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A Study on Design Thinking Fostering Sustainable Product Development

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ABSTRACT: Through interdisciplinary collaboration, user research, and rapid prototyping aimed at analysing sustainable ideas, this study deals with how design thinking can induce green innovation. It highlights real-life examples of companies that have been successful in contributing to the development of green technology, biodegradable products, and energy efficiency through design thinking. This way, design thinking should contribute to transforming consumer behaviour toward more sustainable consumption patterns in alignment with the United Nations Sustainable Development Goals (SDGs). The foundation is based on sustainability theories that drive relevant design responses to global challenges such as climate change and resource depletion. Underlining structured ideation to engineered systems, it should, however, support creating innovative solutions in response to the SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). With sustainability integrated into the ideation and design phase, products designed can perform well in the environment and consider international sustainability objectives. Evidence shows that design thinking fulfills in climate change mitigation and resource efficiency through sustainable product development. Additionally, the application of ecological strategies to work environments serves to reinforce the point that sustainability must be rooted into the practices of product development for a more sustainable tomorrow.

KEYWORDS: Design Thinking, Sustainability, Collaboration, Development

I. INTRODUCTION

Design thinking in collaboration with sustainability is leads a crucial topic for research due to its environmental impact and the recurring effects while also maintaining the interests of the consumer towards the product thus also impacting product loyalty. It is an innovative problem-solving process initiated with human needs and followed through prototyping and brought into existence with the test phase. The latest trends which have gained recognition among the sustainable practices are integrating circular economy in order to maintain resource efficiency over the years. Brown and Martin (2009), were amongst the first people who implemented the concept of design thinking to solve complex sustainability challenges.

Recent literature mention that the latest formulated framework covers ethical sourcing, biodegradability, energy-efficient manufacturing, and waste reduction for sustainable product development. In this regard, IDEO (2021) says that design thinking provides a way of exploring eco-friendly alternatives through iterative prototyping and stakeholder collaboration. Baldassarre et al. (2024) explain that according to the designers, Design Thinking must enclose responsible design, which should not focus on increasing the economic gains but rather address the social and environmental concerns within. Tesla, Unilever, and IKEA are some of the companies that have been cited as evidence that a combination of design thinking with elements of sustainability opens the door for phenomenal strides in green technology, materials science, and waste management.



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Despite the growing popularity and applicability of design thinking in sustainability, the academic discourse has yet to thoroughly research design thinking for sustainable purposes. Supporting empirical research is especially required to determine whether design thinking is conducive to achieving sustainability objectives for businesses. This paper seeks to close this gap through a discussion of secondary data about case studies capturing the ways of applying design thinking to produce various sustainable products.

II. PROBLEM STATEMENT

While traditional innovation lends itself to the improvement of manufacturing and consumption practices, it can overlook many features related to eco-sustainability, focusing mainly on cost and competition. Design thinking can be considered as the most appropriate approach for green product development, but there are challenges in profitability, materials cost, and regulatory concerns. The study will present how design thinking can serve sustainable product development by outlining best practices and challenges and opportunities.

III. REVIEW OF LITERATURE

- ❖ **Niehaus and Mocan (2024)**, focus on understanding how Design Thinking can support sustainable business transformations in volatile, uncertain, complex, and ambiguous environments. Originally focused on product innovation, Design Thinking is considered as an operational and strategic transformation performance approach. This research provides a German case study identifying factors necessary to promote Design Thinking toward sustainable innovations. The findings underscore how a shared company vision, adaptability, and commitment to sustainability are central to achieving long-term resilience and innovation in volatile markets.
- ❖ **Baldassarre et al. (2024)**, propose a conceptual framework built on the principles of responsible innovation. The authors observe that even though Design Thinking is widely used in business for competitive advantage, its social and ecological consequences remain largely unexplored. The study also introduces the concept 'Responsible Design Thinking' (RDT) model, which emphasizes on the ethical concerns linked with innovation. To put this into practice, the study advocates for a transition from competition-driven design models toward a more integrated model that balances innovation with sustainability. The research also outlines a structured agenda for future studies on how Design Thinking can contribute to solving global sustainability challenges more effectively.
- ❖ **Filho et al. (2024)** emphasize that implementing Design Thinking contributes to accomplishing the United Nations Sustainable Development Goals (UN SDGs). The study, based on bibliometric research and 22 case studies, elaborates on the different ways design thinking can be applied in generating long-term sustainable and affordable outcomes. The results suggest that human-centered design fosters many ideas that could enhance critical thinking around sustainability issues. The research highlights how Design Thinking can contribute toward achieving SDGs 8 (decent work and economic growth), 9 (industry, innovation, and infrastructure), 12 (responsible consumption and production), and 13 (climate action). It establishes a theoretical foundation for future research into optimizing Design Thinking methods for sustainability.
- ❖ **Tantiyaswasdikul (2024)**, identify the various ways in which design thinking serves as a process and tool to drive innovation in sustainable built environments. The study proposes a new model integrating design thinking with future-thinking approaches, aiming to achieve a unified framework for sustainability research. The findings highlight the potential of design thinking to address future challenges in sustainable built environments by developing feasible and innovative solutions.
- ❖ **Coughlan et al. (2019)**, identify how interconnected both design thinking and sustainability are using the Research through Design (RtD) methodology. The authors argue that design thinking's and its factors address complex sustainability challenges by creating simple and effective responses. The study demonstrates how design principles can be applied to achieve Sustainable Development Goals (SDGs), emphasizing the importance of broad problem framing, maximizing synergy, and integrating diverse perspectives.



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OBJECTIVES OF THE STUDY

1. To analyze the trends of design thinking in promoting eco-friendly product development.
2. To evaluate the opportunities in implementing design thinking for sustainability

IV. RESEARCH METHODOLOGY

The research relies on secondary data as source of information

- Academic Journals and Books: Peer-reviewed journal papers, conference proceedings, and books on design thinking, sustainability, and eco-friendly product development.
- Industry Reports: Those published by organizations such as UN, World Economic Forum, and corporate sustainability reports of leading companies.
- Case Studies: Reviewing concrete cases of corporations that have synthesized design thinking into their sustainability strategies, such as Tesla, Unilever, and IKEA.

V. ANALYSIS

THE RELATION BETWEEN SUSTAINABILITY AND DESIGN THINKING

Design Thinking and Sustainability are closely interrelated because both focus on innovation that creates meaningful, human-centered solutions while considering their social, environmental, and economic impact. Design Thinking is all about understanding people's needs and behaviours and provide a humanistic solution to solving problems, while sustainability includes the well-being of the planet and future generations.

A key part of Design Thinking is problem framing—getting to the root cause of an issue rather than just treating surface-level symptoms. This idea is crucial in sustainability too, where systems thinking helps us see how certain design choices impact the environment, economy, and society in the long run. While Design Thinking helps generate creative ideas, sustainability ensures those ideas promote responsible behaviour thus aligning with the SDG's. Concepts like the circular economy, waste reduction, and renewable materials all play a role in making sure innovation leads to long-term benefits. Sustainable innovation thrives when designers explore new materials, develop energy-efficient processes, and prioritize ethical supply chains. Design Thinking encourages rapid prototyping to refine ideas before they're scaled up, preventing inefficiencies. In the same way, sustainable design involves testing green materials, analysing carbon footprints, and experimenting with socially responsible business models. By trying different approaches, designers can find solutions that balance functionality and environmental responsibility.

Both sustainability and Design Thinking rely on continuous improvement. Sustainable solutions must adapt to evolving environmental conditions, laws, and social expectations. It's an ongoing process of learning, adjusting, and refining—one that ensures innovation not only solves problems but does so in a way that benefits both people and the planet.

VI. PHASES OF DESIGN THINKING INTEGRATED WITH SUSTAINABILITY

The Five Phases of Design Thinking for Sustainable Product Development

1. **Empathize:** This stage involves understanding the consumer needs and requirements, environmental concerns, and the hindrance it causes in terms of sustainability. Through user research, interviews, and observations, designers gain insights into the expectations of environmentally conscious consumers and identify pain points related to sustainable product adoption. By empathizing with users, designers can develop solutions that align with sustainability goals, ensuring products address real ecological concerns such as waste reduction, ethical sourcing, and long-term environmental benefits.
2. **Define:** In this step, the problem statement is understood and clearly defined on the basis of all the obtained data with higher focus on sustainability. This stage caters to particular and specific needs such as reducing carbon footprints, minimizing resource depletion, or enhancing recyclability. When a problem statement is clearly mentioned, it becomes easier to address the issue with is persistent. This step also helps companies develop products which align with the SDG goals.



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3. **Ideate:** This particular phase focuses on brainstorming ideas and solutions to address the problem and the methods through which it can be incorporated to obtain sustainable materials, energy efficiency, and responsible production methods. This phase encourages interdisciplinary collaboration, where experts from various fields contribute ideas to create environmentally friendly and user-centric products. The goal is to generate multiple concepts that align with SDG principles. Ideation fosters creative solutions that challenge traditional manufacturing processes, encouraging companies to adopt sustainable alternatives such as biodegradable materials, circular economy models, and renewable energy sources.
4. **Prototype:** Once potential solutions are identified, all the possible solutions are created as small prototypes before a full-fledged launch. These prototypes are tested for various aspects with regards to sustainability such as performance, material efficiency, and user engagement. This process helps them to evaluate the feasibility, viability, make the necessary corrections and approach the solution to have a positive impact thus attaining maximum sustainability.
5. **Test:** The final phase involves testing the product in real-world scenarios and assess the impact it makes on a particular sustainability aspect and also focus on the metrics on how it meets the user expectations. Feedback from consumers and sustainability experts helps improve the product's design, functionality, and ecological footprint. Testing validates the product's eco-performance, ensuring its long-term viability and scalability while maintaining adherence to environmental regulations and sustainability certifications.

VII. TRENDS IN DESIGN THINKING SUSTAINABILITY

Biodegradable Materials –Businesses invest immensely in biodegradable options, such as plant-based plastics or compostable packaging so as to reduce the environmental burden of waste and pollution. These materials can decompose in nature thus reducing the carbon footprint.

Circular Economy Models – The focus on shifting from a linear model to a circular economy model focus on how a product can be repaired, reused, or remanufactured instead of disposing as a means of life end of product.

Eco-Friendly Packaging – The replacement of single-use plastics with plant-based, paper-based, and edible packaging solutions has contributed to lessening the damage to the environment and to the consumer mind.

Cradle-to-Cradle Design – Products are being created with the mindset of considering the entire lifespan with the intent that the materials are either reused fully or biodegraded; that is to say, nothing toxic is left behind.

Energy-Efficient Manufacturing – In order to embrace more sustainability, companies are now designing production lines which primarily use renewable energy sources such as solar and wind energy in order to bring down their carbon footprints and reduce overhead costs.

Minimalist Product Design – This design trend is focused on less material being used to give a very simple structure to the object, giving it a high-performance function and making it more recyclable.

Modular and Repairable Products – Modular products in the technology and consumer electronics space let users upgrade and replace components rather than discarding the entire unit, permitting sustainable material use.

Sustainable Fashion and Textiles – The fashion sector is leveraging organic textiles, recycled materials, and responsible sourcing for raw materials to mitigate water consumption, carbon footprint, and textile waste.

3D Printing for Sustainability – Additive manufacturing has minimum wastage in production owing to the accuracy after each layer is placed upon the last; thus, making it feasible to produce locally on-demand with very minimal excess material.



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AI and Data-Driven Sustainability Solutions – Artificial intelligence is majorly used to reduce burden and streamline design decisions with respect to material selection, supply chains, and waste management, boosting the efficiency and assessment of sustainability initiatives.

VIII. CASE STUDY ANALYSIS AND LEARNINGS

1. **Impacts of Design Thinking on Sustainable Product Innovation:** Design thinking has been at the forefront for sustainable product innovation and manufacturing by prioritizing empathy, ideation, and prototyping. These principles are being used by organizations to design eco-friendly alternatives without sacrificing functionality and aesthetics. By taking into consideration user needs and environment aspects, companies provide solutions with sustainability as core.

Case Study Unilever

Unilever's application of design thinking led to the emergence of sustainable products, including the biodegradable ingredient formulations and 100% recycled plastic packaging in its Love Beauty and Planet brand. Iterative prototype testing with environmentally friendly materials is Unilever's approach to making good on feedback from customers to refine, develop, improve, or create new brands or product formulations on a constant basis. Unilever also works with environmental groups, invests in sustainable sourcing of ingredients, and offers long-term sustainability through these processes. Design for sustainability got Unilever to mitigate its carbon footprint, reduce plastic waste, and grow brand value. It has set an ambitious target of achieving net-zero emissions in its supply chain by 2039.

2. **Customer Preferences for Sustainable Products:** With the rise in the importance of sustainability and providing for the other generations, it became necessary to focus on the customer needs and requirements in order to remain relevant in the field of business. Consumer studies show that buyers tend to buy brands placed on the platform of environmental stewardship, which contributes to the growth of green product innovations.

Case Study: The Body Shop

The Body Shop utilizes design thinking in developing product lines considering customer preferences toward sustainability. The company emphasized on ethical sourcing, packaging, and product formulations from customer co-creation workshops. This further lead to the establishment of refill stations, cruelty-free skin care products, and efforts to minimize single-use plastics. Additionally, the company engaged in fair trade through responsible sourcing of ingredients from local communities. Sustainability integration into its product development agenda helps enhance The Body Shop's brand loyalty and sets a standard for ethical business practices.

3. **Cost-Benefit Analysis of Sustainable Design Thinking:** While implementing a design thinking model is a costly affair, the short-term profits obtained might overshadow all the costs involved in the initial processes. According to the fact that open-source-based design is good; the companies that decorate green designs enjoy a reduction in operating costs gained compliance by law and gain loyalty from their customer base."

Case Study: Tesla

Tesla creates cost-efficient electric vehicles through design thinking. Initially high in production costs, Tesla's approach in terms of its variant modifications and alignment of renewable energy is enabling it to gradually reduce the cost of EVs. Tesla was innovative in battery technologies for electric cars that made the electric automobiles reusable and affordable. Tesla also uses sustainable manufacturing methods, owning solar-powered gigafactories and executing closed-loop battery recycling. By its principle of driving long-term profit and effecting huge emission reductions from greenhouse gases, Tesla has changed and humbled the sustainability drive in the car industry.

4. **Lifecycle Assessment on Eco-Friendly Products:** The lifecycle assessment (LCA) refers to the environmental footprint of a product from the extraction of raw materials to the end-of-life disposal. In this context, design thinking provides opportunities for a company to try to minimize waste and energy use at all processes.



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Case Study: Nike

Nike has a great example of sustainable design thinking with Flyknit technology. Through computer-controlled knitting, the company minimized material waste by 60% compared to traditional shoe production. Nike continues to test and improve its materials to enhance product durability and recyclability and, therefore, reduce its environmental impact. Nike also creates shoes from recycled plastic bottles and retired sneaker parts, cementing its commitment to sustainability. Nike's circular economy model ensures that used shoes are recycled into new products, which further minimizes environmental impact.

5. **Adoption Rate of Sustainable Practices in Industries:** There is vast gap in the acceptance and actual acceptance of the sustainable design methods between various sectors and various industries.

Case Study: IKEA

IKEA embodies sustainable design reasoning through the utilization of renewable materials, waste trimming, and engineered packaging. This means IKEA adopts its "People & Planet Positive" strategy within its circular product design framework by enabling customers to recycle and repair their furniture rather than throw it away or into landfills. IKEA has invested in solar farms and wind farms for their energy needs at retailers and manufacturing plants. Through sustainability as an integral part of its business model, IKEA still leads the widerway in the furniture industry towards greener innovative pathways.

IX. DISCUSSION

Design thinking has proven to be a powerful tool in driving sustainable innovation. It helps companies to develop eco-friendly products while remaining competitive. Strength number one: it is a uniting idea between people from various backgrounds to creatively solve problems. This would make room for solutions that not only address environmental concerns but also respect customer desires.

Great examples include IKEA and Unilever, both of which have been successfully putting design thinking to work to create Sustainable packaging and furniture made of renewable materials like wood. These companies consider not merely the product's carbon footprint but the entire life cycle of the product-including its production and possible disposal- ensuring the minimum waste.

However, the use of sustainable design thinking is controversial. Many businesses face the higher up-front cost of eco-friendly materials and processes. Regulators may sometimes establish additional constraints that hinder innovation. Also, consumer awareness, and demand for sustainable products vary from market to market and alter therefore the product adopting rate. The majority of companies adopting the design thought method within their sustainability efforts have noticed long-term impact. Customer loyalty has been strengthened, waste costs have been reduced, and a competitive edge gained within an environmentally-conscious market. For as many industries continue to apply this method of thinking, design thinking thus remains to hold an important center toward building a sustainable future.

X. CONCLUSION

Design thinking is a human-centered process that allows businesses to develop sustainable products by balancing user requirements with environmental issues. It ranges from empathy to ideation, prototyping, and testing to provide creative solutions to problems. Companies like Unilever, The Body Shop, Tesla, Nike, and IKEA employ design thinking to actually minimize waste and increase efficiency. It is a surety of long-term cost savings and efficient resource management. Design thinking becomes a facilitator for cross-disciplinary respectively cross-sectoral cooperative work, fostering an eco-friendly approach. There may, however, be setbacks alongside financing, regulations, and checking a company for compliance. Getting over these challenges results in financial as well as environmental dividends in the future. The research frames a map connecting design thinking and sustainability. It should be able to seal the gaps inherent in conventional methods of sustainability, eventually changing the trajectory of progress and promoting global sustainability.



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XI. SCOPE OF RESEARCH

Future research will need to look at how design thinking affects the sustainability efforts of reducing carbon footprints and resource use over long periods. Further research will explore how AI and big data, along with industry-driven methodologies, may aid in removing barriers while improving the adoption of sustainable innovations in consumer purchase decisions.

REFERENCES

- Baldassarre, B., Calabretta, G., Karpen, I. O., Bocken, N., & Hultink, E. J. (2024). Responsible design thinking for sustainable development: Critical literature review, new conceptual framework, and research agenda. *Journal of Business Ethics*, 195, 25–46.
- Leal Filho, W., Schmidberger, I., Sharifi, A., Vargas, V. R., Rampasso, I. S., Dibbern, T., ... & Kozlova, V. (2024). Design thinking for sustainable development: A bibliometric analysis and case study research. *Journal of Cleaner Production*, 455, 142285.
- BK Kumari, VM Sundari, C Praseeda, P Nagpal, J EP, S Awasthi (2023), Analytics-Based Performance Influential Factors Prediction for Sustainable Growth of Organization, Employee Psychological Engagement, Work Satisfaction, Training and Development. *Journal for ReAttach .Therapy and Developmental Diversities* 6 (8s), 76-82.
- Brown, T. (2009). *Change by design: How design thinking creates new alternatives for business and society*. Harper Business.
- P. Nagpal, A. Pawar and S. H. M, "Predicting Employee Attrition through HR Analytics: A Machine Learning Approach," 2024 4th International Conference on Innovative Practices in Technology and Management (ICIPTM), Amity University Noida, India, 2024 on 21-23 February 2024 pp. 1-4, doi: 10.1109/ICIPTM59628.2024.10563285.
- Niehaus, M., & Mocan, M. (2024). Cultivating design thinking for sustainable business transformation in a VUCA world: insights from a German case study. *Sustainability*, 16(6), 2447.
- P Nagpal, C. Vinotha, et.al. (2024). Machine Learning and AI in Marketing–Connecting Computing Power to Human Insights. *International Journal of Intelligent Systems and Applications in Engineering*, 12(21s), 548–561.
- IDEO. (2021). *Design thinking for sustainability: A practical guide*. IDEO.org.
- Maher, R., Maher, M., Mann, S., & McAlpine, C. A. (2018). Integrating design thinking with sustainability science: a Research through Design approach. *Sustainability science*, 13, 1565-1587.
- Nagpal, P. (2024, September 11). Leveraging artificial intelligence and machine learning for gaining competitive advantage in business development. First International Conference on Advent Trends in Computational Intelligence and Communication Technologies (ICATCICT 2024).
- Martin, R. (2009). *The design of business: Why design thinking is the next competitive advantage*. Harvard Business Press.
- Walter, L. F., Schmidberger, I., Sharifi, A., Vargas, V. R., et al. (2024). Design thinking for sustainable development: A bibliometric analysis and case study research. *Journal of Cleaner Production*, 455, 142285.
- Dr. Pooja Nagpal (2023). The Transformative Influence of Artificial Intelligence (AI) on Financial Organizations World Wide. 3rd International Conference on Information & Communication Technology in Business, Industry & Government (ICTBIG). Symbiosis University of Applied Science, Indore. December 2023
- <https://mark-bridges.medium.com/25-case-studies-exploring-design-thinking-service-design-fab8eb4b9a13>
- <https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case-studies>
- <https://www.imd.org/ibyimd/sustainability/from-pledge-to-performance-using-design-thinking-to-achieve-sustainability-goals/>



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