

# Pedagogical Research and Development

Volume: 5 Issue: 3

2026

ISSN: 2791-3627



DOI: <https://doi.org/10.64907/xkmf.v5i3.prd.5>



**OPEN ACCESS** Freely  
available online

## RESEARCH ARTICLE

# Sustainable UX/UI Design for Climate Action Platforms: Insights from Qualitative Case Studies

Ummy Amerin Asha<sup>1\*</sup>; Aryan Abir Ahmed<sup>1</sup>; Kazi Abdul Mannan<sup>2</sup>

Received: 20 May 2026

Accepted: 25 June 2026

Corresponding author:

<sup>1\*</sup>Ummy Amerin Asha

<sup>1</sup>Department of Graphic Design  
& Multimedia,

<sup>2</sup>Department of Business  
Administration

Shanto-Mariam University of  
Creative Technology  
Dhaka, Bangladesh

E-mail:

ummyamerinasha@gmail.com

Disclosure statement

No potential conflict of interest  
was reported by the  
author(s).

**Abstract:** The environmental impact of digital technologies has become an increasingly critical concern in the context of global climate change. This study investigates the role of sustainable UX/UI design in enhancing the effectiveness of climate action platforms through a qualitative analysis of secondary case studies. Grounded in Sustainable Interaction Design (SID), Persuasive System Design (PSD), and Systems Thinking, the research examines how design strategies influence both environmental performance and user behaviour. The findings reveal that sustainable UX/UI design extends beyond interface aesthetics to include performance optimisation, minimalism, and energy-efficient interactions, which collectively reduce the digital carbon footprint. Additionally, persuasive design elements such as gamification, personalised feedback, and social engagement significantly contribute to promoting sustainable user behaviour. The study highlights the importance of integrating environmental, behavioural, and systemic dimensions into a unified design framework. However, challenges such as the lack of standardised sustainability metrics, trade-offs between visual richness and efficiency, and limited organisational awareness remain significant barriers. This research contributes to the growing field of digital sustainability by offering actionable insights and emphasising the need for interdisciplinary collaboration in designing impactful climate action platforms.

**Keywords:** sustainable ux, climate action platforms, digital sustainability, persuasive design, user behaviour, eco-design, systems thinking

Citation information: Cite this article as: Asha, U.A., Ahmed, A.A., & Mannan, K.A. (2026). Sustainable UX/UI Design for Climate Action Platforms: Insights from Qualitative Case Studies. Pedagogical Research and Development, 5(2), 1-17. DOI: <https://doi.org/10.64907/xkmf.v5i3.prd.5>

## 1. Introduction

The global climate crisis has emerged as one of the most pressing challenges of the 21st century, requiring urgent, coordinated, and interdisciplinary responses across technological, social, and economic domains. While digital technologies are often positioned as enablers of sustainability-facilitating dematerialisation, remote work, and environmental monitoring, they also contribute significantly to global carbon emissions. Recent estimates suggest that the information and communication technology (ICT) sector accounts for approximately 3–4% of global greenhouse gas emissions, a figure expected to rise with increasing digital consumption (Belkhir & Elmeligi, 2018). This paradox positions digital design, particularly user experience (UX) and user interface (UI) design, at a critical intersection between technological innovation and environmental responsibility.

Every interaction with a digital interface-whether loading a webpage, streaming a video, or interacting with a mobile application-requires energy consumption across networks, servers, and user devices. These micro-interactions, when aggregated across billions of users, contribute to a substantial digital carbon footprint (Aslan et al., 2018). Inefficient design choices, such as heavy graphics, excessive animations, and poorly optimised code, exacerbate this footprint, highlighting the need for more sustainable design practices (Sarapure & Kumar, 2024). As such, UX/UI design is no longer confined to usability and aesthetics; it must also incorporate environmental

considerations to mitigate the ecological impact of digital systems.

In parallel, the proliferation of climate action platforms-digital tools designed to promote environmental awareness, behavioural change, and collective action-has transformed the way individuals engage with sustainability issues. These platforms range from carbon footprint tracking applications and energy consumption dashboards to community-based sustainability networks and policy advocacy tools. Their effectiveness depends not only on the accuracy and relevance of the information they provide but also on how this information is presented and experienced by users. UX/UI design plays a pivotal role in shaping user engagement, comprehension, and motivation, thereby influencing the extent to which users adopt sustainable behaviours (Fogg, 2009).

Sustainable UX/UI design has emerged as a conceptual and practical response to these challenges. It involves designing digital products that minimise environmental impact while maximising usability, accessibility, and user engagement. This approach encompasses strategies such as reducing data transfer, optimising performance, employing minimalist design principles, and encouraging environmentally responsible user behaviours (Blevis, 2007). Importantly, sustainable UX/UI design extends beyond technical optimisation to include ethical and behavioural dimensions, recognising that design decisions can influence user choices and societal outcomes.

Despite growing interest in sustainable design, there remains a lack of

comprehensive frameworks that integrate UX/UI design with climate action objectives. Existing research often focuses on isolated aspects, such as energy-efficient coding or persuasive design techniques, without addressing the broader socio-technical context in which digital systems operate. This fragmentation underscores the need for interdisciplinary approaches that combine insights from human-computer interaction (HCI), environmental science, behavioural psychology, and systems thinking.

This study addresses this gap by exploring sustainable UX/UI design within the context of climate action platforms through qualitative analysis of secondary case studies. By examining real-world examples, the research aims to identify design strategies, challenges, and opportunities associated with integrating sustainability into digital interfaces. The study is guided by the following research questions:

- How are sustainable UX/UI design principles implemented in climate action platforms?
- What design strategies effectively promote environmentally responsible user behaviour?
- What challenges and limitations exist in adopting sustainable UX/UI practices?

The significance of this research lies in its potential to inform both academic discourse and practical design processes. For researchers, it contributes to the emerging field of digital sustainability by providing a holistic understanding of UX/UI design in climate contexts. For practitioners, it offers actionable insights into designing more

sustainable and impactful digital products. Moreover, the study aligns with global sustainability agendas, such as the United Nations Sustainable Development Goals (SDGs), particularly Goal 13 (Climate Action), by highlighting the role of digital design in fostering environmental awareness and action (United Nations, 2015).

In conclusion, as digital technologies continue to expand their influence, the need for sustainable UX/UI design becomes increasingly urgent. By integrating environmental considerations into the design process, climate action platforms can not only reduce their ecological footprint but also empower users to contribute to a more sustainable future. This study seeks to advance this agenda by providing a comprehensive analysis of sustainable UX/UI practices through qualitative case study insights.

## 2. Literature Review

Sustainable UX/UI design is an emerging field that integrates environmental considerations into the design and development of digital products. Rooted in the broader concept of sustainable design, it seeks to minimise negative environmental impacts while enhancing user experience and system performance. Blevis (2007) introduced the concept of Sustainable Interaction Design (SID), emphasising the importance of considering environmental consequences throughout the design lifecycle. SID advocates for principles such as resource conservation, lifecycle thinking, and user behaviour influence, positioning design as a catalyst for sustainability.

Subsequent research has expanded on these principles, highlighting the role of efficiency, simplicity, and longevity in sustainable UX/UI design. For instance, minimalist interfaces reduce data transfer and processing requirements, thereby lowering energy consumption (Sarapure & Kumar, 2024). Similarly, designing for durability-ensuring that digital products remain relevant and usable over time-can reduce the need for frequent updates and replacements, contributing to sustainability.

## **2.1 Digital Carbon Footprint and Environmental Impact**

The environmental impact of digital technologies is increasingly recognised as a critical area of concern. The concept of the digital carbon footprint encompasses the total greenhouse gas emissions associated with digital activities, including data storage, transmission, and device usage. Aslan et al. (2018) highlight that internet traffic and data centres are significant contributors to energy consumption, with growing demand driven by streaming services, cloud computing, and mobile applications.

Belkhir and Elmeligi (2018) project that ICT-related emissions could reach 14% of global emissions by 2040 if current trends continue. This underscores the urgency of adopting sustainable practices in digital design. UX/UI designers play a crucial role in this context, as their decisions directly influence the efficiency and performance of digital systems. For example, optimising images, reducing HTTP requests, and minimising code complexity can significantly lower energy consumption.

## **2.2 Climate Action Platforms and Digital Engagement**

Climate action platforms are digital systems designed to facilitate environmental awareness, education, and behaviour change. These platforms leverage UX/UI design to present complex environmental data in accessible and engaging ways. Research indicates that effective design can enhance user comprehension and motivation, leading to increased participation in sustainable practices (Mahyar et al., 2020).

Key features of climate action platforms include data visualisation, personalised feedback, and community engagement. Data visualisation tools, such as interactive dashboards, enable users to understand their environmental impact and track progress over time. Personalised feedback mechanisms provide tailored recommendations, while community features foster social interaction and collective action.

However, the effectiveness of these platforms depends on their usability and accessibility. Poor design can hinder user engagement and limit the impact of sustainability initiatives. Therefore, integrating sustainable UX/UI principles into climate action platforms is essential for maximising their effectiveness.

## **2.3 Persuasive Design and Behaviour Change**

Persuasive design is a critical component of sustainable UX/UI, particularly in the context of climate action. Fogg's (2009) Behaviour Model provides a theoretical framework for understanding how digital systems can influence user behaviour. According to this model, behaviour is a function of motivation,



ability, and triggers. UX/UI design can enhance these factors by providing clear information, reducing barriers, and delivering timely prompts.

Gamification is a widely used persuasive design strategy in climate action platforms. By incorporating elements such as points, badges, and leaderboards, designers can motivate users to engage in sustainable behaviours. Studies have shown that gamification can increase user engagement and promote long-term behaviour change (Deterding et al., 2011).

Social influence is another important aspect of persuasive design. Features such as social sharing, peer comparison, and community challenges can encourage users to adopt sustainable practices by leveraging social norms and peer pressure (Cialdini, 2003). These strategies highlight the potential of UX/UI design to drive behavioural change at scale.

## **2.4 Systems Thinking and Holistic Design Approaches**

Systems thinking provides a holistic perspective on sustainable UX/UI design, emphasising the interconnectedness of technological, social, and environmental factors. Rather than focusing on isolated design elements, systems thinking considers the broader context in which digital products operate. This approach is particularly relevant for climate action platforms, which often involve complex interactions between users, data, and environmental systems.

Parsons (2025) argues that UX should be understood as a structural component of sustainability, influencing not only user

behaviour but also system-level outcomes. By adopting a systems thinking approach, designers can identify leverage points for intervention and develop more effective and sustainable solutions.

## **2.5 Challenges and Research Gaps**

Despite significant advancements, several challenges remain in the field of sustainable UX/UI design. One major issue is the lack of standardised guidelines and metrics for measuring sustainability. While tools exist for assessing performance and usability, there is limited consensus on how to evaluate the environmental impact of digital products.

Another challenge is the trade-off between aesthetics and efficiency. Designers often prioritise visually rich interfaces, which can increase data load and energy consumption. Balancing these competing priorities requires careful consideration and innovative design solutions.

Furthermore, there is a need for greater awareness and education among designers regarding sustainability issues. Many practitioners lack the knowledge and tools to implement sustainable design practices effectively.

The literature indicates that sustainable UX/UI design is a multifaceted field that integrates technical, behavioural, and systemic perspectives. While significant progress has been made, there is a need for more comprehensive frameworks that align design practices with climate action goals. This study contributes to this gap by providing qualitative insights from real-world case studies, offering a deeper

understanding of sustainable UX/UI design in practice.

### **3. Theoretical Framework**

The theoretical foundation of this study is grounded in an interdisciplinary integration of Sustainable Interaction Design (SID), Persuasive System Design (PSD), and Systems Thinking. These frameworks collectively provide a comprehensive lens for understanding how UX/UI design can contribute to environmental sustainability and climate action. By combining environmental, behavioural, and systemic perspectives, this study develops a holistic framework for analysing sustainable UX/UI practices in climate action platforms.

#### **3.1 Sustainable Interaction Design (SID)**

Sustainable Interaction Design (SID), first articulated by Blevis (2007), serves as a foundational framework for incorporating environmental considerations into digital design. SID emphasises the responsibility of designers to consider the ecological consequences of digital products throughout their lifecycle, including production, use, and disposal. It promotes principles such as resource conservation, energy efficiency, and long-term usability.

A central tenet of SID is the concept of “designing for sustainability as an ethical imperative.” This involves not only reducing the environmental footprint of digital systems but also encouraging users to adopt sustainable behaviours. For example, minimalist interfaces and optimised performance reduce energy consumption,

while design features such as feedback and nudges can influence user decision-making (Blevis, 2007).

SID also introduces the idea of “linking invention and disposal,” which highlights the lifecycle impact of digital products. In the context of climate action platforms, this principle underscores the importance of designing systems that are durable, adaptable, and resource-efficient. By extending the lifespan of digital products and minimising unnecessary updates, designers can reduce electronic waste and energy consumption (Hilty et al., 2011).

Furthermore, SID aligns closely with the concept of digital sustainability, which integrates environmental, social, and economic dimensions into digital innovation. This alignment makes SID particularly relevant for climate action platforms, where the goal is not only to inform users but also to promote sustainable practices.

#### **3.2 Persuasive System Design (PSD)**

While SID focuses on environmental impact, Persuasive System Design (PSD) provides a framework for understanding how UX/UI design can influence user behaviour. Developed by Oinas-Kukkonen and Harjumaa (2009), PSD outlines principles for designing systems that motivate and persuade users to adopt desired behaviours without coercion.

PSD is based on four key categories: primary task support, dialogue support, system credibility, and social support. Each of these categories offers design strategies that are highly relevant to climate action platforms.

- **Primary task support** involves simplifying user tasks and providing clear guidance, which enhances usability and reduces cognitive load.
- **Dialogue support** includes feedback, reminders, and rewards that reinforce user engagement.
- **System credibility** ensures that users trust the platform, which is critical for influencing behaviour.
- **Social support** leverages social influence through features such as peer comparison and community engagement.

Fogg's (2009) Behaviour Model complements PSD by emphasising the interaction between motivation, ability, and triggers. According to this model, behaviour occurs when users are sufficiently motivated, capable of performing the behaviour, and prompted by appropriate triggers. UX/UI design can enhance all three components by providing intuitive interfaces, reducing barriers, and delivering timely cues.

In climate action platforms, persuasive design strategies are often implemented through gamification, personalised feedback, and social interaction. For example, users may earn points for reducing their carbon footprint or participating in community challenges that encourage collective action. These strategies not only increase engagement but also foster long-term behavioural change (Deterding et al., 2011).

However, the use of persuasive design raises ethical considerations, particularly regarding user autonomy and transparency. Designers must ensure that persuasive techniques are

used responsibly and do not manipulate users in ways that undermine their agency (Berdichevsky & Neuenschwander, 1999).

### 3.3 Systems Thinking

Systems thinking provides a broader perspective by situating UX/UI design within a complex socio-technical system. It emphasises the interconnectedness of technological, social, and environmental factors, highlighting the need for holistic and integrative approaches to design (Meadows, 2008).

In the context of sustainable UX/UI design, systems thinking encourages designers to consider the entire ecosystem in which a digital product operates. This includes not only the interface and user experience but also the underlying infrastructure, user behaviours, and environmental impacts. For example, a climate action platform may influence individual behaviour, which in turn affects energy consumption and carbon emissions at a systemic level.

Parsons (2025) argues that UX should be viewed as a structural component of sustainability, capable of shaping long-term system outcomes. By adopting a systems thinking approach, designers can identify leverage points for intervention, such as reducing data intensity, promoting behavioural change, or optimising resource use.

Systems thinking also supports the integration of multiple stakeholders, including designers, developers, policymakers, and users. This collaborative approach is essential for addressing complex challenges such as climate change, which



require coordinated efforts across different domains.

### 3.4 Integrated Theoretical Model

This study integrates SID, PSD, and Systems Thinking into a unified framework for analysing sustainable UX/UI design in climate action platforms. The integrated model operates across three dimensions:

- **Environmental Dimension (SID):** Focuses on reducing the ecological footprint of digital systems through efficient design and resource management.
- **Behavioural Dimension (PSD):** Emphasises influencing user behaviour through persuasive design strategies.
- **Systemic Dimension (Systems Thinking):** Considers the broader socio-technical context and long-term impacts of design decisions.

By combining these dimensions, the framework provides a comprehensive approach to understanding how UX/UI design can contribute to climate action. It enables the analysis of both micro-level interactions (e.g., user interface elements) and macro-level outcomes (e.g., environmental impact), offering valuable insights for both research and practice.

## 4. Methodology

This study adopts a qualitative research design based on secondary data analysis to explore sustainable UX/UI design in climate action platforms. Qualitative research is particularly suitable for this study as it allows

for an in-depth examination of complex phenomena within their real-world contexts (Creswell & Poth, 2018). By focusing on case studies, the research captures the nuances of design practices and their implications for sustainability.

Secondary data analysis involves the use of existing data sources, such as academic literature, industry reports, and documented case studies. This approach is appropriate given the emerging nature of sustainable UX/UI design, where primary data may be limited or fragmented. It also enables the integration of diverse perspectives and insights from multiple sources.

### 4.1 Data Sources and Collection

Data for this study were collected from a range of secondary sources, including:

- Peer-reviewed journal articles
- Conference proceedings
- Industry case studies and reports
- UX design portfolios and online platforms
- Sustainability and climate action reports

The selection of sources was guided by relevance, credibility, and accessibility. Priority was given to peer-reviewed publications and well-documented case studies that provide detailed information on UX/UI design practices and sustainability outcomes.

The data collection process involved systematic searching and screening of sources using keywords such as “sustainable UX,” “climate action platforms,” “eco-design,” and “digital sustainability.”

Relevant documents were then reviewed and organised for analysis.

## 4.2 Case Study Selection

Case studies were selected based on the following criteria:

- **Relevance to Climate Action:** The platform must address environmental or sustainability issues.
- **Inclusion of UX/UI Design Elements:** The case must provide insights into design practices and user experience.
- **Availability of Detailed Documentation:** Sufficient information must be available for analysis.
- **Diversity of Contexts:** Cases should represent different sectors, such as public, private, and non-profit organisations.

Examples of selected cases include sustainable design initiatives by technology companies, government environmental platforms, and climate-focused mobile applications. This diversity enhances the generalizability and richness of the findings.

## 4.3 Data Analysis

The study employs thematic analysis to identify patterns and insights across the selected case studies. Thematic analysis is a widely used qualitative method that involves coding and categorising data to uncover recurring themes (Braun & Clarke, 2006).

The analysis process followed these steps:

- **Familiarisation:** Reviewing and summarising the collected data.

- **Coding:** Identifying relevant segments of data and assigning codes.
- **Theme Development:** Grouping codes into broader themes.
- **Interpretation:** Analysing themes in relation to the research questions and theoretical framework.

Key themes identified include sustainable design strategies, user engagement mechanisms, environmental impact, and challenges in implementation.

## 4.4 Validity and Reliability

Ensuring the credibility and reliability of qualitative research is essential. This study employs several strategies to enhance validity:

- **Triangulation:** Using multiple data sources to corroborate findings.
- **Transparency:** Clearly documenting the research process and criteria for case selection.
- **Theoretical Alignment:** Linking findings to established theories such as SID and PSD.

While secondary data analysis has limitations, such as potential bias in source material, careful selection and critical evaluation of sources help mitigate these issues.

## 4.5 Ethical Considerations

As this study relies on publicly available secondary data, ethical concerns are minimal. However, proper citation and acknowledgement of sources are maintained in accordance with academic standards. Additionally, the study critically evaluates the ethical implications of persuasive design,

particularly in relation to user autonomy and transparency (Mannan & Farhana, 2026).

## 4.6 Limitations of the Methodology

Despite its strengths, the methodology has certain limitations:

- **Dependence on Existing Data:** The study is limited by the availability and quality of secondary sources.
- **Lack of Primary User Data:** Direct user perspectives are not captured.
- **Contextual Variability:** Findings may vary across different platforms and contexts.

These limitations highlight the need for future research involving primary data collection and empirical validation.

## 5. Findings and Analysis

This section presents the findings derived from the qualitative thematic analysis of selected secondary case studies on climate action platforms. The analysis is structured around key themes identified during coding: integration of sustainability into UX/UI design, design strategies for environmental efficiency, user engagement and behavioural influence, systemic and infrastructural considerations, and challenges and trade-offs in sustainable UX/UI implementation.

### 5.1 Integration of Sustainability into UX/UI Design

The findings indicate that sustainability is increasingly being embedded into UX/UI design processes, though the depth and consistency of integration vary across platforms. In leading case studies,

sustainability is not treated as an afterthought but as a core design principle influencing decision-making from the early stages of product development.

For instance, corporate design frameworks such as those adopted by large technology organisations emphasise sustainability as part of design governance. These frameworks integrate environmental metrics into design evaluation, ensuring that UX/UI decisions contribute to reduced energy consumption and improved system efficiency. This aligns with the principles of Sustainable Interaction Design (SID), which advocate lifecycle thinking and resource optimisation (Blevis, 2007).

However, many platforms still demonstrate partial or superficial integration of sustainability. In such cases, sustainability is often limited to content (e.g., environmental messaging) rather than embodied in the design itself. This discrepancy highlights a critical gap between intention and implementation, suggesting that sustainable UX/UI design requires both conceptual commitment and technical execution.

Moreover, the analysis reveals that sustainability integration is often driven by organisational priorities and regulatory pressures. Public sector platforms, for example, are more likely to adopt sustainability practices due to policy mandates, whereas private sector initiatives may prioritise performance and user engagement unless sustainability is aligned with business objectives.

## 5.2 Design Strategies for Environmental Efficiency

A prominent theme across case studies is the use of specific design strategies aimed at reducing the environmental footprint of digital platforms. These strategies reflect the environmental dimension of the integrated theoretical framework.

Minimalist design emerges as a fundamental strategy for sustainable UX/UI. By reducing visual clutter, limiting media-heavy elements, and prioritising essential content, designers can significantly decrease data transfer and energy consumption. This approach not only enhances performance but also improves usability by reducing cognitive load (Sarapure & Kumar, 2024).

Case studies demonstrate that platforms employing minimalist design principles achieve faster load times and lower carbon emissions. For example, replacing high-resolution images with optimised graphics or using system fonts instead of custom web fonts reduces data requirements and processing power.

Performance optimisation is another critical strategy, encompassing techniques such as image compression, lazy loading, efficient coding, and server-side optimisation. These practices reduce the computational resources required to deliver digital content, thereby lowering energy consumption (Aslan et al., 2018).

The analysis shows that platforms prioritising performance optimisation not only achieve environmental benefits but also enhance user satisfaction. Faster load times and smoother interactions contribute to a positive user

experience, demonstrating the synergy between sustainability and usability.

Several case studies highlight the adoption of dark mode and energy-efficient colour schemes as a means of reducing energy consumption, particularly on OLED and AMOLED screens. Dark mode reduces screen brightness and power usage, contributing to energy savings at the device level.

While the environmental impact of dark mode may vary depending on device type and usage patterns, its inclusion reflects an increasing awareness of energy-efficient design practices among UX/UI designers.

Data visualisation plays a crucial role in climate action platforms by transforming complex environmental data into accessible and actionable insights. Interactive dashboards, charts, and visual indicators enable users to understand their carbon footprint and track progress over time (Mahyar et al., 2020).

The findings indicate that effective data visualisation enhances user engagement and supports informed decision-making. However, there is a trade-off between visual richness and performance efficiency, requiring careful design considerations to balance clarity and sustainability.

## 5.3 User Engagement and Behavioural Influence

A central finding of this study is the significant role of UX/UI design in influencing user behaviour. Climate action platforms leverage persuasive design techniques to encourage sustainable

practices, aligning with the principles of Persuasive System Design (PSD).

Gamification is widely used to enhance user engagement and motivation. Features such as points, badges, leaderboards, and challenges create a sense of achievement and competition, encouraging users to adopt sustainable behaviours (Deterding et al., 2011).

Case studies demonstrate that gamification can lead to increased user participation and sustained engagement. For example, platforms that reward users for reducing energy consumption or adopting eco-friendly habits report higher levels of user activity and retention.

Personalised feedback mechanisms provide users with tailored insights into their environmental impact and actionable recommendations for improvement. These features enhance user awareness and facilitate behaviour change by making sustainability relevant to individual contexts.

Nudging techniques, such as reminders and prompts, further reinforce desired behaviours by providing timely cues. According to Fogg's (2009) Behaviour Model, these triggers are essential for translating motivation into action.

Social features, including peer comparison, community challenges, and social sharing, leverage social norms to influence behaviour. Users are more likely to adopt sustainable practices when they perceive them as socially desirable or normative (Cialdini, 2003).

The analysis reveals that platforms incorporating social elements achieve higher

levels of engagement and behavioural change. Community-driven initiatives foster a sense of collective responsibility, amplifying the impact of individual actions.

### 5.4 Systemic and Infrastructural Considerations

Beyond interface design, the findings highlight the importance of systemic and infrastructural factors in sustainable UX/UI design. These factors include server efficiency, data centre energy sources, and network optimisation.

Case studies indicate that platforms powered by renewable energy or optimised server infrastructure achieve significantly lower carbon footprints. This underscores the importance of adopting a systems thinking approach, which considers the entire digital ecosystem rather than isolated design elements (Meadows, 2008).

Furthermore, the integration of sustainability metrics into design processes enables continuous monitoring and improvement. Tools that measure carbon emissions and energy consumption provide valuable insights for optimising design decisions.

### 5.5 Challenges and Trade-offs

Despite the potential benefits of sustainable UX/UI design, several challenges and trade-offs are identified.

One of the most significant challenges is the absence of standardised guidelines and metrics for sustainable UX/UI design. Designers often lack clear benchmarks for evaluating environmental impact, leading to inconsistent practices.



Designers frequently face trade-offs between visual richness and performance efficiency. While visually appealing interfaces may enhance user engagement, they often require more resources and energy.

Limited resources, competing priorities, and a lack of awareness can hinder the adoption of sustainable design practices. Organisations may prioritise short-term performance metrics over long-term sustainability goals.

The use of persuasive design raises ethical concerns regarding user autonomy and transparency. Designers must balance the goal of promoting sustainable behaviour with respect for user agency (Berdichevsky & Neuenschwander, 1999).

## **6. Discussion**

The findings of this study provide valuable insights into the role of sustainable UX/UI design in climate action platforms. This section interprets these findings in relation to the theoretical framework and existing literature, highlighting key implications and contributions.

### **6.1 Integrating Environmental, Behavioural, and Systemic Dimensions**

A key contribution of this study is the demonstration that sustainable UX/UI design operates at the intersection of environmental efficiency, behavioural influence, and systemic impact. The integration of Sustainable Interaction Design (SID), Persuasive System Design (PSD), and Systems Thinking provides a comprehensive

framework for understanding this multidimensional relationship.

The findings confirm that effective, sustainable UX/UI design requires alignment across these dimensions. For example, performance optimisation (environmental dimension) must be complemented by persuasive features (behavioural dimension) and supported by efficient infrastructure (systemic dimension). This holistic approach aligns with Parsons' (2025) argument that UX is a structural component of sustainability.

### **6.2 Redefining Usability in the Context of Sustainability**

Traditional definitions of usability focus on efficiency, effectiveness, and user satisfaction. However, this study suggests that usability must be redefined to include environmental considerations. Sustainable UX/UI design extends the concept of usability to encompass ecological impact, emphasising the importance of resource efficiency and long-term sustainability.

This redefinition challenges designers to consider not only how users interact with digital systems but also how these interactions affect the environment. It also highlights the need for new metrics and evaluation frameworks that incorporate sustainability.

### **6.3 Behavioural Design as a Catalyst for Climate Action**

The findings underscore the critical role of behavioural design in promoting climate action. Persuasive design techniques, such as gamification, nudging, and social influence,

are shown to be effective in encouraging sustainable behaviours.

However, the effectiveness of these techniques depends on their alignment with user motivations and contexts. Designers must carefully tailor interventions to ensure relevance and avoid user fatigue. Moreover, ethical considerations must be addressed to ensure that persuasive design respects user autonomy and transparency (Berdichevsky & Neuenschwander, 1999).

## 6.4 The Role of Data Visualisation and Information Design

Data visualisation emerges as a powerful tool for enhancing environmental awareness and decision-making. By presenting complex data in intuitive and engaging formats, designers can empower users to understand their impact and take action.

However, the discussion also highlights the need for balance between visual complexity and performance efficiency. Designers must optimise visualisations to ensure that they are both informative and sustainable.

## 6.5 Addressing Challenges and Advancing Practice

The challenges identified in the findings point to several areas for improvement in sustainable UX/UI design:

- **Standardisation:** Developing guidelines and metrics for sustainable design is essential for ensuring consistency and accountability.
- **Education and Awareness:** Training programs and resources can help

designers integrate sustainability into their practice.

- **Interdisciplinary Collaboration:** Collaboration between designers, developers, and sustainability experts can enhance the effectiveness of design solutions.

## 6.6 Implications for Policy and Industry

The study has important implications for policymakers and industry stakeholders. Governments and organisations can promote sustainable UX/UI design by establishing standards, providing incentives, and supporting research and innovation.

Industry leaders can also play a key role by integrating sustainability into design processes and prioritising long-term environmental goals. This aligns with global sustainability initiatives, such as the United Nations Sustainable Development Goals (United Nations, 2015).

## 6.7 Future Research Directions

Future research should focus on:

- Developing standardised sustainability metrics for UX/UI design
- Conducting empirical studies to validate findings
- Exploring the role of emerging technologies, such as AI, in sustainable design

## 7. Conclusion

This study has explored the critical role of sustainable UX/UI design in the development

and effectiveness of climate action platforms. By employing a qualitative research approach based on secondary case studies, the research provides a comprehensive understanding of how design practices influence both environmental sustainability and user behaviour. The integration of Sustainable Interaction Design (SID), Persuasive System Design (PSD), and Systems Thinking offers a robust theoretical foundation for analysing these relationships.

The findings demonstrate that sustainable UX/UI design is not merely a technical enhancement but a strategic and ethical imperative in the digital age. Design strategies such as minimalist interfaces, performance optimisation, and energy-efficient interactions contribute significantly to reducing the digital carbon footprint. At the same time, persuasive design elements—including gamification, personalised feedback, and social engagement—play a vital role in encouraging users to adopt environmentally responsible behaviours. This dual impact highlights the transformative potential of UX/UI design in advancing climate action.

However, the study also identifies several challenges that hinder the widespread adoption of sustainable design practices. The absence of standardised guidelines and metrics for evaluating sustainability remains a major barrier, leading to inconsistent implementation across platforms. Additionally, designers often face trade-offs between aesthetic appeal and environmental efficiency, requiring careful balancing of competing priorities. Organisational constraints, including limited awareness and

resource allocation, further complicate the integration of sustainability into design processes.

From a broader perspective, the study underscores the importance of adopting a systems thinking approach to UX/UI design. Sustainable outcomes cannot be achieved through isolated design decisions; rather, they require consideration of the entire digital ecosystem, including infrastructure, user behaviour, and environmental impact. This holistic perspective is essential for addressing the complex and interconnected challenges of climate change.

In conclusion, sustainable UX/UI design represents a powerful tool for both reducing the environmental impact of digital technologies and promoting climate-conscious behaviour. Future research should focus on developing standardised sustainability metrics, conducting empirical user studies, and exploring the potential of emerging technologies such as artificial intelligence in sustainable design. By aligning design practices with environmental goals, climate action platforms can play a pivotal role in fostering a more sustainable and resilient future.

## References

- Aslan, J., Mayers, K., Koomey, J. G., & France, C. (2018). Electricity intensity of internet data transmission: Untangling the estimates. *Journal of Industrial Ecology*, 22(4), 785–798.
- Belkhir, L., & Elmeligi, A. (2018). Assessing ICT global emissions footprint:

- Trends to 2040 & recommendations. *Journal of Cleaner Production*, 177, 448–463.
- Berdichevsky, D., & Neuenschwander, E. (1999). Toward an ethics of persuasive technology. *Communications of the ACM*, 42(5), 51–58.
- Blevis, E. (2007). Sustainable interaction design: Invention and disposal, renewal and reuse. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 503–512.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Cialdini, R. B. (2003). Crafting normative messages to protect the environment. *Current Directions in Psychological Science*, 12(4), 105–109.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. *Proceedings of the 15th International Academic MindTrek Conference*, 9–15.
- Fogg, B. J. (2009). A behaviour model for persuasive design. *Proceedings of the 4th International Conference on Persuasive Technology*.
- Hilty, L. M., Arnfalk, P., Erdmann, L., Goodman, J., Lehmann, M., & Wäger, P. A. (2011). The relevance of information and communication technologies for environmental sustainability. *Environmental Modelling & Software*, 25(12), 1618–1629.
- Mannan, K.A., & Farhana, K.M. (2026). *The Principles of Qur'anic Research Methodology: Deriving the Process of Knowledge from Revelation*. KMF Publishers. Open Access (CC BY 4.0). DOI: <https://doi.org/10.64907/xkmf.book.pqrm.26.02.12>
- Mahyar, N., et al. (2020). Visualisation for climate action. *IEEE Computer Graphics and Applications*, 40(5), 8–13.
- Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.
- Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive systems design: Key issues, process model, and system features. *Communications of the Association for Information Systems*, 24(1), 28.
- Parsons, P. (2025). Rethinking UX for sustainable systems. *arXiv preprint arXiv:2510.22053*.
- Sarapure, R. P., & Kumar, T. (2024). Designing sustainable UI/UX: Reducing the environmental impact of digital products. *International Journal of Design Principles*.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. United Nations.