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# ECODESIGN IN POLISH MANUFACTURING COMPANIES – GENERAL INSIGHTS

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**Purpose:** The article presents the results of research into eco-design conducted among selected companies. The aim of the study was to identify how ecodesign is defined, the rationale for ecodesign, the methods used, and the factors that support the development of a product in terms of environmental characteristics.
**Design/methodology/approach**: The study was carried out using the individual in-depth interview method with representatives of 24 companies. Manufacturers from industries representing product categories that fit into the EU's Sustainable Products Initiative were invited to participate in the study.
**Findings:** Not all companies participating in the study are aware of the idea of ecodesign. It was noted that some respondents found it difficult to clearly describe the assumptions of ecodesign. Many respondents seemed to be interested in selected elements of ecodesign. None of the surveyed entities uses a documented procedure to identify and assess the environmental aspects of designed/developed products. In most cases, the companies surveyed rely on the experience and intuition of their employees to develop the environmental features of the products they offer.
**Research limitations/implications**: Future research will continue to identify the drivers and barriers of ecodesign from an organisational perspective. The main limitation of the study is the varying level of verbal communication skills of the interviewees and dispersed knowledge in the companies.
**Practical implications:** Based on the study, it can be concluded that there is a need to support companies in ecodesign activities, for example, by organizing training and workshops to explain strategies and principles of ecodesign. For the vast majority of entities that declared the presence of an environmental mentor in the company, it is an important or very important factor supporting the design or development of products.
**Originality/value:** The paper is addressed to all interested in ecodesign. The study should be seen as a contribution to the discussion about the role of Product-Oriented Environmental Management Systems in sustainability reporting. What makes the research valuable is the attempt to present the issue of ecodesign on the example of companies from different industries.
**Keywords:** ecodesign, manufacturers, individual in-depth interview.
**Category of the paper:** Research paper.

# 1. Introduction

The application of sustainability principles in a business approach involves the comprehensive management of various aspects of an organisation's activities. Ecodesign represents a new management paradigm that demonstrates the ideas of sustainable production and consumption. According to Baumann, Boons and Bragd (2002), the idea of ecodesign emerged in the early 1970s and grew particularly in the 1990s. A report prepared by the European Network of Ecodesign Centres (ENEC) entitled *Envisioning Ecodesign: Definitions, Case Studies and Best Practice*s collates numerous ecodesign definitions. Some of these are listed below (Table 1). Ecodesign is also described in the standard ISO 14006:2020, where ecodesign is defined as a "systematic approach that considers environmental aspects in design and development to reduce adverse environmental impacts throughout the life cycle of a product" (ISO 14006:2020, p. 3).

**Table 1.**
*Selected definitions of ecodesign*

| Definition | Author |
|---|---|
| Ecodesign and Design for Environment (DfE) are terms for strategies that aim to integrate environmental consideration into product design and development. | Dewulf, 2013 |
| Ecodesign involves simultaneously taking into account the environmental impacts associated with the selection of materials, the manufacturing process, the storage and transportation phase, usage, and final disposal. | Plouffe et al., 2011 |
| Ecodesign is a proactive approach of environmental management that aims to reduce the total environmental impact of products. | Pigosso et al., 2010 |
| Ecodesign implies a new way of developing products where environmental aspects are given the same status as functionality, durability, cost, time-to-market, aesthetics, ergonomics, and quality. Ecodesign aims at improving the product's environmental performance and may be seen as a way of developing products in accordance with the sustainable development concept. | Guelere Filho et al., 2007 |
| Ecodesign integrates environmental criteria in the design of products and services so as to get the reduction of environmental impacts they produce, taking into account all stages of their life cycle. | Alonso, 2006 |

Source: author's elaboration based on Prendeville et al., 2014.

Ecodesign is a complex process. It usually consists of the following activities (ISO 14006:2020):

- identification of requirements (from different interested parties) into a product specification,
- transformation of the specification into product function,
- combination of function into product concepts,
- evaluation, refinement, and selection of a final product concept,
- refinement of the selected concept into the final product.

Ecodesign uses a variety of methods and techniques, from semi-quantitative or qualitative approaches to advanced life cycle methods. The literature recommends the use of guides with generic ecodesign guidelines (golden rules) (Luttropp, Lagerstedt, 2006), or ecodesign

strategies based on the classification of products (Joachimiak-Lechman, Lewandowska, and Matuszak-Flejszman, 2019).

In the following years, a number of legal regulations, proposals, and action plans to spread ecodesign were created. In the last few years alone, a number of EU regulations have been developed with regard to specific ecodesign requirements for different groups of energy-using products (e.g. Commission Regulations 2019/2019 ecodesign requirements for refrigerating appliances; Commission Regulations 2019/2020 ecodesign requirements for light sources and separate control gears; Commission Regulations 2019/2021 ecodesign requirements for electronic displays, Commission Regulations 2019/2022 ecodesign requirements for household dishwashers, Commission Regulations 2019/2023 ecodesign requirements for household washing machines and household washer-dryers). At European Union level, several other documents are also worth noting:

- A new Circular Economy Action Plan for a cleaner and more competitive Europe: The plan presents a set of initiatives to create a strong and coherent product policy framework that improves sustainable products, services, and business models (European Commission, 2020).
- Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations: As part of the undertaken initiatives, the Product Environmental Footprint (PEF) method has been developed to support the design of products minimising their environmental impact throughout their life cycle (Official Journal of the European Union, L 471/1 from 30.12.2021).
- Proposal for establishing a framework for setting ecodesign requirements for sustainable products: The paper proposes to extend the scope of the ecodesign framework, noting that the new rules should go beyond energy-powered products to include further requirements (European Commission, 2022).
- The Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464): European Sustainability Reporting Standards (ESRS) refer to ecodesign, for example by requiring the disclosure of circular design applications, leading to increased product durability and optimisation of use (Official Journal of the European Union, L 322/15 from 16.12.2022).
- Regulation (EU) of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for sustainable products (2024/1781): The document is the result of the long-announced extension of the scope of the Ecodesign Directive (2009/125/EC), which introduces, among other things, regulations for a digital passport. The ecodesign requirements in the delegated act shall be such as to improve the following product aspects: durability, reliability, reusability, upgradability, repairability, the possibility of maintenance and refurbishment, the presence of substances of concern, energy use and energy efficiency, water use and

water efficiency, resource use and resource efficiency, recycled content, the possibility of remanufacturing, recyclability, the possibility of the recovery of materials, and environmental impacts, including carbon footprint and environmental footprint (Official Journal of the European Union from 28.06.2024).

Taking into account the above regulations as well as other market factors, it can be expected that interest in ecodesign among entrepreneurs will increase. Therefore, it is worth to assess the activities undertaken by business practice in this area. In the second half of 2023, qualitative research was launched with the primary aim of analysing the issue of ecodesign on the example of manufacturers of selected industries. Manufacturers operating in industries that have been recognised in the Circular Economy Action Plan and subsequently in the Regulation (EU) of the European Parliament and of the Council (2024/1781) as relevant for building a market for sustainable products were invited to in-depth interviews.

The qualitative research took place in two stages. The aim of the first part of the study was to determine whether and to what extent the selected companies consider life cycle perspectives when designing and developing the products they offer. It has been shown that the companies surveyed are beginning to think in terms of life cycle, although not all of the actions taken are impressive (Joachimiak-Lechman, 2024). Presumably, many of the respondents did not identify their environmental activities with ecodesign. It is therefore worth analysing the surveyed companies' awareness of eco-design, including how they define the concept, what rationale they follow, what methods they use, and what factors, according to the surveyed companies, support activities leading to environmental product development. Determining the above issues was the aim of the second phase of research, the results of which are presented in this article.

The topic of ecodesign has been addressed in Polish (e.g. Annuszewska et al., 2011; Dostatni, Mikołajewski, and Rojek, 2023; Siwiec et al., 2024) and foreign literature (e.g. van Hemel, Cramer, 2002; Coté, Booth, 2006; Fernández-Viñé, Gómez-Navarro, Capuz-Rizo, 2010; Dekoninck et al., 2016; Triguero et al., 2023; Saari et al., 2024) for years. The studies show progress in terms of the application of ecodesign. In the paper of Saari et al. (2024), the CE maturity matrix was presented, which comprises five maturity levels mapped with seven linear manufacturing value chain phases. The matrix was piloted with manufacturing industry companies from Finland, Italy, Germany and Ireland. The results showed that in the area of product design, none of the interviewed manufacturing industry companies remained at the linearity level, where linearity means designing a product without taking into account durability, upgradeability, circularity or sustainability (Saari et al., 2024). A survey conducted by Triguero et al. (2023) among Spanish manufacturing companies proved that when designing products, the most common practice is to design for recycling, followed by design for reuse (DfR) and design for disassembly (DfD) (Triguero et al., 2023).

An analysis among Polish small and medium-sized enterprises (SMEs) carried out more than 10 years ago, i.e., prior to the intensification of the European Union's pro-environmental policy, showed little interest in ecodesign (Annuszewska et al., 2011). Recent studies show

a much higher level of engagement in companies in this area, especially among large companies, but the pro-environmental orientation of SMEs is also observed (Dostatni, Mikołajewski, Rojek, 2023). What makes the research presented in this article valuable is the attempt to show the issue of ecodesign on the example of companies from different industries in Poland. On the basis of the results obtained, attention was drawn to the necessity of reinforcing entrepreneurs in the field of ecodesign. Research conducted using interviews and company workshops with Finnish manufacturing companies showed that for supporting product design, there is a need for more comprehensive coverage of social, circularity and criticality aspects, and life cycle thinking in sustainability assessment (Hanski et al., 2024). Research on product sustainability has also been conducted in the Swedish fashion industry. A need of specific knowledge was underlined. Most of the interviewees emphasized the importance of knowing their whole supply and value chain for sustainable design, production and logistics, for reducing emissions, water use and chemicals, and for enabling transparency and recycling (Le Feber, Smit, 2023).

## 2. Methods

The study was carried out using the individual in-depth interview method with representatives of 24 companies, in close cooperation with the Warsaw Marketing Research Centre. As noted, manufacturers from industries representing product categories that fit into the EU's Sustainable Products Initiative were invited to participate in the study (PKD codes: 14.13, 31.09, 26.20, 27.40, 27.51, 23.32, 23.99, 20.30). The criterion used to select companies for the qualitative study was commitment to product-focused environmental activities. Recruitment was carried out by a trained person using an appropriate questionnaire. Data of companies were taken from the database Dan & Bradstreet and the Central Economic Information Service. During recruitment, an attempt was made to contact more than 600 companies. The list of entities for which contact details were available (as of 14.12.2022) is shown in Table 2.

The main causes of excluding a company from the study were ineffective contact or refusal for various reasons, usually due to lack of time (the study was intended for a manager with responsibility for product policy with an understanding of environmental issues) or lack of interest in pro-environmental activities. At last, 24 companies were chosen. A brief description of the companies interviewed is provided in Table 3. The study was conducted using a structured interview scenario. Each interview was recorded and transcribed. The interview transcriptions were analyzed through content analysis.

**Table 2.**
*Number of companies for which contact details were available*

| Industry | Employment | | | |
|---|---|---|---|---|
| | **Up 9** | **10-49** | **50-250** | **Over 250** |
| Manufacture of other outerwear | 951 | 344 | 98 | 9 |
| Manufacture of other furniture | 1478 | 338 | 188 | 96 |
| Manufacture of computers and peripheral equipment | 221 | 36 | 10 | 5 |
| Manufacture of electric lighting equipment | 177 | 57 | 50 | 13 |
| Manufacture of household appliances | 28 | 15 | 11 | 20 |
| Manufacture of building ceramics | 40 | 30 | 10 | 4 |
| Production of insulating materials | 70 | 50 | 23 | 4 |
| Production of paints and varnishes | 127 | 71 | 30 | 9 |

Source: author's elaboration.

**Table 3.**
*Characteristics of companies participating in the study*

| Respondent code | Industry | Number of employees | Organizational and legal form |
|---|---|---|---|
| 1 | Manufacture of other outerwear | Up 9 | Individual business activity |
| 2 | Manufacture of other outerwear | 10-49 | General Partnership |
| 3 | Manufacture of other outerwear | Over 250 | Joint-stock company |
| 4 | Manufacture of other furniture | 50-250 | Individual business activity |
| 5 | Manufacture of other furniture | 50-250 | Limited liability company |
| 6 | Manufacture of other furniture | 10-49 | Individual business activity |
| 7 | Manufacture of computers and peripheral equipment | Up 9 | Individual business activity |
| 8 | Manufacture of computers and peripheral equipment | 10-49 | Individual business activity |
| 9 | Manufacture of computers and peripheral equipment | 10-49 | Limited liability company |
| 10 | Manufacture of electric lighting equipment | 10-49 | General Partnership |
| 11 | Manufacture of electric lighting equipment | 10-49 | Limited liability company |
| 12 | Manufacture of electric lighting equipment | Over 250 | Limited liability company |
| 13 | Manufacture of household appliances | Over 250 | Joint-stock company |
| 14 | Manufacture of household appliances | Over 250 | Limited liability company |
| 15 | Manufacture of household appliances | 50-250 | Joint-stock company |
| 16 | Manufacture of building ceramics | Up 10 | Limited liability company |
| 17 | Manufacture of building ceramics | 50-250 | General Partnership |
| 18 | Manufacture of building ceramics | Over 250 | Limited liability company |
| 19 | Production of insulating materials | 10-49 | Limited liability company |
| 20 | Production of insulating materials | Over 250 | Limited liability company |
| 21 | Production of insulating materials | 10-49 | Limited liability company |
| 22 | Production of paints and varnishes | 10-49 | Limited liability company |
| 23 | Production of paints and varnishes | 10-49 | Individual business activity |
| 24 | Production of paints and varnishes | 50-250 | Limited liability company |

Source: author's elaboration.

## 3. Results

As an introduction to the interview topic, the question was asked: *have you ever heard of ecodesign?* This question was answered in the affirmative by 14 respondents, with 8 of them giving a strongly positive answer. The others supplemented their statement with phrases such as "I've heard about it", "I've heard, but only in buzzwords", or "I've heard something there". Respondents who answered yes to the first question were then asked to describe the context in which they had heard the term ecodesign. The most frequent answers were “legal requirements” and “general market trends”. In the third question, respondents were asked to define ecodesign. The statements were grouped into 3 main categories, which were assigned subcategories (Table 4).

**Table 4.**
*Definition of ecodesign*

| Superior category | Major category | Frequency of occurrence | Subcategory | Frequency of occurrence |
|---|---|---|---|---|
| Definition of ecodesign | Definitions including the general principles of eco-design | 11 | action related to ecology | 5 |
| | | | designing with the principle of environmental sustainability | 1 |
| | | | manufacturing the best products in terms of ecology at minimum cost | 2 |
| | | | manufacturing environmentally friendly products | 3 |
| | Definitions including the selected life cycle issues | 16 | manufacturing products with the least pressure on the environment | 6 |
| | | | manufacturing products that are easily degradable | 4 |
| | | | using eco-friendly materials | 1 |
| | | | implementing solutions allowing optimal energy consumption | 1 |
| | | | lowering the wastefulness of production | 1 |
| | | | creating durable products | 1 |
| | | | creating products from recyclates | 2 |
| | Definitions related to the life cycle | 4 | Design taking into account the environmental performance of the product in the whole life cycle | 2 |
| | | | Design taking into account all environmental aspects occurring in the life cycle of a product | 2 |

Source: author’s elaboration based on conducted research.

As a rule, respondents allowed themselves a broader and multi-faceted statement, starting with the general premise of ecodesign (e.g. an ecology-related activity), and then supplemented the argument by referring to selected product life cycle issues. The respondents often pointed to "manufacturing products with the least pressure on the environment" (6 statements). Reference to the term "product life cycle" in the definition of ecodesign appeared four times. Of the respondents giving this answer, two belonged to the energy-related products industry.

The next question was: *How do you identify and assess the environmental aspects of the products you design/develop?* None of the surveyed companies indicated a specific method used independently and systematically (e.g. MET matrix, ERPA /MECO matrix, ECM method, EQFD Ecodesign Pilot method, MIPS method, LCA method). One of the surveyed entities belonging to the energy-related products industry uses a calculator prepared for internal purposes, which contains basic parameters for calculating the carbon footprint. Significantly, none of the surveyed entities uses a documented procedure to identify and assess the environmental aspects of designed/developed products.

Subsequently, respondents were asked what rationale they follow when designing/developing products in terms of environmental features. The statements were grouped into 3 main categories and 6 sub-categories (Table 5). Most surveyed companies rely on the experience and intuition of employees and consider their product-oriented pro-environmental actions to be subconscious (9 statements). Few companies study the environmental preferences of their customers (5 statements). Most of these companies have their own design departments (4 entities), so internal expertise is an additional rationale for environmental product development. Externally sourced R&D services are used by 5 entities, of which 2 entities indicated the use of advanced analyses such as carbon footprint calculation (manufacturer of energy-related products) and LCA studies (manufacturer of insulating materials).

**Table 5.**
*The rationale for ecodesign*

| Superior category | Major category | Frequency of occurrence | Subcategory | Frequency of occurrence |
|---|---|---|---|---|
| The rationale for ecodesign | Signals from the market | 10 | Customer preferences (determined by consumer research) | 5 |
| | | | Competitors' activities | 3 |
| | | | Individual requirements of customers | 2 |
| | Signals from inside the organization | 14 | Experience and intuition of employees | 9 |
| | | | Expert knowledge from within | 5 |
| | Other | 5 | External R&D | 5 |

Source: own elaboration based on conducted research.

Another issue raised in the interview was the competence of the surveyed companies in developing the products' environmental aspects. Representatives of the interviewed entities were asked to rate their competence on a scale from 1 to 5 (where 1 means no competence, 5 means very high competence). Most of the surveyed companies considered their competence to be very high (9 statements) or high (7 statements). Only 3 companies admitted they were not competent in this area, and 2 companies considered their competence to be low. The others had no opinion on the matter.

The next question of the interview focused on the environmental aspects that are most important to respondents during product design/development. Respondents were asked about direct environmental aspects (which are under their management control) and environmental

aspects occurring in a life cycle perspective (beyond management control, but which the manufacturer can influence). When asked about the direct environmental aspects considered during product design/development, most respondents stated the answer one without thinking long. "Consumption of production materials" was indicated most frequently (11 statements), followed by "energy consumption during operational processes" (6 statements). Respondents were also asked to identify the most critical environmental aspects from the product life cycle perspective. For the majority of respondents, "product durability/ reliability" was the most important one (11 statements).

Finally, respondents were asked to comment on what helps them plan and implement activities that serve to design and develop the products they offer with respect to environmental issues. In this regard, having an environmental management system, the presence of an environmental mentor, and working in an interdisciplinary team could be potentially important (Glenn, 2002; Gupta, Dangayach, Singh, 2015). The purpose was to determine whether a particular factor is present - if so, how important it is.

One tool that potentially supports pro-environmental activity is an environmental management system based on ISO 14001. Among the surveyed companies, only 3 have a certified system that meets the requirements of ISO 14001. Importantly, each of them considered this system a significant factor in developing the environmental aspects of the products. 6 companies rely on internal guidelines for environmental issues (calling them an “internal standard”, “company standard”, or “departmental book”). Half of them stated that internal guidelines are essential in developing the environmental aspects of the products, while the rest had no opinion in this regard.

Another issue raised was the question of defining environmental targets for specific product parameters. Only 1 company out of 3 with a certified EMS admitted that it formulates ecodesign goals. The other manufacturers define goals for the entire organization, e.g. in the area of material consumption. A representative of this company assessed that such action clearly helps them improve their products' features. Two companies without a formalized EMS declared that they define environmental goals for their products. One company assessed such a practice as very helpful.

A potentially important factor supporting companies in pro-environmental activities is the presence of an environmental mentor in the company. Among the surveyed companies, 9 entities admitted that such a person exists at their company. For the vast majority (7 statements), the presence of an environmental mentor is an important or critical factor in supporting the product design/development process. A company representative commented as follows: "The environmental mentor not only spreads good energy or encourages various activities but also keeps an eye on what we already have". A representative from another company pointed out that “while the environmental mentor oversees all pro-environmental activities, the most important role is played by product mentors, who are responsible for creating the product and implementing pro-environmental changes”.

The next question addressed the issue of working in an interdisciplinary team. Among the surveyed entities, 16 companies confirmed that they establish interdisciplinary teams when designing or developing products, and for 12 of them, this is an important or very important factor supporting the development of the pro-environmental features of these products. Networking (the process of information exchange) was mentioned several times as an important factor in the above area. For example, one company described the practice of periodic meetings between salespeople or product managers and management, during which suggestions for product development are given to designers.

## 4. Discussion

The qualitative study included companies that belong to selected industries and declared during recruitment that they take pro-environmental measures focused on products. Nevertheless, the question, *Have you ever heard of ecodesign*? not by all respondents was answered in the affirmative. Only one-third of the respondents answered this question with a definite affirmative. There was also some disappointment in the way ecodesign was defined. Many statements manifested pertinent insights, but only 4 respondents were able to define the concept of ecodesign comprehensively. Of the respondents giving this answer, two belonged to the energy-related products industry. Given that ecodesign requirements have long been developed for these sectors, one might have expected more manufacturers of energy-related products to give a comprehensive definition. However, the previous study proved that ecodesign requirements are unquestionable drivers for activities from a life cycle perspective. For example, all surveyed manufacturers of energy-powered products improve their products in terms of energy intensity (Joachimiak-Lechman, 2024). A study conducted over a decade ago by Akman, Pişkin, and Kremer (2011) showed that even then understanding of ecodesign is particularly pronounced among suppliers of electrical and electronic components (Akman, Pişkin, Kremer 2011).

Legal issues as well as pragmatic consideration drive ecodesign, as confirmed by other studies (Siwiec et al., 2023). When asked about the direct environmental aspects considered during product design/development, respondents most frequently indicated “consumption of production materials”. For many companies, this aspect was important mainly for economic reasons. A similar insight can be drawn for environmental aspects of the product life cycle. The majority of respondents assessed "product durability/reliability" as the most important one, highlighting the correlation of this aspect with customer satisfaction.

It is noteworthy that none of the companies surveyed disclosed the specific method they use independently and systematically to identify and assess the environmental aspects of the product life cycle. In most cases, these companies depend on the experience and intuition of

their employees. Quite surprising, then, are the statements made by the companies surveyed about the competence in developing the environmental aspects of the products they offer. Most of them were rated as very high or high. Despite the high level of self-assessment, based on the entirety of the respondents' statements, it can be concluded that there is a need to support companies in the area of ecodesign, for example, by organizing training and workshops to explain ideas, strategies, principles of ecodesign, etc.

## 5. Summary

It can be concluded that not all companies participating in the study are aware of the idea of ecodesign. It was noted that some respondents found it difficult to clearly describe the assumptions of ecodesign. Many respondents seemed to be interested in selected elements of ecodesign. None of the surveyed entities uses a documented procedure to identify and assess the environmental aspects of designed/developed products. However, they were able to select the most important direct and indirect aspects of the products they offer, which are taken into account in the design/development process. Additional conclusions are as follows:

- Companies with a certified environmental management system recognized that it is a crucial factor that helps to develop environmentally friendly products.
- For the vast majority of entities that declared the presence of an environmental mentor in the company, it is an important or very important factor supporting the ecodesign or environmental development of products.
- For most entities that confirmed that they set up interdisciplinary teams when designing or developing the products with respect to environmental issues, it is an important or very important factor supporting such activities.

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