White paper on eco-design and Life Cycle Assessment (LCA) in the industry

[Product ecodesign = product + eco + design]

This document intends to share the voice of the industry on the topic of ecodesign, supported by the conduct of life cycle assessment, taking into account the market and customer's perspective (a "product" developed to match a customer need), environmental considerations ("eco") and engineering views ("design"), to depict what an industrial application of ecodesign should be.
Observations and statements here are built on existing international standards about ecodesign and practical experiences from the members of the Community of Interest (CoI).
For the sake of simplicity and ease of reading, the term "product" in this document embraces products; hardware/ software/ integrated solutions and services (standard solution in portfolio or customer specific solution).
We distinguish here the nature of a LCA, which is a measurement tool of environmental impacts, from ecodesign that is conducting systemic changes in product design and development processes and fosters circular economy. As such, a LCA is an instrument at the service of ecodesign.

The environmental impact of most companies is generally either at the upstream or at the downstream of their value chain, not in the intermediate operational activities. In terms of GHG, the majority of emissions are falling under Scope 3, as opposed to Scopes 1 and 2. As such, to align with the long-term environmental commitments pledged by the members of the CoI (such as SBTi and the Paris Agreement), a transformation in the design, manufacturing, sales, usage, recycling, and disposal processes is required. Ecodesign is an approach enabling industries to remain on course with their decarbonization goals. Maintaining credibility among all stakeholders, including investors, regulators, customers, civil society, NGOs, partners, and distributors, is essential

Ecodesign and products fundamentals: a pragmatic and business approach

Customer centricity

The CoI members would like to emphasize the importance of keeping in mind customer centricity and that environmental objectives should not undermine the primary objective of a product, which is to respond to a customer by reaching the expected performances and needs.

Environmental objectives, safety and security standards and product/service performances

The CoI members acknowledge the significance of integrating environmental considerations into the decision-making process of product design, while ensuring compliance with established safety and security standards.
The concept of trade-off, as advanced by the ISO/IEC62430:2019 standard on ecodesign principles, assumes paramount importance. It is relevant to observe that such trade-offs extend beyond a single environmental aspect ("different environmental aspects throughout all life cycle stages" or a "specific aspect between life cycle stages" -Cf. §4.2 c and d) and should "take into account other aspects such as safety, quality" (Cf. §4.2 a). Although it is part of the informative annex of the standard, the significance of note 3 in §A.2, which addresses trade-offs between environmental, technical, and quality aspects, is particularly important for industrial stakeholders.
Numerous products can effectively have a direct impact on customers' life and safety (eg: a car's seat or tire, electric appliances etc..). As such, no technical option should be imposed as a standalone requirement because it has expected environmental benefits (e.g. by a customer towards its accountable prime supplier). Instead, the influence of an option on the entire product must be thoroughly assessed and proven not to result in any safety compromise before it is adopted (e.g. a given renewable material that might negatively affect the reliability or safety of a product.)
Conversely, the rejection of a technical solution offering anticipated environmental benefits must not be arbitrary. The decision should also result from a thorough assessment, evaluating the solution's impact on the product overall technical-economic trade-off. For instance, the adoption of recycled metals with identical properties or the incorporation of recycled polymers with slightly lower but sufficient properties compared to virgin materials exemplify potential approaches.

Ecodesign, a lever to anticipate regulations and requirements

The CoI members recognize the imperative of incorporating environmental objectives and provisions into market and customer requirements. While binding legislation has already established

environmental frameworks, objectives, and requirements in many sectors, this trend is expected to increase with upcoming standards, directives, and regulations such as CSRD, Green Taxonomy, ESPR, DPP, and Green Claims. The integration of environmental performance into product design hence serves as a potent lever for anticipating future market needs and regulatory compliance. This, in turn, creates a strong incentive for effective ecodesign management throughout the product design and development process.
Besides, when customers express their needs, they do not consistently address environmental concerns in a comprehensive manner. While some requirements are mandatory, such as compliance with regulations, or evident, like the desire to limit waste and pollution even below regulatory thresholds whenever possible and affordable, there are other requirements and options that are not fully known by the customer. Consequently, manufacturers must take the initiative to propose achievable impact reduction targets that align with environmental commitments.

Environmental benefits to support the product value proposition

The functional and business approaches are intertwined with ecodesign, as they all strive to maximize a product's efficiency.
The ISO/IEC62430:2019 standard (§ 3.2.1) highlights the business perspective in product development, emphasizing the creation of a value proposition throughout the various stages of the product life cycle. The dedicated section (§ A.1.3) focuses on the "determination of aspects of the product [that] could be optimized so as to minimize adverse environmental impacts" without downgrading the functionality delivered, or upgrading that are not necessary.
The adoption of an ecodesign approach alongside a business mindset are mutually reinforcing and support the identification of business drivers and product properties enabling effective and efficient reduction of environmental impacts. The product's value proposition, which lies at the core of product development, must also serve as the foundation of an industrial ecodesign approach. An example of this integration can be found in the reduction of embedded mass in equipment, which contributes to decreased fuel consumption of a platform.
Thus, it is crucial to transcend a sole focus on environmental factors and merge it with a business perspective. It is the role of companies to transform ecodesign principles into functional offerings that provide tangible benefits to customers.

The data challenge and the need for cooperation

For a holistic thinking…

The concept of life cycle thinking aims to address the environmental impacts generated throughout the entire life cycle of a product, encompassing its journey from production to disposal (i.e cradle to grave), including the usage phase. Yet, a significant challenge arises from the fact that a single actor often holds influence only over one segment of the production chain.
The ISO/IEC62430:2019 standard, for example, highlights the impact of material selection on the overall scale of an automobile. It notes that opting for lightweight materials, such as high-alloy steel or aluminum, may require higher energy expenditure during the manufacturing stage; however, the trade-off is lower fuel consumption during the use stage due to the reduced mass. This consideration extends beyond the car or platform manufacturer and should be acknowledged throughout the entire value chain, involving customers and suppliers alike.

… Calling for better cooperation along the value chain

Establishing upstream collaboration with suppliers and fostering collaboration downstream with customers is essential to fully unlock improvement potential. Engaging the entire value chain is however challenging due to variations in maturity levels and practices among different actors. Moreover, the tools and calculation methods used may differ across the value chain, further adding complexity and emphasizing the necessity of cooperation. Such collaborations should be built upon a shared understanding of needs and potential solutions. Long-term partnerships thrive on trust between partners, which can be strengthened through transparent data exchange throughout the value chain. The ISO/IEC 62430:2019 standard (§5.6 and 6.6) as a matter of fact addresses the exchange of information within the value chain and underlines that "it should facilitate the reduction of adverse environmental impacts throughout the entire life cycle of the product." The standard adds, "Information exchange for cooperation among the relevant stakeholders involved should start as early as possible in the [Ecodesign process]." Whenever feasible, data exchange should therefore be incorporated into long-term contracts signed between partners. This would allow complete traceability of environmental benefits for end users and ensures fair and transparent distribution of the generated value.

To facilitate successful early cooperation and the exchange of relevant information for the design activities, examples of information that should be exchanged need to be identified. This adds to the information about the environmental aspects of either the complete system under development (provided by the system integrator) or some of its components (provided by the supplier).
While it is customary to request environmental data from suppliers, certain clarifications are necessary to avoid confusion regarding the objective, feasibility of data delivery, and the actual utilization of the data. Additionally, as mentioned earlier, suppliers may not all be at the same level of maturity or employ identical calculation methods.
Firstly, it is imperative to consider both general information about a supplier, such as its policies and certifications, as well as information about its components, for example to be able to provide data to carry out LCAs. These types of information should however be collected and treated differently by buyers/procurement. Secondly, it is crucial to distinguish between existing components (Commercial Off-The-Shelf - COTS) and those specifically designed for the customer via the "build to specification" approach. In the latter case, complete data may not be readily available, necessitating additional efforts to obtain robust data.
Collaboration around operational information from customers and users, such as anticipated usage conditions and end-of-life scenarios, would also be beneficial to the entire supply chain, particularly for co-engineering purposes. This collaboration would enable the integration of related constraints and opportunities in a coherent manner. Examples of such collaboration include take-back contract with customers, preventive maintenance of the product with the customer, which can be valorized to extend products life or product as service model.

Data heterogeneity, a challenge to cooperation

While in the past, available data and sources of data were both limited; today, we are faced with an abundance of sources and tools, diverse databases and calculation methods, resulting in discrepancies in numerical values and data uncertainty. The qualification of data has consequently become a concerns as the lack of accessible data that is robust and standardized is an obstacle to establishing

baselines and clear targets as well as carrying out evaluations, which are all crucial for making progress in addressing environmental challenges.
To improve the current situation, it is necessary to establish common improvement objectives, that promote the development of homogeneous and robust datasets for specific sectors and the pertinent communities involved. This could foster a collaborative environment and drive progress towards addressing data-related challenges in ecodesign.
Creating such solid pool of data is however challenging considering the competitive landscape in which industrial actors operate. To overcome this challenge, having the support and overseeing of third-party entities and/or the public sector acting as a guarantor appears as necessary. An example can be found in the tire industry through initiatives like the Tire Industry Project (TIP), which focuses on defining standards and developing databases for tire materials.
Notwithstanding the complexity surrounding data, it should not impede decision-making process promoting ecodesign. In the upstream phase, detailed and thoroughly validated data may not be mandatory and preliminary data can suffice to guide initial decision-making processes.

Implementing ecodesign in practice: the need for tailored approach and tool

LCA: an evaluation supporting eco-design activities in practice and not only theory

Environmental assessment practices need to be adapted to align with ecodesign activities, rather than the other way around. The CoI members advocates for an iterative assessment approach, that corresponds to the evolving maturity of the solution being developed.
In certain cases, particularly for complex industrial products, only limited information about the future product is available at the early development stages. This limitation however does not pose a significant problem for ecodesign activities, which primarily require key trends to estimate environmental impacts and determine the appropriate directions for improvement. In fact, some CoI members have observed from experiences that it is crucial to incorporate environmental evaluations and ecodesign orientations from the early stages to prevent arriving too late, when the R&D budget has already been allocated, the product structure already defined and materials already chosen.
The ISO/IEC62430:2019 standard, in §6.3.d, paves the way for adapting environmental assessment practices to the actual context and possibilities. It states: "in order to determine what aspects are significant, the organization should establish a method, based mainly on environmental criteria, which should take into account as many types of environmental impacts as possible." This implies that, in order to anticipate the environmental impact of a product, considering a broad range of impacts beyond CO2 is recommended. Yet, it is important to point out that a comprehensive coverage of impact may not always be the best way to go, as a multi-criteria approach can introduce complexity and slow down decision-making processes for ecodesign. This complexity can be addressed by using methodologies that propose the calculation of a “Single score” based on all the categories of impact. The priority then should be placed on identifying the most significant aspects. In other words, the early simplified assessment should primarily focus on environmental aspects that are key sizing parameters for architecture and design, and only partially on impacts that represent the "translation" of environmental aspects into effects.
Once the product is developed and technical information becomes available, the environmental assessment may evolve towards more classic and accurate LCAs for the sake of environmental improvement characterization and recording and, if needed, it can also support communication. When conducting a comprehensive assessment is possible, it effectively allows to identify impacts that would otherwise be challenging to predict. It is essential to emphasize that pre-design and post-design

assessments complement each other, and are not mutually exclusive or in competition with one another

Finally, one need to keep in mind that the diversity of approaches by different actor will remain as long as environmental databases are not exhaustive nor standardized.

Tools and support available

Directly linked to the need to customize lifecycle assessments addressed in the preceding paragraph, is the need to develop corresponding tools to enable these assessments. The members of the CoI have all had to develop their toolboxes, suited to their specific sector of activity.
Whether it takes the form of guidelines, checklists, scorecards, or even more advanced digital computing tools built using internal data, creating these tools can be challenging and resource-intensive. One possibility to mitigate the complexity of carrying out full LCA is to generate a large set of results from an initial set of LCAs and to use the output to create simplified models.
As such, as mentioned in the paragraph on data heterogeneity, support from regulators and institutions would be welcome. It could be sharing do's and don't, gathering experiences from multiple actors in order to establish sector specific recommendations of best practices, sharing tips on tools creation and tailoring, databases harmonization etc...

Promoting the adopting of ecodesign practices: culture change and financing

Culture change

The implementation of ecodesign necessitates a shift in processes, which in turn requires concrete support from top management. This support can take the form of financial resources, directives, and integration within the company's overall strategy. Additionally, training employees at various levels is crucial to facilitate this process of change.
All members of the CoI have recognized the importance of training employees at two distinct levels. On one hand there is a need to train specialists and experts who will be responsible for tasks such as conducting life cycle evaluations, carrying out calculations, and serving as references or support for other functions in relation to ecodesign. This training for specialists delves into deeper technical aspects. On the other hand, there is also a need for more general and informative training. The CoI members agree that for ecodesign to be fully integrated into industrial processes, it cannot remain solely the responsibility of specialists. Knowledge must be disseminated and popularized throughout the organization. Additionally, it should be noted that the implications of ecodesign extend beyond environmental considerations. It is important for employees to grasp the potential risks, such as financial and business risks, particularly those posed by climate change, that a company may face if it does not implement ecodesign.
Beyond training specialists and non-specialists, the engagement and commitment of management at all levels (senior, middle, and supervisory) is mandatory in order for significant change to occur. For ecodesign to become a standard practice across an industry, and for the development of appropriate trainings, tools, and support systems for ecodesign, the management must actively endorse, support, and provide the financial resources for these initiatives. Without such commitment, the transformation will be slow, sporadic and lack systematic implementation.

Financing and costs of ecodesign

As stated earlier, in order to effectively integrate ecodesign into processes and practices in a sustainable and enduring manner, it is essential to adopt a business perspective that incorporates considerations of profitability. Consequently arises a need to evaluate the costs associated with ecodesign, both recurring and non-recurring, and to engage in discussions regarding how to finance these initiatives initially.

Presently, not all customers are willing to pay the highest price solely in the interest of sustainability and environmental impact. There is today a complex and variable relationship between sustainability, financial considerations and risks. Depending on the customer, each parameter might be weighted differently resulting in different priorities.

Conclusion

Through this paper, the CoI members have sought to provide an understanding of the challenges they face in their respective industries when implementing LCAs and adopting ecodesign practices. Although each sector has its own particularities, through collaborative discussion and knowledge-sharing, common challenges, good practices and areas were increased cooperation is needed have been identified. Attention has notably been drawn to the importance of customer centricity and the fact that ecodesign aligns with a business mindset. The challenges around the availability of robust and qualified data has been stressed, calling for further cooperation with the support of a third party and/or the public sector. Another challenge commonly found in the experience of all members is the challenge of culture change and of embarking the top management, which is also directly linked to the question of the cost of ecodesign and how to finance it.

The CoI members aspire with this paper to foster further dialogue among industrial stakeholders, policymakers, and relevant entities within the European Union (EU). It is their hope that this collaborative effort fosters a shared understanding and paves the way for meaningful progress in realistic sustainable industrial practices