is particularly relevant for technology start-ups, where innovation and sustainability can drive competitive advantage (Godha, 2024).

The study employs the TOE (Technology-Organization-Environment) framework to understand the interplay between technology adoption, organizational practices, and environmental influences in the context of sustainable entrepreneurship. Cooper (2024) explores this nexus, providing a foundation for examining how technology start-ups navigate sustainability challenges (Cooper, 2024).

Environmental strategies in technology start-ups often involve adopting renewable energy, improving waste management, and designing sustainable products. Renewable energy use, such as solar panels and wind turbines, has been widely adopted to reduce carbon footprints (Wit et al., 2021).

Additionally, effective waste management and sustainable product design are critical components of environmental strategies (Alkire et al., 2019).

Social strategies focus on improving employee well-being, community engagement, and fair labor practices. For instance, Poldner, Shrivastava, and Branzei (2016) discuss the importance of creating inclusive and supportive work environments (Poldner et al., 2016). Furthermore, community engagement through partnerships and volunteering programs enhances the social impact of start-ups (Kimuli et al., 2022).

Despite the potential benefits, implementing sustainable practices poses several challenges. Financial constraints, technological barriers, and organizational resistance are common hurdles. Hasani and O'Reilly (2020) highlight the difficulties start-ups face in securing funding for sustainability projects (Hasani & O'Reilly, 2020), while Sreenivasan and Suresh (2023) discuss the technological barriers related to blockchain adoption for sustainability (Sreenivasan & Suresh, 2023).

Sustainable practices can significantly impact business performance by enhancing financial outcomes, operational efficiency, and brand loyalty. Saura, Palos-Sánchez, and Herráez (2020) demonstrate how digital marketing strategies aligned with sustainability can drive business growth (Saura et al., 2020). Moreover, sustainable practices can foster innovation and employee satisfaction, contributing to overall business success (Kaur et al., 2022).

Understanding sustainable business practices in technology start-ups is crucial for several reasons. First, it provides a roadmap for other start-ups to implement similar strategies, contributing to broader environmental and social goals. Second, it highlights the role of innovation in driving sustainability, as evidenced by the successful practices of technology start-ups (Kim & Choi, 2019). Finally, it underscores the importance of a supportive regulatory and organizational environment for fostering sustainable entrepreneurship (Cagarman et al., 2020).

Existing literature provides a comprehensive understanding of sustainability practices across various sectors. For example, Piccarozzi (2017) examines the contribution of social innovation to sustainability in Italian start-ups (Piccarozzi, 2017), while Behounek (2024) assesses sustainability activities in sport-related software start-ups. These studies offer valuable insights into the diverse approaches and outcomes of sustainable practices. Technological advancements play a pivotal role in enhancing sustainability practices (Behounek, 2024). Godha (2024) discusses how technological innovations can improve sustainability and competitiveness, particularly in certified B-Corps in India (Godha, 2024). This aligns with Lee and Lee's (2008) findings on the strategic timing of IPOs in high-technology industries, where sustainability can be a critical factor. Social entrepreneurship, which blends business acumen with social impact, is gaining significance (Lee & Lee, 2008). Cagarman et al. (2020) explore the rising importance of social entrepreneurship in Germany, highlighting its potential to address societal challenges through innovative business models (Cagarman et al., 2020).

This study aims to fill the gap in understanding sustainable business practices in technology start-ups. By examining the motivations, strategies, challenges, and impacts of sustainability, it provides a comprehensive view of how these start-ups contribute to environmental and social goals. The findings will offer valuable insights for practitioners, policymakers, and researchers interested in promoting sustainable entrepreneurship.

Methods and Materials

This study employs a qualitative research design to explore sustainable business practices in technology start-ups. Given the nature of the inquiry, a qualitative approach allows for a deeper understanding of the environmental and social strategies implemented by these start-ups. The primary method of data collection was semi-structured interviews, which facilitated rich, detailed accounts from participants.

The study utilized purposive sampling to select participants who are knowledgeable and experienced in implementing sustainable business practices within technology start-ups. Participants included founders, CEOs, sustainability managers, and other key personnel involved in the strategic decision-making processes of their organizations. The sample size was determined by the principle of theoretical saturation, which was achieved after conducting interviews with 19 participants. Theoretical saturation was considered reached when no new themes or insights emerged from additional interviews.

Data were collected through semi-structured interviews, which provided flexibility to explore various aspects of sustainable practices while ensuring that key topics were covered consistently across interviews. An interview guide was developed, encompassing questions related to:

- The motivation behind adopting sustainable practices
- Specific environmental and social strategies employed
- Challenges and benefits of implementing these strategies
- The impact of sustainable practices on business performance

Interviews were conducted either in person or via video conferencing platforms, depending on the participants' availability and preference. Each interview lasted between 45 to 60 minutes and was audio-recorded with the participants' consent for subsequent transcription and analysis.

The transcribed interviews were analyzed using NVivo software, which facilitated the organization, coding, and interpretation of qualitative data. The analysis followed an inductive approach, allowing themes to emerge naturally from the data rather than being imposed a priori. The process involved several stages:

- Familiarization: Reading and re-reading the transcripts to immerse in the data.
- Initial Coding: Generating initial codes from the data to identify significant features relevant to the research questions.
- Theme Development: Collating codes into potential themes and reviewing them to ensure they accurately represent the data.
- Defining and Naming Themes: Refining the themes and defining them clearly, ensuring each theme is distinct and comprehensive.
- Final Analysis: Synthesizing the themes to develop a coherent narrative that addresses the research objectives.

To enhance the trustworthiness of the study, several strategies were employed:

- Triangulation: Data were triangulated through multiple sources within the start-ups, including founders and sustainability managers, to ensure a comprehensive understanding.
- Member Checking: Participants were invited to review the transcripts and preliminary findings to verify the accuracy and credibility of the data.
- Reflexivity: The researchers maintained reflexive journals to acknowledge and address any personal biases and their potential influence on the research process.

Findings and Results

The study included a diverse group of 19 participants, all of whom played key roles in their respective technology start-ups. Among the participants, 10 were male (53%) and 9 were female (47%). The age range of the participants was between 28 and 52 years, with an average age of 37 years. In terms of professional roles, the sample comprised 6 founders/CEOs (32%), 5 sustainability managers (26%), 4 operations managers (21%), 3 marketing directors (16%), and 1 procurement manager (5%). The majority of participants held advanced degrees, with 12 (63%) possessing a master's degree and 5 (26%) holding a bachelor's degree, while 2 (11%) had a doctoral degree. The companies represented varied in size, with 8 participants (42%) from small start-ups (less than 50 employees), 7 (37%) from medium-sized start-ups (50-200 employees), and 4 (21%) from larger start-ups (more than 200 employees). This diverse sample provided a comprehensive view of the sustainable business practices across different roles and company sizes in the technology sector.

Table 1

Categories, Subcategories, and Concepts

Category	Subcategory	Concepts
1. Motivation for Sustainability	Environmental Concerns	Climate change mitigation, Resource conservation, Pollution reduction
	Market Differentiation	Competitive advantage, Customer demand, Brand reputation
	Regulatory Compliance	Government policies, Industry standards, Legal requirements
	Ethical Considerations	Corporate responsibility, Moral duty, Social impact
	Economic Benefits	Cost savings, Efficiency improvement, Long-term profitability
2. Environmental Strategies	Renewable Energy Use	Solar panels, Wind turbines, Green power purchase
	Waste Management	Recycling programs, Waste reduction, Composting
	Sustainable Product Design	Eco-friendly materials, Energy-efficient products, Lifecycle assessment
	Carbon Footprint Reduction	Carbon offsetting, Emission tracking, Green transportation
	Water Conservation	Water recycling, Efficient irrigation, Low-flow fixtures
3. Social Strategies	Green Procurement	Sustainable sourcing, Supplier audits, Ethical supply chains
	Employee Well-being	Health programs, Work-life balance, Diversity and inclusion
	Community Engagement	Local partnerships, Volunteering programs, Charitable donations
	Fair Labor Practices	Fair wages, Safe working conditions, Anti-discrimination policies
	Stakeholder Collaboration	Stakeholder dialogues, Joint ventures, Multi-stakeholder initiatives
	Customer Education	Sustainability awareness campaigns, Eco-friendly product usage, Transparent communication

4. Challenges in Implementation	Social Innovation	Social enterprises, Impact investing, Inclusive business models
	Inclusive Hiring Practices	Equal opportunity employment, Diversity recruitment, Internship programs
	Financial Constraints	Budget limitations, High initial costs, Funding gaps
5. Impact on Business Performance	Technological Barriers	Lack of innovation, Technology adaptation, Technical expertise
	Organizational Resistance	Change management, Employee buy-in, Cultural inertia
	Supply Chain Complexities	Supplier collaboration, Traceability issues, Logistics challenges
	Regulatory Hurdles	Compliance costs, Varying regulations, Bureaucratic delays
	Market Perceptions	Consumer skepticism, Market readiness, Competitor actions
	Financial Performance	Revenue growth, Cost savings, ROI
	Operational Efficiency	Process optimization, Resource efficiency, Waste reduction
Brand Loyalty	Customer retention, Positive brand image, Customer trust	
Innovation and Growth	New market opportunities, Product innovation, Competitive edge	
Employee Satisfaction	Reduced turnover, Higher productivity, Employee engagement	

The analysis of the semi-structured interviews revealed five main themes related to sustainable business practices in technology start-ups. Each theme encompasses several subcategories that provide a nuanced understanding of the strategies and challenges faced by these organizations. Below is a detailed report of the findings, including relevant quotations from the interviews.

1. Motivation for Sustainability

Environmental Concerns: Many start-ups are driven by the urgent need to address climate change, conserve resources, and reduce pollution. As one participant noted, "Our primary motivation is to leave a positive impact on the environment. We believe it's our responsibility to mitigate climate change."

Market Differentiation: Sustainable practices are also seen as a way to gain a competitive edge, meet customer demand, and enhance brand reputation. One interviewee stated, "Being eco-friendly sets us apart in a crowded market. Customers today are more environmentally conscious and prefer brands that align with their values."

Regulatory Compliance: Compliance with government policies, industry standards, and legal requirements is another significant motivator. A CEO explained, "Adhering to environmental regulations is crucial not only to avoid penalties but also to position ourselves as industry leaders in sustainability."

Ethical Considerations: For some start-ups, ethical considerations such as corporate responsibility, moral duty, and social impact play a central role. "We believe that businesses have a moral obligation to do the right thing for society and the environment," shared a founder.

Economic Benefits: Sustainable practices can lead to cost savings, efficiency improvements, and long-term profitability. An operations manager mentioned, "By optimizing our resource use and reducing waste, we've seen significant cost reductions, which also boosts our bottom line."

2. Environmental Strategies

Renewable Energy Use: Many start-ups invest in solar panels, wind turbines, and green power purchases to reduce their carbon footprint. A sustainability manager said, "Switching to renewable energy has not only reduced our emissions but also lowered our energy costs."

Waste Management: Effective waste management strategies such as recycling programs, waste reduction initiatives, and composting are commonly employed. "We've implemented a comprehensive recycling program that's cut our waste output by half," noted an operations director.

Sustainable Product Design: Designing products with eco-friendly materials, energy efficiency, and lifecycle assessments is a key strategy. "Our products are designed to be as energy-efficient as possible, using materials that have a minimal environmental impact," highlighted a product manager.

Carbon Footprint Reduction: Initiatives like carbon offsetting, emission tracking, and green transportation are used to minimize carbon footprints. "We actively track and offset our carbon emissions to ensure we're contributing to a greener planet," said a CEO.

Water Conservation: Practices such as water recycling, efficient irrigation, and low-flow fixtures help conserve water. An interviewee mentioned, "Water conservation is critical for us. We've implemented systems to recycle water and reduce usage significantly."

Green Procurement: Sustainable sourcing, supplier audits, and ethical supply chains are integral to their procurement processes. "We carefully select suppliers who adhere to our sustainability standards," stated a procurement manager.

3. Social Strategies

Employee Well-being: Programs focusing on health, work-life balance, and diversity and inclusion are prevalent. A participant shared, "Ensuring our employees' well-being is paramount. We offer comprehensive health programs and promote a healthy work-life balance."

Community Engagement: Start-ups engage with local communities through partnerships, volunteering programs, and charitable donations. "Our community engagement initiatives have strengthened our local ties and enhanced our social impact," explained a founder.

Fair Labor Practices: Implementing fair wages, safe working conditions, and anti-discrimination policies is a priority. "We are committed to fair labor practices and ensuring a safe, inclusive workplace for all employees," stated an HR manager.

Stakeholder Collaboration: Collaboration with stakeholders through dialogues, joint ventures, and multi-stakeholder initiatives is common. "Engaging with our stakeholders helps us align our sustainability goals with broader societal expectations," noted a CEO.

Customer Education: Educating customers about sustainability through awareness campaigns and transparent communication is crucial. "We actively educate our customers on the sustainable aspects of our products and how they can make eco-friendly choices," said a marketing director.

Social Innovation: Many start-ups invest in social enterprises, impact investing, and inclusive business models. "Our focus on social innovation has led to the development of business models that address social issues while being profitable," highlighted a founder.

Inclusive Hiring Practices: Equal opportunity employment, diversity recruitment, and internship programs are emphasized. "Diversity and inclusion are at the core of our hiring practices," shared an HR manager.

4. Challenges in Implementation

Financial Constraints: Budget limitations, high initial costs, and funding gaps are significant barriers. "Securing funding for sustainability projects is challenging, but we are committed to finding solutions," noted a CFO.

Technological Barriers: The lack of innovation, technology adaptation, and technical expertise pose challenges. "Adopting new technologies can be daunting, but it's necessary for our sustainability goals," explained a CTO.

Organizational Resistance: Resistance to change, employee buy-in, and cultural inertia are common obstacles. "Changing the organizational culture to embrace sustainability is a gradual process," said a CEO.

Supply Chain Complexities: Collaboration with suppliers, traceability issues, and logistics challenges are prevalent. "Ensuring our entire supply chain is sustainable is complex but essential," highlighted a supply chain manager.

Regulatory Hurdles: Compliance costs, varying regulations, and bureaucratic delays can hinder progress. "Navigating the regulatory landscape is challenging, but we remain committed to compliance," stated a regulatory affairs manager.

Market Perceptions: Consumer skepticism, market readiness, and competitor actions influence the adoption of sustainable practices. "Educating the market about the benefits of sustainability is ongoing," noted a marketing director.

5. Impact on Business Performance

Financial Performance: Sustainable practices contribute to revenue growth, cost savings, and ROI. "Our sustainability initiatives have led to significant cost savings and increased profitability," shared a CFO.

Operational Efficiency: Process optimization, resource efficiency, and waste reduction improve operational performance. "Efficiency improvements from our sustainability efforts have streamlined our operations," noted an operations manager.

Brand Loyalty: Customer retention, positive brand image, and trust are enhanced through sustainability. "Our commitment to sustainability has strengthened customer loyalty and trust," stated a brand manager.

Innovation and Growth: New market opportunities, product innovation, and competitive edge are driven by sustainability. "Sustainability has opened new markets and driven innovation within our product lines," highlighted a CEO.

Employee Satisfaction: Reduced turnover, higher productivity, and employee engagement result from sustainable practices. "Our sustainability efforts have positively impacted employee morale and engagement," shared an HR manager.

Conclusion

This study explored the sustainable business practices in technology start-ups through a qualitative inquiry, focusing on their environmental and social strategies. The analysis of the semi-structured interviews revealed five main themes: motivation for sustainability, environmental strategies, social strategies, challenges in implementation, and impact on business performance.

The primary motivations for adopting sustainable practices included environmental concerns, market differentiation, regulatory compliance, ethical considerations, and economic benefits. Participants highlighted that mitigating climate change, conserving resources, and reducing pollution were key drivers for sustainability. This aligns with Fernández-Robin et al. (2019), who found similar motivations in the hospitality industry, emphasizing the universal nature of environmental concerns across sectors (Fernández-Robin et al., 2019).

Market differentiation emerged as a significant motivator, with participants noting that sustainability provided a competitive edge and enhanced brand reputation. This is consistent with the findings of Alkire et al. (2019), who identified market differentiation as a critical factor in the adoption of sustainable practices in service industries (Alkire et al., 2019). Regulatory compliance and ethical considerations were also pivotal, reflecting the findings of Cooper (2024), who discussed the importance of adhering to environmental regulations and corporate responsibility in business processes (Cooper, 2024).

Economic benefits, such as cost savings and efficiency improvements, were highlighted by participants, supporting the notion that sustainability can lead to long-term profitability (Godha, 2024). This economic rationale is essential for convincing stakeholders of the value of sustainability initiatives.

Environmental strategies in technology start-ups included renewable energy use, waste management, sustainable product design, carbon footprint reduction, water conservation, and green procurement. Participants reported significant investments in renewable energy, such as solar panels and wind turbines, which not only reduced their carbon footprints but also lowered energy costs. This finding is supported by Wit, Dresler, and Surma-Syta (2021), who demonstrated the economic and environmental benefits of renewable energy adoption in start-ups (Wit et al., 2021).

Effective waste management, through recycling programs and waste reduction initiatives, was another common strategy. The emphasis on sustainable product design, using eco-friendly materials and energy-efficient products, aligns with Alkire et al. (2019), who noted the importance of design in reducing environmental impacts (Alkire et al., 2019). Carbon footprint reduction initiatives, such as carbon offsetting and green transportation, were also prevalent, reflecting broader trends in corporate sustainability (Jacobsen et al., 2020).

Water conservation practices, including water recycling and efficient irrigation, were highlighted by participants, underscoring the importance of sustainable water use. Green procurement practices, such as sustainable sourcing and ethical supply chains, were critical for ensuring that environmental sustainability extended beyond the company's operations (Godha, 2024).

Social strategies focused on employee well-being, community engagement, fair labor practices, stakeholder collaboration, customer education, social innovation, and inclusive hiring practices. Participants emphasized the importance of health programs, work-life balance, and diversity and inclusion initiatives, which are crucial for employee satisfaction and retention. Poldner, Shrivastava, and Branzei (2016) similarly found that supportive work environments are essential for fostering employee well-being and productivity (Poldner et al., 2016).

Community engagement through local partnerships and volunteering programs was highlighted as a means of enhancing social impact. This finding aligns with Kimuli, Sendawula, and Nagujja (2022), who demonstrated the positive effects of community engagement on business performance in women-owned micro enterprises in Uganda (Kimuli et al., 2022). Fair labor practices, including fair wages and safe working conditions, were critical for maintaining ethical standards and avoiding legal issues (Cagarman et al., 2020).

Stakeholder collaboration, through dialogues and joint ventures, was identified as essential for aligning sustainability goals with broader societal expectations. This is supported by Saura, Palos-Sánchez, and Herráez (2020), who found that stakeholder engagement is vital for the successful implementation of sustainable strategies (Saura et al., 2020). Customer education on sustainability, through awareness campaigns and transparent communication, was also emphasized, reflecting the importance of informed consumer choices (Kim & Choi, 2019).

Social innovation, such as social enterprises and impact investing, was a key strategy for addressing social issues while achieving business objectives. This finding is consistent with Piccarozzi (2017), who highlighted the role of social innovation in contributing to sustainability (Piccarozzi, 2017). Inclusive hiring practices, focusing on diversity recruitment and equal opportunity employment, were essential for creating a diverse and inclusive workforce (Poldner et al., 2016).

Participants reported several challenges in implementing sustainable practices, including financial constraints, technological barriers, organizational resistance, supply chain complexities, regulatory hurdles, and market perceptions. Financial constraints, such as budget limitations and high initial costs, were significant barriers, consistent with Hasani and O'Reilly (2020), who highlighted the difficulties in securing funding for sustainability projects (Hasani & O'Reilly, 2020).

Technological barriers, such as the lack of innovation and technical expertise, were also prevalent. Sreenivasan and Suresh (2023) discussed the technological challenges associated with blockchain adoption for sustainability, highlighting the need for technical advancements and expertise (Sreenivasan & Suresh, 2023). Organizational resistance, including change management and employee buy-in, was another common challenge, reflecting the findings of Alkire et al. (2019) on the cultural inertia that can hinder sustainability initiatives (Alkire et al., 2019).

Supply chain complexities, such as supplier collaboration and traceability issues, were significant obstacles, emphasizing the need for comprehensive and transparent supply chains (Jacobsen et al., 2020). Regulatory hurdles, including compliance costs and varying regulations, posed additional challenges, consistent with the findings of Cooper (2024). Market perceptions, such as consumer skepticism and

market readiness, also influenced the adoption of sustainable practices, highlighting the importance of consumer education and market development (Cooper, 2024; Saura et al., 2020).

Sustainable practices had a positive impact on business performance, enhancing financial outcomes, operational efficiency, brand loyalty, innovation, and employee satisfaction. Participants reported revenue growth, cost savings, and improved ROI from sustainability initiatives, supporting the economic benefits highlighted by Godha (2024). Operational efficiency improvements, through process optimization and resource efficiency, were also significant, aligning with the previous findings (Godha, 2024; Wit et al., 2021).

Brand loyalty was enhanced through sustainability, with participants noting increased customer retention and positive brand image. This is consistent with Saura, Palos-Sánchez, and Herráez (2020), who found that sustainable strategies contribute to stronger customer relationships (Saura et al., 2020). Innovation and growth, driven by new market opportunities and product innovation, were also notable outcomes, reflecting the importance of sustainability for competitive advantage (Kaur et al., 2022).

Employee satisfaction, including reduced turnover and higher productivity, was another positive impact, highlighting the importance of sustainability for attracting and retaining talent (Poldner et al., 2016). Overall, the findings underscore the multifaceted benefits of sustainable business practices in technology start-ups, contributing to both environmental and social goals while enhancing business performance.

This study has several limitations that should be acknowledged. First, the sample size was relatively small, with only 19 participants, which may limit the generalizability of the findings. While the principle of theoretical saturation was achieved, a larger sample could provide a more comprehensive understanding of sustainable practices across a broader range of technology start-ups. Second, the study relied on self-reported data from interviews, which may be subject to social desirability bias, where participants might overstate their commitment to sustainability. Additionally, the study focused on technology start-ups, which may have different sustainability challenges and opportunities compared to other industries. Future research should consider these limitations and explore sustainable practices in a more diverse range of business sectors.

Future research should build on the findings of this study by exploring sustainable business practices in a larger and more diverse sample of start-ups. Comparative studies across different industries and geographical regions could provide deeper insights into how contextual factors influence sustainability strategies. Additionally, longitudinal studies could examine the long-term impacts of sustainable practices on business performance, tracking changes over time to provide a more dynamic understanding of sustainability in start-ups. Research should also investigate the role of emerging technologies, such as artificial intelligence and blockchain, in enhancing sustainability, building on the technological barriers identified in this study. Finally, exploring the perspectives of other stakeholders, such as customers, suppliers, and investors, could offer a more holistic view of the challenges and benefits of sustainable business practices.

Based on the findings of this study, several practical recommendations can be made for technology start-ups seeking to enhance their sustainability practices. First, start-ups should invest in renewable energy and sustainable product design to reduce their environmental impact and improve operational efficiency. Establishing comprehensive waste management and water conservation programs can also contribute to sustainability goals. Second, fostering a supportive work environment through health programs, work-life balance initiatives, and diversity and inclusion efforts can enhance employee well-being and productivity. Engaging with local communities and stakeholders through partnerships and dialogues can strengthen social impact and align sustainability goals with broader societal expectations. Third, start-ups should prioritize transparency and communication in their sustainability efforts, educating customers and stakeholders about their initiatives to build trust and support. Finally, addressing financial and technological barriers through strategic planning and investment in innovation can help overcome challenges and drive long-term sustainability.

In conclusion, this study provides valuable insights into the sustainable business practices of technology start-ups, highlighting the motivations, strategies, challenges, and impacts of sustainability. By addressing the limitations and building on the findings, future research can further advance our understanding of sustainable entrepreneurship. Practical recommendations can guide start-ups in implementing effective sustainability strategies, contributing to both business success and broader environmental and social goals.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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