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Sustainable Innovation in the Household Appliances Sector: Implementation of Ecodesign and Sustainable Material Selection in an Italian Company - Drivers, Limitations and Insights from Field Research.

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INTRODUCTION: Sustainable transition for product manufacturing companies requires the coordinated action of policymakers, universities and research centers, industries and consumers. Thus, stimulating dialogue and collaboration between academia and real business realities is a valuable opportunity to create fruitful synergies: scholars – being privileged observers into research issues – may provide companies with innovative, scientifically sound and long-termed methodological insights. Companies, on the other hand, may stimulate researchers' awareness on real-world challenges that industries must face. This assumption prompted the Italian institutional initiative "From research to business" within which the Ministry of University and Research is co-funding – together with Italian companies – research projects to support sustainable innovation. One of these projects has been co-financed by a large Italian household appliance company and is currently carried out by the authors. The overarching research aim is the development of a novel holistic approach to integrate material selection for sustainability and sustainable design-related strategies for Italian household appliances manufacturers. The contribution presents the main insights derived from field research conducted within the above-mentioned company.

To date – at least regarding scholarly knowledge – both material selection[1] and sustainable and circular design[2] are individually broadly explored fields and may count on major literature contributions. However, these theoretical approaches - although potentially valid - are not always actually and efficiently implemented in real business contexts: this implementation gap affects the full exploitation of the competitive advantage and environmental benefits that such methodological strategies and processes could instead offer if introduced since the early product design and material selection phases. Furthermore, manufacturing companies (product-oriented) must deal with increasingly strict regulatory requirements regarding sustainability (e.g. ESPR, PPWR) to ensure product compliance: therefore, it is increasingly essential to implement strategies to both reduce impacts along the product life cycle *(ecodesign approach)* and to ensure a responsible and circular use of materials *(eco-informed material selection).*

METHODS: the research is based on a mixed-method approach, according to the following protocol:

1. Mapping of the existing interactions among different company departments (design, quality, legal, etc.) for material selection and product design choices through unstructured and semi-structured interviews with company stakeholders.

[1] Ashby, M. F., 2022; Ashby, M. F., 2012; Ashby, M. F., & Johnson, K., 2013
[2] Bakker, C. A. et al., 2014; Bhamra, T., & Lofthouse, V., 2016; Bocken, N. M. et al., 2016; Clark, G. et al., 2009; Vezzoli, C. & Manzini, E., 2008

2. Provision of training activities on sustainable design tools and methods and material selection delivered by academic researchers.
3. Identification – through participatory activities – of sustainability-related decisions drivers, factors impacting design choices, requirements impacting on materials selection; and, not least, of the limits to the use of ecodesign tools (e.g. checklists, LCA or Design for X approaches, CAD-integrated tools, etc.).

RESULTS: The research identified the main drivers guiding sustainability-related choices in the studied household appliance company such as the impact of the regulatory framework (e.g. introduction of reparability indices, EPR schemes, limitations on the use of certain packaging materials), consumers' attention to environmental issues and brand positioning (e.g. perceived quality and durability). Furthermore, critical aspects that nowadays limit the integration of environmental considerations since the early design stages were also extracted.