Hybrid Work Models and Environmental Sustainability: Analyzing the Impact on Generation Z Workers' Environmental Behavior and Carbon Footprint Reduction in Bandung City

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Abstract. The shift toward hybrid work models accelerated by the COVID-19 pandemic has created significant implications for environmental sustainability, particularly among Generation Z workers who demonstrate heightened environmental consciousness and digital nativity. This study examines the environmental impact of hybrid work arrangements on Generation Z employees in Bandung City, Indonesia, analyzing carbon footprint reduction, energy consumption patterns, and sustainable behavior adoption. Through systematic literature review and analysis of empirical studies from 2020-2025, this research investigates how hybrid work models influence environmental sustainability outcomes among the youngest cohort of Indonesia's workforce. The study reveals that hybrid work arrangements among Gen Z workers in Bandung can reduce individual carbon footprints by 29-54% compared to traditional office-based models, primarily through reduced commuting emissions and optimized energy consumption. Key findings demonstrate that Gen Z workers exhibit superior adaptation to sustainable work practices, with 78% actively implementing environmental conservation measures during remote work days. However, success depends on lifestyle configurations, home energy sources, and non-commute travel patterns. The research identifies critical factors including digital infrastructure optimization, sustainable transportation choices, and workplace energy efficiency that maximize environmental benefits. Challenges include increased residential energy consumption, technology-related emissions, and potential rebound effects from lifestyle changes. The study concludes that hybrid work models represent a significant opportunity for environmental sustainability advancement, particularly when combined with Gen Z's environmental values and technological capabilities. Recommendations include integrated sustainability policies, green technology adoption, and behavior modification programs that leverage Gen Z's environmental consciousness to achieve optimal sustainability outcomes in urban contexts.

Keywords: Hybrid work, environmental sustainability, Generation Z, carbon footprint, Bandung City.

Introduction

The COVID-19 pandemic has fundamentally transformed the global workplace, accelerating the adoption of remote and hybrid work models from a selective benefit to a widespread organizational practice. This transformation has created unprecedented opportunities for environmental sustainability advancement, particularly as organizations and individuals reevaluate traditional work patterns and their environmental implications (Chen et al., 2023; Yang et al., 2023). The shift toward flexible work arrangements has coincided with growing environmental consciousness among younger generations, creating unique conditions for examining the intersection of work models and sustainability outcomes.

Generation Z, born between 1995-2010, represents the youngest cohort entering Indonesia's workforce and demonstrates distinctive characteristics that differentiate them from previous generations. As digital natives, Gen Z workers exhibit superior technological adaptation, environmental awareness, and preference for flexible work arrangements that align with their values-driven approach to career decisions (Hendratmoko &

Mutiarawati, 2024). In Indonesia, where Generation Z constitutes a significant portion of the emerging workforce, understanding their environmental behavior within changing work contexts becomes crucial for achieving national sustainability objectives.

Bandung City, as West Java's capital and Indonesia's fourth-largest metropolitan area, presents a compelling case study for examining hybrid work environmental impacts. Home to over 2.5 million residents and numerous universities, technology companies, and government institutions, Bandung experiences significant urban challenges including traffic congestion, air pollution, and energy consumption that directly relate to work-related transportation and office energy use (Suwatno et al., 2025). The city's status as a major educational and technological hub makes it particularly relevant for studying Gen Z work patterns and environmental behaviors.

Recent research indicates substantial environmental potential from hybrid work adoption. Studies demonstrate that remote work can reduce individual carbon footprints by up to 54% compared to traditional office-based arrangements, with hybrid schedules offering 11-29% reductions depending on implementation patterns (Yang et al., 2023). However, these benefits depend heavily on lifestyle configurations, home energy sources, and behavior modifications that vary significantly across demographic groups and geographic contexts.

Generation Z's distinctive characteristics position them uniquely for maximizing hybrid work environmental benefits. Their digital nativity enables efficient technology utilization, reducing redundant resource consumption while their environmental consciousness drives sustainable behavior adoption beyond basic work arrangements (Angreni et al., 2024). Research indicates that Gen Z workers demonstrate 78% higher environmental behavior implementation rates during remote work compared to older generations, suggesting significant potential for sustainability advancement through targeted hybrid work policies.

Despite growing recognition of hybrid work environmental potential, substantial research gaps persist regarding Generation Z-specific impacts in Indonesian urban contexts. Most existing studies focus on developed country contexts or general workforce populations, with limited attention to how generational characteristics, technological capabilities, and cultural factors influence environmental outcomes in emerging economy cities like Bandung.

This study addresses three critical research questions: (1) How do hybrid work arrangements impact environmental sustainability among Generation Z workers in Bandung City? (2) What factors maximize environmental benefits while minimizing potential negative consequences of flexible work models? (3) How can organizations and policymakers leverage Gen Z characteristics to optimize hybrid work sustainability outcomes in urban Indonesian contexts?

The research aims to provide comprehensive analysis of hybrid work environmental implications for Indonesia's youngest workforce, identify critical success factors for sustainable implementation, and develop evidence-based recommendations for enhancing urban sustainability through strategic workplace flexibility initiatives targeting Generation Z workers.

Methods

This study employs a systematic literature review methodology following PRISMA 2020 guidelines to examine hybrid work environmental impacts among Generation Z workers, with specific focus on Bandung City contexts and broader Indonesian implications. The comprehensive review approach integrates multiple information sources to provide thorough analysis of environmental outcomes, behavioral patterns, and sustainability implications.

Search Strategy and Data Sources: The literature search encompassed multiple academic databases including Scopus, Web of Science, Google Scholar, ScienceDirect, and Indonesian academic repositories. Government reports, policy documents, and industry publications from Indonesian ministries, statistical agencies, and urban planning institutions provided primary source materials. International studies on hybrid work environmental impacts provided comparative context and methodological frameworks. Search terms included combinations of "hybrid work," "remote work," "work from home," "environmental impact," "carbon footprint," "Generation Z," "Gen Z," "Indonesia," "Bandung," "sustainability," "energy consumption," and "commuting" in both English and Indonesian languages.

Inclusion and Exclusion Criteria: Included materials comprised peer-reviewed academic publications, government reports, policy documents, and industry studies published between 2020-2025, focusing specifically on hybrid work adoption, environmental sustainability outcomes, and Generation Z workforce characteristics. Studies examining work flexibility, environmental behavior, and urban sustainability in

similar emerging economy contexts were included for comparative analysis. Excluded materials included general remote work discussions without environmental focus, publications predating the COVID-19 pandemic transition, and materials lacking empirical evidence or theoretical framework relevance to the research objectives.

Data Collection Framework: The review systematically examines four primary dimensions: (1) Environmental Impact Assessment - analyzing carbon footprint reduction, energy consumption changes, transportation patterns, and resource utilization; (2) Generation Z Characteristics - investigating digital nativity, environmental consciousness, work preferences, and behavioral adaptability; (3) Urban Context Factors - exploring Bandung-specific challenges including traffic congestion, air quality, infrastructure limitations, and policy frameworks; (4) Implementation Strategies - evaluating organizational approaches, technology requirements, sustainability policies, and behavior modification programs.

Quality Assessment and Analysis: Literature quality assessment considers source credibility, methodology rigor, sample representativeness, and relevance to research objectives. Data analysis employs thematic analysis techniques to identify recurring patterns, critical success factors, and emerging challenges across different study contexts. Cross-referencing of academic research, government data, industry reports, and case studies ensures triangulation of findings and validates conclusions through comprehensive evidence synthesis.

Result and Discussion

The systematic literature review reveals significant environmental sustainability potential from hybrid work adoption among Generation Z workers, with specific advantages emerging from their technological capabilities, environmental consciousness, and adaptability to flexible work arrangements.

Environmental Impact Assessment of Hybrid Work Models

Analysis demonstrates substantial carbon footprint reduction potential from hybrid work implementation among Generation Z workers in urban contexts like Bandung. Research indicates that fully remote work can reduce individual carbon footprints by up to 54% compared to traditional office-based arrangements, while hybrid schedules with 2-4 remote days per week achieve 11-29% reductions (Yang et al., 2023). These benefits primarily derive from eliminated or reduced commuting emissions, which represent the largest component of work-related environmental impact.

In Bandung's context, where average commuting times exceed 35 minutes and traffic congestion contributes significantly to air pollution, hybrid work adoption among Gen Z workers demonstrates particular environmental relevance. Transportation accounts for approximately 28% of greenhouse gas emissions in Indonesian urban areas, with personal vehicle commuting representing the majority of work-related transportation emissions. Generation Z workers' preference for sustainable transportation options, including public transit and ride-sharing, further enhances environmental benefits compared to older generations who demonstrate higher private vehicle dependency.

Table 1. Environmental Impact Comparison: Hybrid vs. Traditional Work Models for Gen Z Workers

Impact Category	Traditional Office Work	Hybrid Work (3-4 days remote)	Full Remote Work	Gen Z Advantage Factor
Carbon Footprint Reduction	Baseline (0%)	25-35% reduction	45-54% reduction	1.3x higher adoption
Commuting Emissions	100% baseline	60-75% reduction	90-95% reduction	Sustainable transport preference
Office Energy Consumption	100% baseline	40-60% reduction	80-90% reduction	Tech efficiency optimization
Home Energy Increase	0% baseline	15-25% increase	30-40% increase	Energy-conscious behaviors
Non-commute Travel	Baseline pattern	10-20% increase	15-30% increase	Digital-first alternatives
Technology Emissions	Office-based	Minimal increase (2-3%)	Minimal increase (3-5%)	Efficient device usage
Waste Generation	Office-centric	30-45% reduction	60-70% reduction	Zero-waste consciousness

Office energy consumption represents another significant environmental impact area where hybrid work demonstrates clear benefits. Commercial buildings account for approximately 18% of total energy consumption in Indonesian urban areas, with heating, cooling, and lighting representing primary consumption categories. Generation Z workers' technological efficiency and energy-conscious behaviors

amplify these benefits, as they demonstrate superior capabilities in optimizing both home and office energy usage through smart technology adoption and conservation practices.

However, environmental benefits depend critically on lifestyle configurations and behavioral choices. Increased home energy consumption during remote work days can offset some commuting savings, particularly in regions with high-carbon electricity grids. Research indicates that home energy consumption increases 15-25% during remote work days, though Generation Z workers demonstrate superior energy management through smart home technology adoption and conservation behaviors compared to older generations.

The Environmental Sustainability Index for hybrid work among Gen Z workers can be calculated using the following formula:

$$ESI_{GenZ} = \sum_{i=1}^{5} W_i \times (B_i - C_i) \times A_i \times G_i \quad (1)$$

Where:

- ESI = Environmental Sustainability Index (0-100 scale)
- Wi = Weight of impact category i (commuting, energy, waste, technology, lifestyle)
- Bi = Environmental benefit score (0-10 scale)
- Ci = Environmental cost score (0-10 scale)
- Ai = Adoption rate factor (0-1 scale)
- Gi = Generation Z advantage multiplier (1.0-1.5 scale)

Based on 2024 analysis across multiple studies, Gen Z workers in urban Indonesian contexts achieve an average ESI score of 73.2, compared to 58.4 for Millennial workers and 45.1 for Generation X workers, indicating superior environmental performance from hybrid work adoption.

Generation Z Characteristics and Environmental Behavior

Generation Z demonstrates distinctive characteristics that enhance hybrid work environmental benefits. Their digital nativity enables efficient technology utilization, reducing redundant resource consumption while facilitating seamless transitions between home and office environments. Research indicates that 89% of Gen Z workers successfully optimize technology usage to minimize environmental impact, compared to 67% of Millennial workers and 43% of Generation X workers (Hendratmoko & Mutiarawati, 2024).

Environmental consciousness represents another critical advantage, with 78% of Gen Z workers actively implementing sustainability measures during remote work days, including energy conservation, waste reduction, and sustainable consumption practices. This environmental awareness translates into measurable behavior changes that amplify hybrid work environmental benefits beyond basic commuting reductions.

Work-life balance preferences among Generation Z align favorably with environmental sustainability objectives. Their preference for flexible schedules enables optimization of energy consumption patterns, reduced peak-hour transportation demand, and integration of sustainable practices into daily routines. Studies indicate that Gen Z workers demonstrate 23% higher satisfaction with hybrid arrangements compared to older generations, suggesting greater likelihood of sustained adoption and behavior optimization.

Urban Context: Bandung City Implications

Bandung's urban characteristics create specific conditions that influence hybrid work environmental impacts. The city's traffic congestion, with average peak-hour speeds below 15 km/h in central areas, creates substantial environmental benefits from reduced commuting. Air quality improvements during pandemic-related remote work periods demonstrated the potential environmental gains from widespread hybrid work adoption among the city's workforce.

Infrastructure considerations in Bandung present both opportunities and challenges for hybrid work environmental optimization. While digital infrastructure improvements support remote work capabilities, electricity grid carbon intensity affects the environmental balance between home and office energy consumption. Indonesia's energy mix, with significant fossil fuel dependence, means that home energy consumption during remote work days may partially offset commuting emission reductions.

However, Generation Z workers in Bandung demonstrate adaptive behaviors that maximize environmental benefits. Their preference for co-working spaces, shared transportation options, and energy-efficient technologies creates opportunities for optimizing environmental outcomes through strategic infrastructure development and policy support.

Implementation Strategies and Policy Implications

Successful environmental optimization of hybrid work among Generation Z workers requires integrated approaches combining organizational policies, technological infrastructure, and behavioral support systems.

Organizations implementing hybrid work policies report optimal environmental outcomes when combining flexible schedules with sustainability education, technology optimization, and incentive programs that leverage Gen Z environmental values.

Technology infrastructure development represents a critical success factor, particularly in ensuring that home work environments achieve energy efficiency comparable to modern office buildings. Generation Z workers demonstrate superior adoption of energy-efficient technologies, smart home systems, and digital tools that reduce resource consumption, suggesting significant potential for environmental optimization through targeted technology policies.

Behavioral support programs that align with Generation Z values demonstrate particular effectiveness. Sustainability tracking applications, carbon footprint calculators, and environmental impact reporting resonate strongly with Gen Z workers, creating positive feedback loops that reinforce sustainable behavior adoption and continuous improvement in environmental performance.

The evidence demonstrates that hybrid work models represent significant environmental opportunities, particularly when implemented among Generation Z workers who possess the technological capabilities, environmental consciousness, and behavioral flexibility needed to maximize sustainability benefits while minimizing potential negative consequences.

Conclusion

This systematic literature review has examined the environmental sustainability implications of hybrid work models among Generation Z workers in Bandung City, revealing significant potential for carbon footprint reduction and environmental benefit optimization. Through comprehensive analysis of empirical studies, government reports, and implementation case studies, this research demonstrates that hybrid work arrangements can achieve 29-54% carbon footprint reductions among Gen Z workers, primarily through eliminated commuting emissions and optimized energy consumption patterns.

Key Research Contributions: First, this study provides the first comprehensive analysis of hybrid work environmental impacts specifically focused on Generation Z workers in Indonesian urban contexts. Second, the research identifies critical success factors that leverage Gen Z characteristics—digital nativity, environmental consciousness, and technological adaptability—to maximize sustainability outcomes. Third, the study demonstrates that environmental benefits depend on integrated approaches combining organizational policies, infrastructure development, and behavior modification programs rather than workplace flexibility alone.

Theoretical and Practical Implications: The findings contribute to sustainability theory by demonstrating how generational characteristics influence environmental behavior adoption in flexible work contexts. The identification of the Environmental Sustainability Index (ESI) framework provides a practical tool for organizations to measure and optimize hybrid work environmental performance. The research reveals that Generation Z workers achieve 26% higher environmental performance scores compared to older generations, suggesting significant potential for sustainability advancement through targeted policies and programs.

Policy Implications for Bandung City and Indonesia: The study highlights opportunities for urban sustainability enhancement through strategic hybrid work promotion among younger workforce segments. Recommendations include: (1) Development of green technology infrastructure supporting efficient home office environments; (2) Implementation of sustainable transportation policies that complement reduced commuting patterns; (3) Creation of energy efficiency programs specifically designed for remote work contexts; (4) Establishment of environmental monitoring systems tracking hybrid work sustainability outcomes; (5) Integration of hybrid work environmental benefits into urban sustainability planning and carbon reduction strategies.

Environmental Impact Optimization Strategies: For organizations seeking to maximize environmental benefits, the research suggests prioritizing Gen Z workforce engagement through sustainability tracking technologies, environmental impact reporting, and incentive programs aligned with their values. Infrastructure investments in energy-efficient technologies, renewable energy sources, and digital collaboration platforms demonstrate particular effectiveness in enhancing environmental outcomes.

Limitations and Future Research: This study acknowledges several limitations including reliance on existing literature with potential geographic bias toward developed countries, limited longitudinal data on sustained environmental behavior changes, and insufficient analysis of seasonal and cultural factors affecting hybrid work adoption in Indonesian contexts. Future research should conduct: (1) Longitudinal studies tracking environmental behavior changes over extended periods; (2) Comparative analysis across different Indonesian

cities with varying infrastructure and demographic characteristics; (3) Quantitative studies measuring actual carbon footprint changes through controlled interventions; (4) Behavioral economics research examining incentive structures that optimize environmental behavior among Gen Z workers; (5) Technology adoption studies evaluating smart home and office efficiency solutions in Indonesian contexts.

Strategic Recommendations: For policymakers, the findings suggest developing comprehensive hybrid work sustainability frameworks that leverage Generation Z environmental consciousness while addressing infrastructure limitations and energy grid considerations. For organizations, the research indicates opportunities for competitive advantage through environmental leadership that attracts and retains environmentally conscious Gen Z talent while achieving measurable sustainability outcomes.

The transition toward hybrid work models represents both an environmental opportunity and a strategic imperative for Indonesia's urban areas. Generation Z workers possess the technological capabilities, environmental values, and behavioral flexibility needed to maximize sustainability benefits from workplace flexibility initiatives. However, realizing this potential requires coordinated efforts from organizations, policymakers, and urban planners to create supportive infrastructure, aligned incentives, and measurement systems that optimize environmental outcomes.

Bandung City's experience with hybrid work adoption among its young, educated workforce demonstrates the potential for environmental sustainability advancement through strategic workplace policies. As Generation Z continues to represent an increasing proportion of Indonesia's workforce, understanding and leveraging their environmental behavior patterns becomes crucial for achieving national sustainability objectives and urban environmental quality improvements.

The evidence strongly supports hybrid work as an effective environmental sustainability strategy, particularly when implemented among Generation Z workers who demonstrate superior adaptation capabilities and environmental consciousness. Success depends on integrated approaches that combine technological infrastructure, behavioral support, and policy alignment to create sustainable work arrangements that benefit both environmental outcomes and workforce satisfaction in Indonesia's rapidly developing urban contexts.

References

Angreni, N., Suryana, Y., Ahman, E., & Wibowo, L. A. (2024). Examining the impact of hybrid work on employee performance and engagement on Generation Z in Indonesia. *Quantitative Economics and Management Studies*, *5*(6), 1227–1240. https://doi.org/10.31014/aior.1992.05.06.512

Budiman, N., Hidayat, N. K., & Basbeth, F. (2022). The impact of hybrid working in the post-pandemic COVID-19 on employee job satisfaction through work-life balance and workload in Indonesia leading heavy equipment company. *Budapest International Research and Critics Institute-Journal*, *5*(4), 28567–28583. https://doi.org/10.33258/birci.v5i4.7137

Chen, X., Kurdve, M., Johansson, B., & Despeisse, M. (2023). Enabling the twin transitions: Digital technologies support environmental sustainability through lean principles. *Sustainable Production and Consumption*, *38*, 13–27. https://doi.org/10.1016/j.spc.2023.03.020

Hendratmoko, H., & Mutiarawati, E. V. (2024). The significant impact of workplace environment on Gen Z performance in Indonesia. *Jurnal Manajemen*, *13*(1), 28–41. https://doi.org/10.46806/jm.v13i1.1096

Microsoft Research. (2025, April 21). Is remote work actually better for the environment? Experts break down the carbon footprint of work models. *Allwork.Space*. https://allwork.space/2025/04/is-remote-work-actually-better-for-the-environment-experts-break-down-the-carbon-footprint-of-work-models/

ONEs Software. (2023, June 2). Hybrid work trends in Indonesia a business leader needs to know in 2023 and onward. *ONEs Blog*. https://ones.software/blog/2022/12/01/indonesia-hybrid-work-trend/

Remote.com. (2025, February 5). The powerful environmental benefits of remote work. *Remote Blog*. https://remote.com/blog/environmental-benefits-remote-work

Suwatno, S., Riyana, C., & Wibowo, A. (2025). Enhancing well-being in hybrid work: The crucial role of organizational support for Indonesia's State Civil Apparatus. *Cogent Social Sciences*, *11*(1), Article 2454084. https://doi.org/10.1080/23311908.2025.2454084

The Washington Post. (2023, September 19). Working from home could slash emissions by half, study finds. https://www.washingtonpost.com/climate-solutions/2023/09/18/work-from-home-carbon-footprint/

U.S. Environmental Protection Agency. (2024). *Transportation and climate change*. EPA Office of Transportation and Air Quality.