Universidad de Lima

Facultad de Ingeniería

Carrera de Ingeniería Industrial

THE ROLE OF ECODESIGN IN CIRCULAR ECONOMY TO IMPROVE THE PERFORMANCE OF ENTERPRISES IN THE FASHION INDUSTRY: A SYSTEMATIC REVIEW OF LITERATURE

Tesis para optar el Título Profesional de Ingeniero Industrial

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Lima – Perú

Diciembre de 2023

Propuesta
Carrera Ingeniería Industrial

Título

The Role of Ecodesign in Circular Economy to Improve the Performance of Enterprises in the Fashion Industry: A Systematic Review of Literature

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Resumen: Los altos índices de contaminación detectados en la industria de la moda exigen acciones para cambiar sus actividades de producción basadas en modelos lineales. La transición a una economía circular utilizando el ecodiseño como herramienta conlleva retos y limitaciones para alcanzar los beneficios de un mejor rendimiento empresarial. El objetivo de este artículo es identificar el impacto de incluir el ecodiseño como herramienta de la economía circular para mejorar el rendimiento en las empresas de la moda, analizando la literatura existente desde 2013 hasta 2021 a través de una revisión sistemática de la literatura (SLR). Los resultados muestran que el ecodiseño es un pilar que favorece la consecución de la economía circular gracias al diseño de productos más sostenibles que pueden volver al ciclo productivo y/o ser reciclados para reducir los impactos ambientales desde la primera etapa de su ciclo de vida. Además, se identificaron metodologías y herramientas que impulsan a las empresas hacia el ecodiseño. El éxito de la aplicación del ecodiseño influye en el rendimiento empresarial, lo que se traduce en una mayor eficiencia energética y de recursos en los procesos, una reducción de costes y una mayor rentabilidad. Para lograrlo es necesario el compromiso de todas las partes implicadas en la cadena de valor. De este modo, las empresas pueden conseguir una ventaja competitiva, mejorar el valor de su marca y lograr una mayor satisfacción del cliente.

Palabras Clave: Ecodiseño, Economía circular, Rendimiento empresarial, Industria textil y de la confección, Sostenibilidad, Ventaja competitiva

Abstract: High rates of contamination found in the fashion industry call for actions to change their linear model-based production activities. The transition to a circular economy using ecodesign as a tool entails challenges and constraints to attain the benefits of an improved business performance. The aim of this article is to identify the impact of including ecodesign as a tool of circular economy for improved performance in fashion businesses, analyzing the existing literature from 2013 to 2021 through a systematic literature review (SLR). Results show that ecodesign is a pillar that favors the achievement of circular economy thanks to the design of more sustainable products that can return to the production cycle and/or be recycled so as to reduce environmental impacts from the first stage of their life cycle. In addition, methodologies and tools driving companies toward ecodesign were identified. Successful ecodesign application influences business performance leading to an improved energy and resource efficiency in processes, reduced costs, and higher profitability. Achieving this requires the engagement of all the parties involved in the value chain. Thus, businesses may achieve a competitive advantage, improve their brand value, and attain a better customer satisfaction.

Keywords: Ecodesign, Circular Economy, Business Performance, Textile and Apparel Industry, Sustainability, Competitive Advantage

Línea de investigación IDIC – ULIMA

Ecoeficiencia y Tecnologías Limpias

Área y Sub-áreas de Investigación:
Área de Investigación: Design & Manufacturing Engineering
Sub-área de Investigación: Gestión Ambiental Sostenible

Objetivo (s) de Desarrollo Sostenible (ODS) relacionado (s) al tema de investigación.

ODS9 – INDUSTRIA, INNOVACIÓN E INFRAESTRUCTURA

PLANTEAMIENTO DEL PROBLEMA

Industries frequently talk about sustainability and environmental care because of their growing concern about the negative impacts generated by most businesses (Gardetti and Torres 2017; Martínez Barreiro 2016). The textile industry is one such, as it generates 10 percent of the total CO_2 emissions as well as 20 percent of wastewater (Convención Marco de las Naciones Unidas sobre el Cambio Climático [UNFCCC] 2018; Aquino 2019), not to mention the high rates of energy and water consumption (Tinoco Gómez, Raez Guevara, and Rosales López 2009; Gardetti and Torres 2017). This makes it the second most contaminating industry worldwide after the oil industry (Aquino 2019).

Based on the impacts observed, there is a need to focus on a way to reduce waste generation, as 73 percent to 85 percent of used garments end up in a landfill or are incinerated. In addition, recycled materials used in manufacturing new clothing accounts for less than 1 percent. This translates to over a 100-billion-dollar loss per year (Martínez Barreiro 2016; Ellen MacArthur Foundation 2017; UNFCCC 2018; Cigarán 2019). Furthermore, the number of times people use garments before disposing of them has decreased by 36 percent compared to 15 years ago (Ellen MacArthur Foundation 2017; Larios 2020), accounting for a yearly 460-billion-dollar loss for consumers (Ellen MacArthur Foundation 2017).

Considering the depletion of nonrenewable resources, the linear model used by many companies to manufacture, sell, use, or consume a product to be ultimately disposed of (Stahel 2019) needs to be replaced by a circular one (Balboa and Domínguez Somonte 2014; Martínez and Porcelli 2018; Cigarán 2019).

Studies conducted in this regard in recent years show that using both ecodesign and a circular economy could help businesses attain a competitive advantage (Mellado 2019; Cigarán 2019; Velenturf and Purnell 2021). Therefore, this literature review research aims to identify the impact of including ecodesign as a tool of circular economy for an improved performance of enterprises in the fashion industry.

OBJETIVOS

Identify the impact of including ecodesign as a tool of circular economy for an improved performance of enterprises in the fashion industry.

JUSTIFICACIÓN

A circular economy provides three types of benefits: economic, environmental, and business opportunities (Ellen MacArthur Foundation 2015). For the first type, the benefit is the sources of employment once companies grow (Martínez and Porcelli 2018; Velenturf and Purnell 2021) and the country's GDP increases (Ellen MacArthur Foundation 2015).

As for environmental opportunities, a circular economy would enable the use of the 4Rs (reduce, reuse, recycle, and reclaim) to reduce water and energy consumption (Ellen MacArthur Foundation 2017) as well as carbon dioxide emissions (Estévez 2019; Serón Galindo 2020; Velenturf and Purnell 2021). It would also allow for minimization and/or elimination of nonrenewable raw materials to generate more productivity and value from the earth and soil and reduce the amount of waste as well as the use of fertilizers and pesticides (Ellen MacArthur Foundation 2015, 2017; Martínez and Porcelli 2018).

Finally, recycling would create business opportunities such as savings in the cost of raw materials (Estévez 2019), industrial symbiosis and reutilization (Melgarejo 2019), and less volatile prices for virgin raw materials (Ellen MacArthur Foundation 2017; Estévez 2019; Velenturf and Purnell 2021). In addition, technology and innovation would be maximized (Ellen MacArthur Foundation 2015, 2017; Martínez and Porcelli 2018; Estévez 2019; Melgarejo 2019), and a new demand for internal services such as reverse logistics and product reconditioning would emerge to put products back in the process while providing the best customer service with improved products to increase customer satisfaction (Ellen MacArthur Foundation 2015). In this sense, companies may attain a competitive advantage and maximize their business in a sustainable manner.

On the other hand, ecodesign drives companies to improved performance and efficiency through cleaner technologies while meeting their customer demand, minimizing their waste management costs (Balboa and Domínguez Somonte 2014; IHOBE 2000), reducing their nonrenewable resources consumption, optimizing quality, and extending product use life (Rodríguez Viñas 2015).

Impact of Ecodesign and Circular Economy on Business Performance

By applying ecodesign and/or circular economy as part of a business operation, companies may have great opportunities for improved productivity and performance by maximizing the value of an organization from more environment-friendly manufacturing of products that can be better appreciated by people.

Following the same pattern, Celi (2015) mentions improved efficiency through recycling and/or reclamation of most resources by using circular economy, which helps environmental impact reduction and product value maximization to attain economic gain (Velenturf and Purnell 2021; Barros et al. 2021) and cost

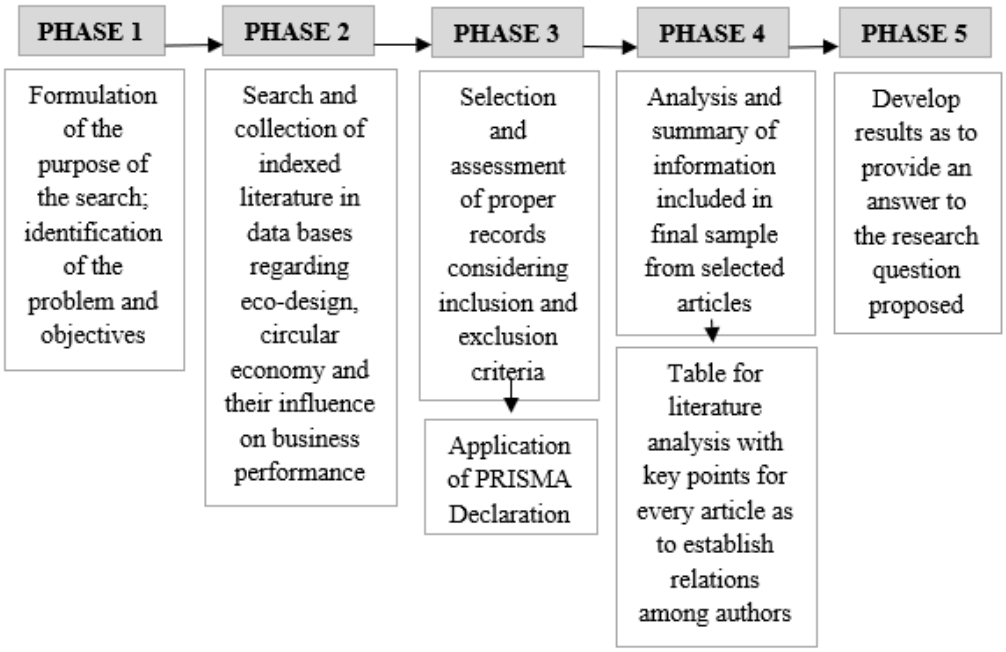
savings (Fonseca et al. 2018). Likewise, ecodesign implementation enables economic opportunities for companies through more innovative product creation that fits market trends to achieve potentially higher income (Rodrigues, Pigosso, and McAloone 2015) and profits (Ramírez Juidías and Galán Ortiz 2015). As for Ruiz, Canales, and García (2015), they state that the contribution of these two constructs in business performance is associated with three aspects: business growth optimization, linear economy risk management, and competitiveness increase. The first aspect would be attained by reducing operation costs and including innovations in new product development. As for the second aspect, this would address resources constraints, price volatility, environmental impact from carbon dioxide emissions, water footprint, and energy consumption. Finally, competitiveness would increase by having more differentiating features against competitors and strengthening the relationship with company stakeholders. Likewise, González (2015) points out that ecodesign applied by textile companies may improve their image and performance. IHOBE (2018a) states that efficiency and productivity can increase by using circular economy in the organization operations.

The potential contribution of the proposal is mainly related to Sustainable Development Goal 12: "Ensure sustainable consumption and production patterns" and Goal 9: “Building resilient infrastructures, promoting sustainable industrialization and innovation”. ENEL and Symbola Foundation (2018 quoted in Ghisellini and Ulgiati 2020) provide examples of Italian textile companies that have obtained benefits from a circular economy. One of them worked on pre-consumption textile waste regeneration intended for a green fabric and thread production line which reduced their water consumption by 89 percent, their energy consumption by 76 percent, and their CO_2 emissions by 96 percent. Another applicability of ecodesign and circular economy could be in the case of clothing companies, where a large amount of solid waste is generated during the process. To minimize this aspect, collections could be created from the remanufacturing of unused garments or post-industrial waste, or even with second-use garments.

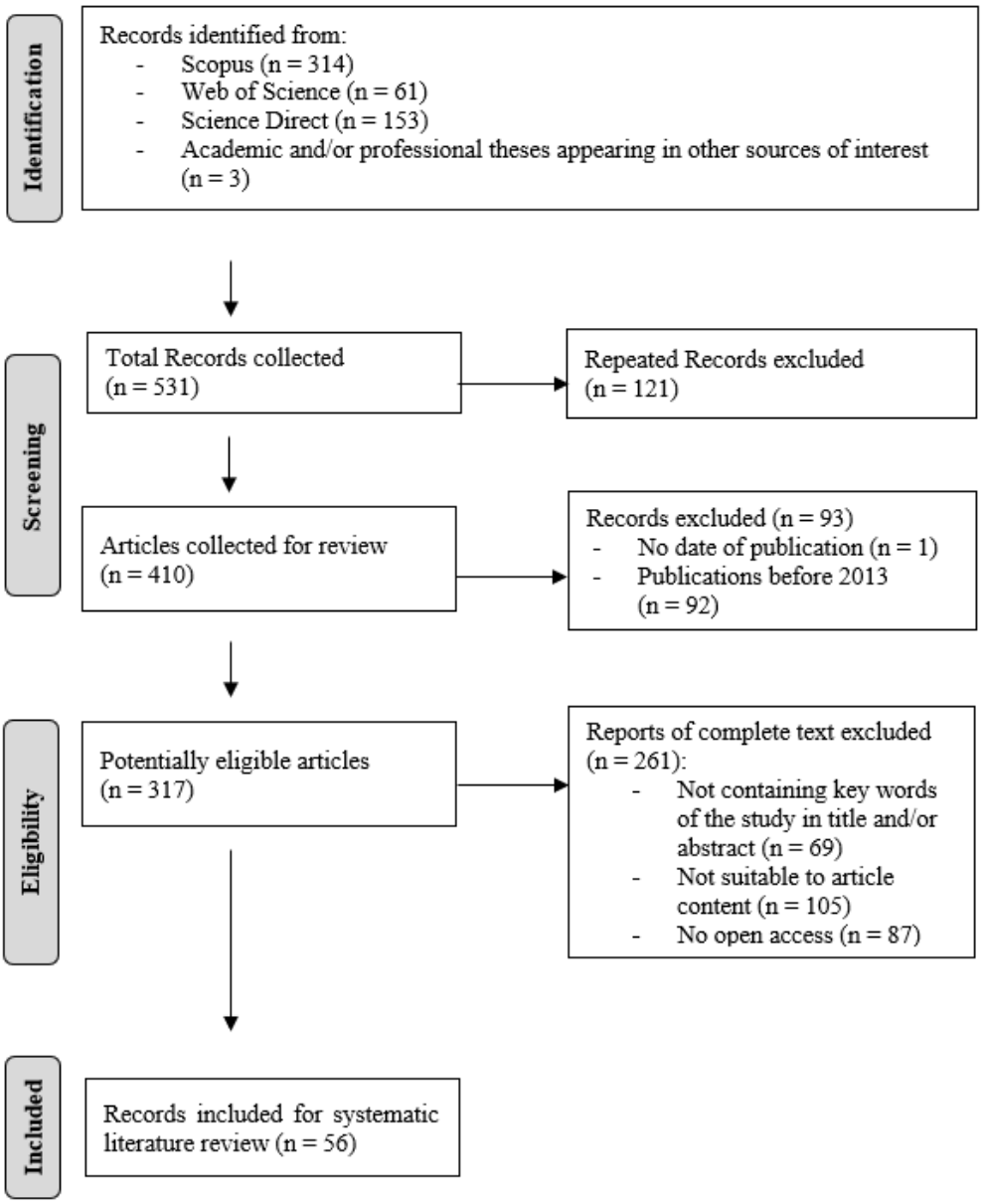
DISEÑO METODOLÓGICO

The methodology used in this research is a systematic literature review

1. PHASE 1: Formulating the Purpose of a Search
2. PHASE 2: Finding the Studies
3. PHASE 3: Selecting and Assessing Documents
4. PHASE 4: Document Analysis and Summary
5. PHASE 5: Results Development



PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses): “tool for an increased clarity and transparency in publishing systematic reviews” (Pérez Rodrigo 2012, 2). This is a guideline to the steps involved in selecting and filtering articles so as to exclude any literature not relevant to the research results.



Since the research was focused on a systematic literature review, the main limitations were found in the process of searching for and collecting information. Thus, there were 87 articles whose abstracts were interesting and appropriate for the present study; however, there was no open access to complete information, so they had to be discarded.

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ANEXOS.

Datos del artículo publicado

- **Nombre del artículo:** The Role of Ecodesign in Circular Economy to Improve the Performance of Enterprises in the Fashion Industry: A Systematic Review of Literature
- **Autores:** Michelle Jochamowitz Yriberry / Sasha Jochamowitz Yriberry
- **Co autor(es):** Rosa Patricia Larios Francia

Publicación en revista

- **Nombre de la revista:** The International Journal of Environmental Sustainability
- **Volumen:** 19
- **Número:** 2
- **Año:** 2023
- **Pp:** 43-74
- **Enlace web donde se encuentra publicado el artículo (identificador DOI, ISBN, ISSN o equivalentes):** ISSN: 2325-1077 (Print) ISSN: 2325-1085 (Online) / https://doi.org/10.18848/2325-1077/CGP/v19i02/43-74

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