

## Nanotechnology and its Role in Product Sustainability

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### Abstract:

The research revolves around activating the role of modern technologies as a solution for developing products to achieve sustainability. Nanotechnology is considered one of the most important technologies that work on developing material properties and creating new materials. The problem addressed by the research is the failure to achieve sustainability in the design of some products due to the prevalence of many commonly used traditional products made from environmentally harmful materials and production methods that do not meet sustainability standards and represent a burden on the environment that is difficult to address. The research discussed the concept and importance of sustainability in product design, the historical development of material use in product design, and the development of new material properties in product design. It also discussed nanotechnology, nanomaterials, and their impact on developing product properties. Can new materials be used through nanotechnology to develop products and support them with properties that achieve sustainability? The research also aims to demonstrate how sustainability can be achieved in product design by transforming environmentally harmful traditional products into sustainable products by replacing harmful materials with new nanomaterials. It sheds light on the role of nanotechnology and the resulting nanomaterials in achieving sustainability in product design by developing their properties.

**Problem Statement:** Sustainability of products is one of the most important trends that designers should focus on in product development processes. The problem lies in the failure to achieve sustainability in the design of some products due to the prevalence of many conventional products that are commonly used, which are manufactured from materials and production methods that are environmentally harmful, and do not meet sustainability standards, posing a burden on the environment that is difficult to address. Aims and objectives: The research aims to: Demonstrate how sustainability can be achieved in product design by transforming traditional products with negative environmental impact into sustainable products through the replacement of harmful materials with newly developed nanomaterials. Highlight the role of nanotechnology and the resulting nanomaterials in achieving sustainability in product design through the enhancement of their properties.

**Hypothesis and Methodologies:** If it is possible to develop traditional products by replacing their materials with innovative nanotechnology materials, this will contribute to increasing the rates of achieving sustainable principles for these products. Environmental problems can be addressed, and the sustainability rates of traditional products can be increased by replacing traditional materials with innovative nanotechnology materials. The study has adopted the descriptive analytical Method for studying the problem and achieving research hypotheses.

**Research Importance:** Emphasizing the importance of integrating modern technologies as a solution to develop products to achieve sustainability. Activating the role of nanotechnology in the process of product development to achieve sustainability. Utilizing modern technologies to achieve product sustainability. Directing designers to focus on nanotechnology in developing the properties of traditional products to work towards achieving sustainability.

**Results:** Nanomaterials are considered one of the most important options for developing traditional products into advanced modern products through their contribution to increasing the quality and efficiency of products, reducing their size, increasing their durability and effectiveness, reducing waste, reducing environmental impact...etc. Nanotechnology is already being used in various industries such as energy, transportation, healthcare, and consumer goods, to develop sustainable products with improved properties and reduced environmental impact. The industrial designer's awareness of what nanotechnology and nanomaterials are contributes to integrating these materials into products and creating sustainable and advanced products. Nanomaterials offer alternatives with multiple properties, whenever their size and ways of forming their particles are controlled, which makes them a fertile material for development and scientific research. Nano technology contributes to transforming environmentally harmful materials or waste into useful, harmless materials with advanced properties, which supports products and contributes to achieving sustainability and preserving the environment. Nanotechnology contributes to transforming local raw materials into nanomaterials with properties like limited materials and raw materials that are imported, which supports the economy of countries and contributes to preserving limited raw materials and resources.

### Keywords:

Product development - Sustainability - Nanotechnology - Nanoproducts - Sustainable products

### References:

- 1- Abdul Kareem, E. A. (2019). The Concept of Sustainable Design and Its Impact on the Quality of Interior Design Environment. *Architecture, Arts, and Humanities Journal*.
- 2- Abdulhamid, D. K. (2018). Considerations for Achieving the Concept of Sustainable Design in Industrial Design. *Architecture and Arts Journal*, Issue 11, Part 1.
- 3- Abouelsoud, A. M. (2019). The strategies of sustainable design for a better product design future. *Journal of Applied Art and Science*.
- 4- Abu Ghneimah, W. A., Mustafa, S. N.-D., & El-Saadani, N. O. (2023). Sustainability in product design and its applications on the packaging of organic food products. *Journal of Architecture, Arts, and Humanities*, Vol. 8, No. 38.
- 5- Ahmed, M. S., & Hassanein, T. K. (2022). Sustainable materials in industrial lighting units. *International Design Journal*.
- 6- Al-Amayreh, A. (2015). *Interior Design and Decoration Engineering*. Amman: Dar Al-Amal, First Edition.
- 7- Al-Ashmaawi, S. A. (2016). Nanotechnology in enhancing the functional performance of sportswear. *International Design Journal*, Volume 6, Issue 2.
- 8- Al-Eskandarani, M. S. (2010). *Nanotechnology: for a Better Tomorrow*. Kuwait: World of Knowledge series.
- 9- Al-Habshi, N. A. (2011). *What is Nanotechnology?* Saudi Arabia: King Fahd National Library Catalog.
- 10- Awad, A. M. (1992). Requirements for Selecting Design Materials in the Field of Engineering Product Design. *Journal of Sciences and Arts*.
- 11- Fadel, A. A., & Alkhalef, N. A. (2021). The role of nanotechnology in achieving the dimensions of sustainable development. *Journal of Management and Economics*, Issue 129.
- 12- Farid, A. E., Abu Ghazala, A. A., & Al-Shami, A. A.-M. (2015). *Smart and Nanomaterials in Construction: An Introduction to Enhance the Efficiency and Integration of Smart Buildings*. Jazan University Journal, Applied Sciences Branch.
- 13- Hashem, E. M., & Alsindioni, K. F. (2015). Modern Trends in Design and Their Role in Reducing Solid Environmental Waste Resulting from Use. *Journal of Applied Sciences and Arts*.
- 14- Ibrahim, Z. S. (2020). Nanotechnology treatments for wooden materials and their use in interior design technology. *Journal of Architecture, Arts, and Humanities Sciences*.
- 15- Imam, M. H. (2013). Intellectual Transformations in Interior Design and Furniture during the 21st Century. Vol. 1 of the *Scientific Journal of the Third International Conference of the Faculty of Applied Arts*.
- 16- Kamel, D. M. (2016). Sustainable Furniture as a Dominant Trend for the Third Millennium. *Journal of Applied Sciences and Arts*.
- 17- Mehran, S. A.-S. (2014). Nanotechnology and its impact on furniture production. *Al-Amara wa Al-Funun*, no. 14.
- 18- Mohammed, D. Y. (2013). Technology of modern adhesives used in interior design. <https://www.researchgate.net/publication/333677983>.
- 19- Mohammed, O. Y. (2019). Environmental Scenario as an Approach to Achieving Sustainability in Product Design. *Journal of Architecture, Arts, and Humanities*, 49.
- 20- Nafea, M. A. (2018). Smart Materials Technology in Functional Systems for Industrial Design Products. *International Journal of Design*.
- 21- Naseer, R. A. (2017). The impact of sustainability and advanced technology on interior design and furniture for temporary facilities. *Journal of Applied Sciences and Arts*.
- 22- National Nanotechnology Initiative. (2023, April 24). Retrieved from <https://www.nano.gov>: <https://www.nano.gov/about-nanotechnology/applications-nanotechnology>
- 23- Sabry, A. M. (2020). New Materials Produced by Nanotechnology and Their Industrial Applications in Product Design. *International Design Journal*.
- 24- Sherif, F. A.-M., Khalil, M. K., & Ahmed, N. S. (2017). Building Construction and Nanotechnology: A New Vision for Architecture. *International Design Journal*, Volume 7, Issue 1.

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