CONSTRUCTING THE SUSTAINABLE WORKPLACE INTERIOR THROUGH MATERIAL PRACTICES

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Published: 2025-04-30
Submitted: 2024-09-20
Accepted: 2025-04-14

ARSNET, 2025, Vol. 5, No. 1, 54–67
DOI: 10.7454/arsnet/v5i1.115
ISSN 2777-0710 (online)
ISSN 2777-0702 (print)

Abstract

This study discusses the design development of a sustainable workplace interior, using PITA office—a furniture company in Indonesia—as the context of study. The design aims to create a sustainable office environment that reflects the company's commitment to sustainability, particularly in relation to various interior material practices. This study applies Nirmal Kishnani's six principles of sustainable design within the Asian context to the interior design of the PITA office, encompassing the principles of efficacy, ecology, wellness, embeddedness, advocacy, and integration. A qualitative approach was implemented through observation, documentation, and interviews to analyse the context based on the six sustainable design principles and inform further design propositions. The study explores how such sustainable principles can be translated materially to provide office interior design that is responsible for users and the environment. It identifies the material criteria relevant for designing a sustainable workplace interior, which supports energy efficiency, reduces environmental impact, creates a connection with locality, and provides well-being for its users. Such material practice criteria contribute to the way sustainable interiors can be achieved holistically as part of an environmentally responsible design approach.

Keywords: sustainable interior, workplace, material practice, responsible design

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Introduction

The study explores the material principles and practices that become relevant in designing a sustainable workplace interior. With devastating impacts of climate change that are already apparent and will continue to affect our planet for generations, the buildings and infrastructure in our cities offer a unique opportunity to be part of the solution (Goodbun & Jaschke, 2012). The study notes that with a high level of urbanisation, interior design projects become more plausible in initiating positive change in this area. Interior designers are in a good position to bring change with a sustainable design approach, especially given their emphasis on renovation projects (Moxon, 2012).

Fundamentally, designers should aim to produce environmentally responsible designs. Implementing environmentally responsible design must improve people's quality of life (Fernando et al., 2022). Thus, this article attempts to discuss the potential for applying sustainable design principles in interior design practice, focusing on the PITA office interiors as a case study as part of their commitment to creating a sustainable work environment that aligns with their sustainability goals. The study starts by reviewing the literature on sustainable interior and work environment.

Sustainable interior as a material-driven practice

Sustainable interior explores how all aspects of designing an interior, including planning, execution, and implementation, reflect long-term economic, social, and environmental goals in mind (Celadyn, 2019; Kang & Guerin, 2009; Mihyun Kang & Guerin, 2009; Walker, 2006; Wilkinson et al., 2014). This study focuses on creating an environmentally friendly work environment to enhance comfort, create a more productive atmosphere, and offer greater control over operating costs. Such offices can also encourage employee participation in energy and water conservation, as well as waste management initiatives (Wardhani et al., 2020).

Sustainable interior is part of environmentally responsible design, which is a holistic approach to creating physical objects and the built environment that prioritises long-term sustainability (Birkeland, 2002). It goes beyond mere aesthetics and functionality to consider broader economic, social, and environmental implications of design decisions. Creation of the built environment involves resource issues, potential environmental degradation, human health issues, building economics, and community development (Kang & Guerin, 2009; Wilkinson et al., 2014).

Whilst sustainable design influences all design stages, from the initial planning and conceptualisation to the execution of the final product or project (Binggeli, 2013), this study focuses on material practice as the basis of a sustainable interior. Material practice reflects consideration on how material is sourced, used, and implemented in creating spaces and objects that not only meet immediate needs but also contribute to a more sustainable future. This involves making conscious choices about resource

consumption, energy use, waste management, and social impact (De Caro, 2022). The use of materials in sustainable interior should have the least possible negative environmental effects (Binggeli, 2013; Wardhani et al., 2020; Wijaya & Margaretha, 2021). This involves selecting materials based on the 3R principles: Reduce, Reuse, and Recycle, to minimise waste without sacrificing function (Lubonja & Dervishi, 2019; McDonough & Braungart, 2002; Mrinalini et al., 2023).

Opting for modular or customisable materials can further minimise waste and environmental impact. By carefully considering material criteria and their application in the sustainable interior, we can significantly reduce the amount of waste generated and prevent harm to the environment (Birkeland, 2002; Lubonja & Dervishi, 2019; McDonough & Braungart, 2002; Mrinalini et al., 2023; Walker, 2006). This approach aligns with the core principles of ecology, promoting a harmonious relationship between human activities and the natural world.

Material selection in sustainable interior design plays a vital role as a connection between ecological, economic, and social systems (Kang & Guerin, 2009; Wilkinson et al., 2014). Every decision from the practice of selecting materials, starting from paying attention to specifications of the materials, to the installation process, will be fundamental to responsible design (Birkeland, 2002; Jones, 2008). While inappropriate material choices can lead to environmental degradation, pollution, and increased carbon emissions, sustainable alternatives support regenerative systems (Robertson, 2017). For example, selecting reclaimed wood, recycled metals, or natural materials can reduce waste.

To achieve sustainability in interiors, interior material selection practices must align with economic viability, ecological stewardship, and social equity (Kang & Guerin, 2009; Robertson, 2017; Wilkinson et al., 2014). This means moving from conventional, resource-intensive materials to modular, adaptable, non-toxic solutions that extend product life cycles (Lubonja & Dervishi, 2019; Mrinalini et al., 2023). By adopting a systemic approach to materiality, one considers embodied carbon, supply chain ethics, and end-of-life recycling, designers can significantly reduce the environmental footprint of the built environment while improving the well-being of its occupants.

Sustainable workplace interior

A workplace is a vital hub fostering collaboration, communication, and a sense of community (Simahendali et al., 2023). It is a space where individuals gather to work independently or in teams, build relationships, and develop shared cultural norms (McLaurin, 2022). The design of a workplace should be meticulously tailored to meet the unique requirements of the specific job functions and the individuals who will be working in that space. This involves carefully considering factors such as the nature of the work, the required equipment, and the preferences of the employees (Harter et al., 2003; McLaurin, 2022).

A focus on the work environment is important as it significantly influences employee productivity, shaping how effectively employees can perform their tasks. A well-designed workplace can optimise productivity by providing employees with the necessary tools, fostering a supportive environment, and promoting a sense of well-being (El-Zeiny, 2012; Harter et al., 2003; McLaurin, 2022; Wardhani et al., 2020). It plays a crucial role in shaping employee health and performance (El-Zeiny, 2012).

Positive social relations with other people influence the mental health of employees (Harter et al., 2003). To foster a positive and productive work environment, a workspace design should prioritise employee well-being and collaboration. By aligning the design with the company's work culture, we can create a space that encourages positive interactions and enhances employee engagement. Ultimately, a workplace design that supports the company's work culture is expected to have a positive impact on employee performance. When employees feel valued, connected, and inspired by their surroundings, they are more likely to be motivated, engaged, and productive (Simahendali et al., 2023).

To achieve a sustainable workplace interior, this study employs the six sustainable design principles that can be applied when designing an interior building according to Kishnani (2012). The first principle of six sustainable design principles is efficacy, an act of integration and managing tradeoffs and synergies within a whole, seeking long-term effectiveness (Kishnani, 2012). The second principle is ecology, which is about how the design can have a positive influence on the balance of the ecosystem, respecting and repairing networks of living communities (Kishnani, 2012). The third principle focuses on wellness, which is how design can provide welfare to its users through providing environmental stimuli that influence the individual and bring a connection with the outdoors, community, and nature (Kishnani, 2012).

The fourth principle focuses on embeddedness, optimising local resources as a form of attachment to culture and context development, encouraging local reliance and self-sufficiency (Kishnani, 2012). The fifth principle highlights the need for advocacy, which is the community's involvement and contribution in the development process to improve the regional economy (Kishnani, 2012). Advocacy by the community responds to existing challenges and offers effective solutions (Kishnani, 2012; Pursal, 2010). The sixth principle focuses on integration as the designer should be able to understand existing problems, provide solutions, and align all processes towards optimal performance.

The strategy of the interior of the workspace to achieve the six principles of sustainability is best realised through the use of materials. In achieving efficacy, it is necessary to ensure that the materials used are durable and have good performance, minimise waste, and maximise function (Binggeli, 2013; Kishnani, 2012; McDonough & Braungart, 2002). By prioritising the selection of environmentally friendly materials, the ecological principle will be strengthened (Binggeli, 2013; DeMouthe, 2006; Kishnani, 2012). Based on the sustainable principles, embeddedness is

realised through the application of flexible solutions that are mutually integrated (DeMouthe, 2006; Kishnani, 2012), while advocacy is reflected in the use of local materials that empower communities (Kishnani, 2012). Wellness is prioritised by selecting materials that support user comfort and fitness (Binggeli, 2013; Kishnani, 2012). On the other hand, the integration principle is actualised with modular systems such as flexible partitions, lightweight materials, and adaptive furniture that allow for dynamic space transformation (Atmodiwirjo & Yatmo, 2019; Binggeli, 2013; Kishnani, 2012). Aligning the material practices in designing sustainable interior allow development of workspace that is not only sustainable but also meaningful, adaptive, and humanises its users.

Method

This research uses a qualitative approach of case study, conducted through observation, documentation in the field, and interviews (Creswell, 2007; Creswell & Creswell, 2018). Observations and documentation of the PITA office provide assessments of its current situation (Figure 1). Interviews with office workers based on the six principles of sustainable design are used to collect data that can be used to develop an interior design context that aligns with PITA's primary goal of creating sustainable workspaces. These principles become the basis of a guiding framework for the design process, ensuring that every decision is aligned with sustainability goals. The study then focuses on how the use of materials in the design influences each principle, creating an office environment that not only meets functional requirements but also contributes to a more sustainable future.

Figure 1. PITA office existing condition (Photographs by authors)

Discussion

This discussion aims to understand how the sustainable interior of PITA office employs material in its design practice, meeting the principles of sustainable design, from efficacy, ecology, wellness, embeddedness, advocacy, and integration. The application of efficacy for long-term effectiveness can be observed in the strategic division of office design zones. The efficacy of office space design may begin with careful consideration of its layout and the optimal placement of different zones. The design study started by considering the division of work zones in the office to save energy related to sunlight and reduce the use of artificial lighting, effectively and efficiently. Some work areas that are used for activities that

need daylight are integrated. Observation of the PITA existing area shows that the surrounding façade uses glass windows that maximise sunlight entering the space. A double-glazing system has facilitated the building envelope, reducing the heat entering the room.

Figure 2. The zones division promoted by PITA: the display, focus, socialisation, collaboration, and service zones (Images by authors)

By strategically positioning all areas (Figure 2), where employees typically engage in intensive tasks, in the area that receives the most sunlight, we can maximise the utilisation of natural light (Stamets, 2004). Similarly, placing the showroom or display area, where showcasing products or presentations is common, in the area that receives the most afternoon sunlight ensures that both areas benefit from natural light throughout the day. This approach helps to reduce reliance on artificial lighting, leading to significant energy savings. Natural light is widely believed to enhance work productivity and create a more pleasant working environment (Moxon, 2012).

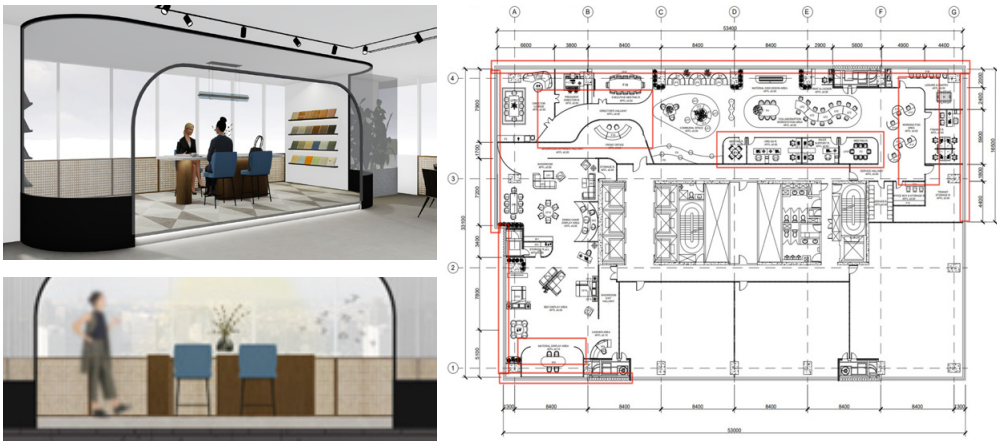


Figure 3. Glass partitions for interior spaces (Images by authors)

The choice of materials also plays a crucial role in optimising natural lighting further. The use of glass as room partitions for areas positioned in the periphery of the building façade (Figure 3) is a deliberate effort to maximise natural light transmission into the office space. The translucent nature of glass allows sunlight to penetrate the interior, creating a brighter and more inviting atmosphere (Binggeli, 2013). This improves employee morale and contributes to energy efficiency by reducing the need for artificial lighting.

The study further considers how selection and utilisation of materials can have a positive influence on the balance of the

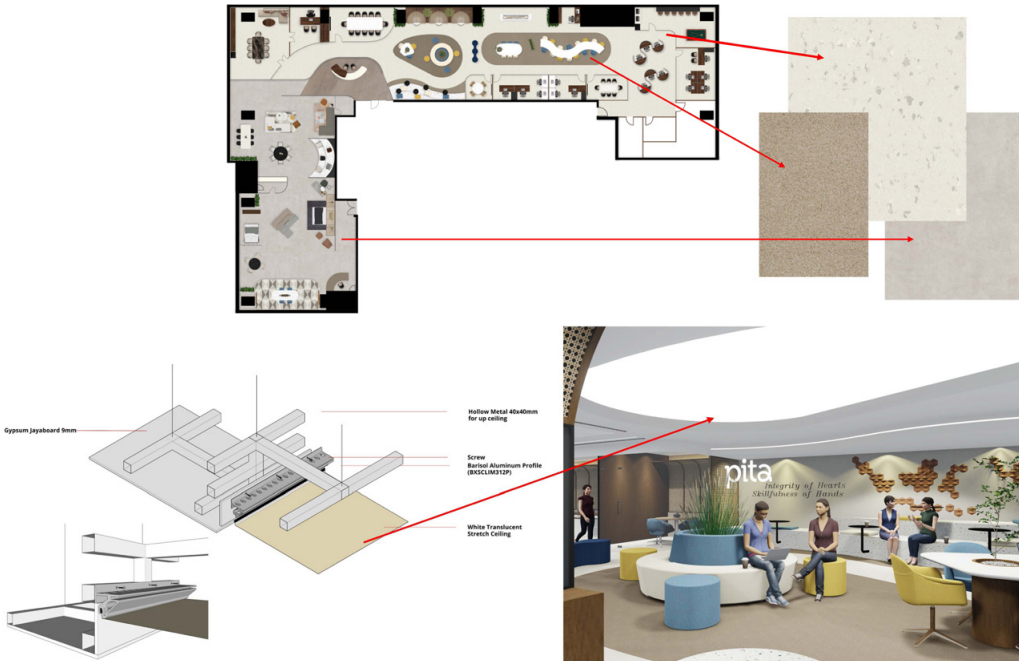


Figure 4. Floor area and floor material (top); ceiling area and ceiling material (bottom) (Images by authors)

ecosystem, respecting and repairing networks within the system (Kishnani, 2012). In particular, this study explores the use of recyclable or recycled materials in interior design. For example, the floor material uses PVC vinyl sheet (Figure 4, top) produced by the company that has sustainable means of production and routinely recycles their waste generated during the production. The vinyl sheet also allows reuse for future projects or being recycled if they are no longer suitable for use.

On the other hand, the ceiling material uses a stretch membrane, which is 100% recyclable and very light. This can reduce installation costs, and no material is wasted during the installation process because the material is measured according to its area (Figure 4, bottom). In addition, the stretch membrane is highly durable, which can be used for 60 years or more with minimal and easy maintenance.

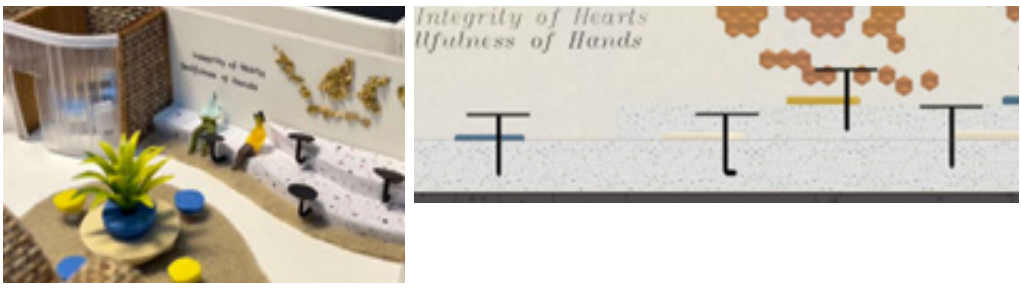
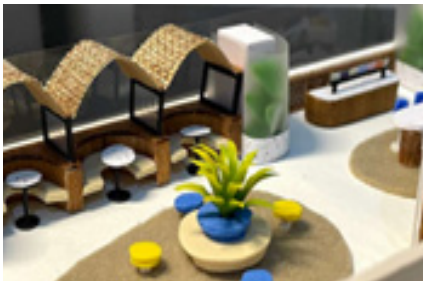


Figure 5. The application of rattan in vertical elements as a partition and artwork (Images by authors)

In the vertical components of the design, such as walls, partitions, and built-in furniture, the study applies glass, wood veneer, and rattan materials that are locally produced and can be recycled. Glass, which is transparent and reflective, allows natural light still enter the office space. Glass itself is a material that is easy to clean and can be recycled; wood veneer is used to reduce the use of solid wood. Wood veneer is a surface coating for the material that still shows the original wood texture;

Meanwhile, rattan enriches the room with texture (Binggeli, 2013; DeMouthe, 2006). With their respective advantages, glass offers transparency, light, and ease of maintenance; wood veneer provides another alternative to reduce the use of raw materials; while rattan adds a sustainable natural element. Materials for custom furniture in the form of terraced seats (Figure 7, top), display cabinets (Figure 7, middle), and top tables (Figure 7, bottom) use terrazzo mortar as a material that can be printed into shape. Terrazzo is also considered environmentally friendly because it is made from recycled materials.



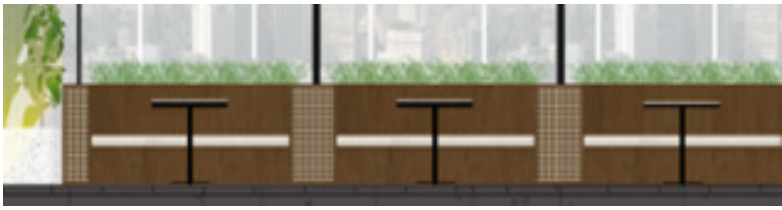


Figure 6. The application of rattan in furniture (Images by authors)

As part of the wellness and integration principles, the study further considers how the materiality of the interior can provide welfare to its users by understanding user needs and offering solutions from the best alternatives for essential needs. In PITA, the relationship between employees is considered important; therefore, collaboration is encouraged. One effective strategy is to design collaboration areas with minimal partitions, as illustrated in Figure 8. These open and accessible spaces promote casual encounters and facilitate teamwork. Additionally, the overall room layout should be designed to encourage interaction between different areas within the office. By creating a sense of interconnectedness, we can foster a more collaborative and dynamic work environment.

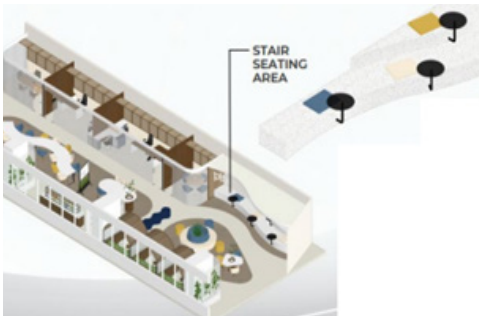


Figure 7. The application of terrazzo materials for seating (left), display cabinet (middle), and table (right) (Images by authors)

The workstation design also incorporates a modular system that allows desks to be adjusted to accommodate various work activities depending on changing needs. This departure from the traditional assigned-seat system fosters collaboration, reduces feelings of isolation among workers, and encourages their sense of advocacy, an important principle of sustainable design. By implementing a flexible seating arrangement, the office ensures that desks are not underutilised when employees are absent or working remotely. This practical approach maximises the

Figure 8. Collaboration and communal area with minimal partitions (Images by authors)

efficiency of the workspace and promotes a more collaborative and adaptable work environment.

An essential aspect in the collaboration areas can be seen in the utilisation of indoor plants (Figure 9). Indoor plants bring material qualities that positively affect employees, such as improving air quality, reducing noise annoyance, increasing humidity, and creating a more visually appealing environment (de Vries et al., 2023). Bringing plants indoors improves the well-being of users by providing connectivity with nature. Plant selection is based on plant types that can survive indoors and have a good capacity to absorb CO_2, such as the *Spathiphyllum* (lily) and *Dracaena marginata plants* in communal areas and the *Nephrolepis exaltata* (fern) in collaboration areas.

Figure 9. Indoor plants in the collaboration and communal area (Images by authors)

The following principle is embeddedness, or the optimisation of the use of local resources, as a way to connect with the culture and contribute to the area's development. To achieve a sense of embeddedness, we must prioritise optimising local resources. In this particular design project, woven rattan, a

traditional and cherished material in the region, was selected as the preferred resource. Traditionally, rattan symbolises the value of togetherness and cooperation, as the more strands of rattan are woven together, the stronger and more aesthetically pleasing the final product becomes (Anshory & Sanjatmiko, 2023; Lola Lighting, 2023).

The design project uses synthetic rattan to align itself with sustainable principles. Synthetic rattan is made from HDPE (High-Density Polyethylene), a material that is 100% recyclable and known for its exceptional durability. With an estimated lifespan of up to 20 years, synthetic rattan offers a long-lasting and sustainable alternative to natural materials. Synthetic rattan is also highly customisable, allowing for the creation of unique and adaptable rattan modules that seamlessly integrate into the PITA office interior design, as illustrated in Figure 10. The chosen motif, the webbing motif, often referred to as the *Tanjung Flower* motif, is a nod to the local culture and environment. The *Tanjung Flower* is a type of cherry tree flower commonly found in Indonesia, which represents a connection to the region's natural beauty and heritage.

The application of the advocacy principle here is realised through selecting materials that communicate with the user. This principle invites user feedback on the material's performance during the design's use phase (Kishnani, 2012). This principle is related to material integration. It assesses whether the selected sustainable materials can be in harmony with user behaviour and functional requirements in the interior (Celadyn, 2019; Lubonja & Dervishi, 2019; Mihyun Kang & Guerin, 2009; Wilkinson et al., 2014). Post-occupancy evaluation can reveal users' attitudes and behaviours towards their material choices (Atmodiwirjo & Yatmo, 2019; Celadyn, 2019; Wilkinson et al., 2014). Post-occupancy evaluation is an important tool for material advocacy, revealing how users physically interact with sustainable material choices. This evaluation examines whether material choices have successfully fulfilled their advocacy role.

Figure 10. The application of synthetic rattan (Images by authors)

Conclusion

Applying the six sustainable design principles to design ideas in the PITA office has yielded valuable insights into the key material criteria of a sustainable workplace interior. A more sustainable and responsible workspace interior can be

holistically achieved by carefully identifying the material criteria produced from such a design project. First, materials can be used to support long-term effectiveness and energy efficiency. In addition to strategically placing work zones according to their activity levels, artificial lighting can be reduced by prioritising materials that maximise the use of natural light.

Secondly, appropriate materials should be used to minimise waste, reduce the environmental impact of the office, and support environmental balance. This can be done by multiple strategies. Choosing modular or customisable materials can significantly reduce waste. Another strategy is to use of recycled or recyclable materials with long durability and easy maintenance, therefore reducing environmental impact in the long term. Another criterion of the material practice for a sustainable interior is the use of materials that bring better performance and enhance the well-being of its users. An example is the addition of natural elements, which provide material qualities that have positive effects on the surrounding environment.

The last criterion highlights the locality of material, be it as local identity or as part of a localised production. The design of the PITA office demonstrates such a commitment to locality through its use of synthetic rattan and terrazzo. Traditionally, rattan symbolises togetherness and cooperation, bringing local identity to the interior. Locally produced material, such as terrazzo, becomes important to reduce transportation emissions and support the local economy.

This study explores material practices as the basis of designing a sustainable workplace interior. Future studies may be done to understand if efforts to apply such material practices in the PITA office interior may yield significant environmental and social benefits. By exploring the design of a sustainable workplace interior through its materialities, the project reflects a holistic approach to design that is not only environmentally responsible but also contributes to its users' wider well-being and productivity.

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