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Systematic Review

Integrating Circular Economy Principles in the New Product Development Process: A Systematic Literature Review and Classification of Available Circular Design Tools

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Abstract: Nowadays, the circular economy represents a promising strategy for achieving sustainable development through optimising resource efficiency, extending product lifespans, and reducing environmental impacts. Despite the growing interest in circular design practices, companies often face difficulties integrating these principles into their established New Product Development (NPD) processes. This is mainly due to the overwhelming number of available design tools and methods, which are fragmented, challenging to navigate, overlap in functionality, and lack standardisation. This study provides a comprehensive mapping, classification, and analysis of 77 existing circular design tools identified through a systematic literature review and supplementary online searches. The tools were systematically categorised according to format, data type, industry sector, circular strategies, innovation focus, aims, and applicability across the NPD stages. The results indicate a predominance of physical, qualitative, and sector-agnostic tools, emphasising circularity integration within the Discover, Define, and Develop phases of the design process. This structured classification facilitates stakeholder navigation of existing resources, highlighting opportunities for more targeted, industry-specific tool development, consumer-oriented approaches, and the importance of considering Industry 4.0 technologies in circular design practice. Future research could address these gaps by developing customised frameworks, validating tool effectiveness through real industrial applications, and promoting deeper integration of circular design tools within NPD practices and business objectives.

Keywords: circular economy; circular design; new product development; NPD; design tools; systematic literature review

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1. Introduction

In an era increasingly defined by resource scarcity, climate change, pollution, and biodiversity loss, the circular economy has emerged as a viable solution for achieving sustainable development [1]. This paradigm represents a fundamental shift from the conventional linear economic model—which follows a pattern of resource extraction, production, consumption, and disposal, leading to significant material losses—toward a more regenerative system. The circular economy promotes strategies such as leasing, sharing, reuse, maintenance, repair, refurbishment, and recycling of materials and components, aiming to optimise resource efficiency, extend product lifespans, and minimise waste generation [2,3].

The European Union has played a leading role in institutionalising and accelerating this transition through a range of regulatory and strategic frameworks. Notably, the Circular Economy Action Plan (CEAP), launched in March 2020, outlines a broad roadmap to promote sustainable products, empower consumers, and foster circularity in production processes. The CEAP covers many sectors, including electronics, ICT, textiles, construction, packaging, and food systems [4]. More recently, the Ecodesign for Sustainable Products Regulation (ESPR), adopted in 2024, established a set of ecodesign requirements for nearly all product categories placed on the EU market, expanding beyond energy-related products to address circularity, durability, reparability, and material content [5].

A key enabler of this transition is circular design, an approach aimed at developing products and services that maximise material efficiency while maintaining high functionality and minimising environmental impacts across their entire lifecycle [6,7]. By embedding circular principles in the New Product Development (NPD) process (the New Product Development (NPD) process is a structured set of activities aimed at transforming an organisation's concept into a market-ready product by integrating technical advancements and responding to market opportunities. It encompasses iterative stages of ideation, design, prototyping, evaluation, and commercialisation to ensure feasibility, innovation, and competitive advantage [8,9]), circular design can drive economic growth while mitigating environmental harm [10,11].

In addition, the emergence of Industry 4.0 and digital technologies, such as artificial intelligence (AI), the Internet of Things (IoT), additive manufacturing, and big data, is reshaping the way products are conceived, designed, manufactured, and delivered. These technologies open up new opportunities for innovation and sustainability, but they also pose complex design challenges to consider [12].

Within this evolving landscape, designers and other stakeholders involved in NPD play a pivotal role in shaping the environmental impact of products throughout their lifecycle, particularly in the early design phases [13,14]. These initial stages are critical, determining most of a product's environmental footprint [15]. Key decisions made at this stage—such as selecting renewable resources, material choices, energy consumption, toxicity, waste management, and recovery strategies—have long-term implications for sustainability [16]. Once product specifications are finalised and resources, infrastructures, and processes are allocated, only minor modifications are still feasible [10].

Despite the increasing recognition of circular design principles, integrating them into industrial product development remains a challenge for many companies. While a large number of tools and methods have been created to support circularity, the sheer abundance and fragmentation of these resources often hinder their adoption [17–20]. Companies frequently struggle to navigate the landscape of available tools, making it challenging to identify the most appropriate resources for their specific needs. Additionally, many tools overlap in purpose, lack standardisation, or are not designed with direct industrial application in mind, further complicating their implementation [16,21–24].

Several studies have attempted to map and classify circular design tools to facilitate their use in industrial settings. For instance, Rexfelt and Selvefors categorised 65 tools into five main families to improve navigation and selection [25], while Royo et al. mapped 70 circular tools and methods to assess how many addressed product lifespan extension [26]. Additionally, Suppipat and Hu conducted a scoping study to investigate the availability of circular design tools, specifically in the electrical and electronic sectors [6].

While these studies offer valuable insights, they highlight the need for a comprehensive and updated overview that systematically organises the extensive range of circular design tools and maps them specifically to the early stages of the NPD process. The absence of such a structured classification makes it difficult for companies to access, evaluate, and

effectively implement these tools, creating a persistent challenge in the practical application of circular design strategies [23,27,28].

This study seeks to address these limitations by mapping, classifying, and analysing available circular design tools. Specifically, it aims to answer the following research questions:

- What circular design tools and methods are currently available, and how can they be classified to support the early stages of the NPD process?
- To what extent do these tools overlap, and what are the key gaps in their characteristics and applicability within the NPD process?

By systematically classifying 77 available resources, this research supports NPD stakeholders in identifying and adopting the most relevant tools, facilitating their integration into product development. Finally, this study contributes to the ongoing discourse on circular design by critically assessing the existing landscape and identifying critical gaps to guide future research in the field.

The rest of this paper is organised as follows: Section 2 describes the research methodology, including the systematic literature review process and classification criteria. Section 3 displays the results and interpretation of the tool mapping and categorisation, supported by explanatory visuals. Section 4 discusses the findings and summarises key insights. Finally, Section 5 concludes the paper and proposes directions for future research.

2. Methodology

The methodology consists of three main steps: (1) identifying relevant tools through a systematic literature review, (2) categorising tools based on key classification criteria, and (3) mapping tools to the early stages of the New Product Development (NPD) process. Each step is detailed in the following subsections. The entire analysis and classification process was conducted using Microsoft Excel, while data visualisation and graphical representation of results were performed using the RAWGraphs open-source platform [29].

2.1. Systematic Literature Review

To ensure methodological rigour in identifying circular design tools from existing research, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [30] were followed, although the review protocol was not formally registered.

A preliminary comparison between Web of Science and Scopus revealed that both databases produced similar search results. However, Scopus was ultimately selected as the sole source because it is the largest abstract and citation database of peer-reviewed literature, providing extensive global and regional coverage across multidisciplinary research fields [31].

Based on the first research question, the following search query was formulated: TITLE-ABS-KEY ((“new product development” OR “NPD”) AND (“method” OR “tool”) AND (“sustainability” OR “circular economy”) AND “design”). The search was refined to include only publications where the specified keywords appeared in the title, abstract, or keywords section. Given the novelty of the topic and the need to capture the latest research, no time restrictions were applied, and the Scopus database was updated until January 2025.

The initial database search yielded 716 results. The first filtering step restricted the selection to English-language documents within the following subject areas: Engineering, Environmental Science, Business, Management and Accounting, Social Sciences, Decision Sciences, Economics, Econometrics, and Finance. Only open-access articles were considered to further refine the dataset, reducing the selection to 196 documents. A preliminary screening of titles and abstracts was then conducted to exclude irrelevant papers, resulting

in a subset of 84 articles for in-depth analysis. Ultimately, 16 papers were identified as directly relevant to this study, introducing nine tools for integration into the framework.

The screening and selection of articles were performed independently by the first author to minimise bias. The complete systematic review process, including identification, screening, and inclusion phases, is summarised in the PRISMA flow diagram in Figure 1.

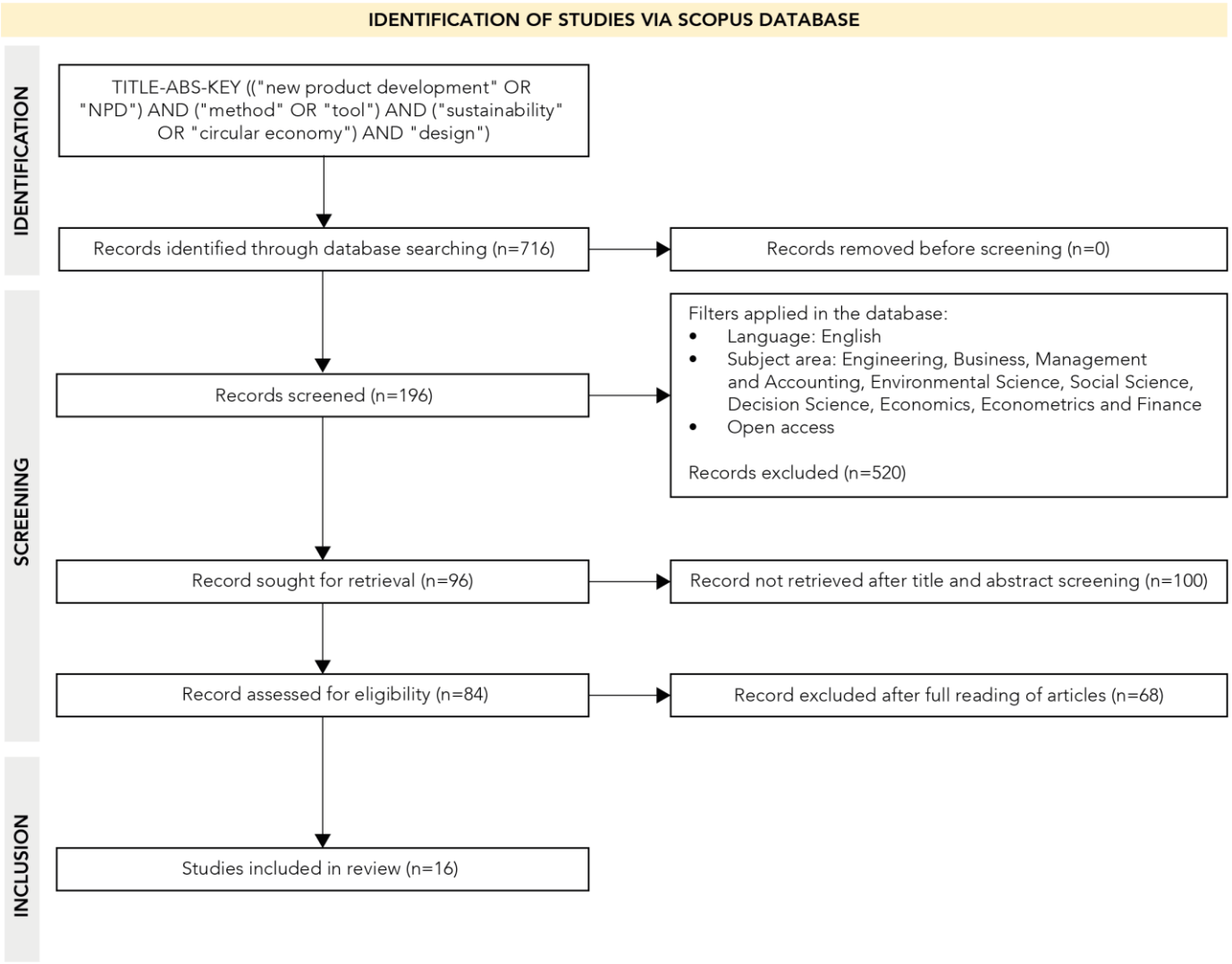

Figure 1. Systematic literature review process flow diagram based on the PRISMA statement [30], including inclusion and exclusion criteria applied to retrieved articles.

Given the limited number of publications identified in the academic literature, the research was expanded using snowballing (i.e., reviewing references from key studies) and web searching. This additional step also allowed the inclusion of tools developed and used in practice by companies, design organisations, or consulting firms. Keywords such as "circular tool", "circular design method", "circular product design tool", "circular product design method", "circular economy tool", and "design for circularity tool" were used to ensure a comprehensive collection of relevant resources. No language or industry sector restrictions were applied during the snowballing and web search phases to capture a broader and more diverse range of tools. Finally, tools with broken links, inaccessible websites, or tools described or cited in the literature but not actually available for consultation were excluded from the final dataset. It is important to note that several resources identified were structured as toolkits, meaning they included multiple tools with different objectives, for-

mats, and target users. Each tool within a toolkit was considered and classified separately to avoid confusion and ensure analytical clarity. For instance, the well-known "Circular Design Guide" toolkit, developed by the Ellen MacArthur Foundation in collaboration with IDEO, was disaggregated and analysed as a set of distinct tools [32].

2.2. Classification Criteria

All the tools found through the systematic literature review, supplemented by web searches and snowballing, were collected and classified in an Excel database. Inspired by previous tool mapping studies [25,33], each tool was assessed based on the criteria outlined in the third column of Table 1 in order to assign the corresponding classification and sub-classification identifiers listed in the first and second columns.

Table 1. Criteria used to classify the circular design tools along with corresponding classification and sub-classification identifiers.

Classification Identifier	Sub-Classification Identifiers	Criteria Description
General Information	Name, Reference Link, Authorship, Year, Language, Access Conditions	Basic details regarding each tool, including its origin, language availability, and accessibility (e.g., free or free demo).
Format	Physical, Digital, Hybrid	Tools classified as physical (e.g., guidelines, worksheets, strategy cards, or canvases used in workshops), digital (e.g., databases, Miro/Mural boards, spreadsheets, dashboards, and checklists available online), or hybrid, combining both physical and digital formats.
Data Type	Qualitative, Quantitative, Hybrid	Categorisation based on whether the tool provides descriptive insights, numerical data analysis, or a combination of both.
Industry Sector	All or Specific (e.g., Fashion, Electronics, Construction, Furniture, etc.)	Identifies whether the tool is designed for general use across industries or tailored to specific sectors.
Circular Strategies	Not Specific Focus, Specific Strategies	Differentiates tools that provide a broad perspective on circular strategies from those focused on specific aspects (e.g., design for durability, remanufacturing, disassembly, product-service systems).
Innovation Focus	Materials	Includes material libraries and databases that help design teams explore and select sustainable and circular materials, as well as guidelines on the use of recycled or recyclable resources.
	Product	Focuses on product design and its components, including associated services from a circular perspective. This category covers, for instance, information cards, case study databases, design guidelines, ideation canvases, and concept evaluation tools.
	Packaging	Encompasses tools aimed at developing more sustainable and resource-efficient packaging solutions, such as design guidelines and checklists for assessing packaging circularity.
	Business Model	Covers tools that support circular product design and address related business model adaptations aligned with circular strategies, such as product-service systems. Tools focused exclusively on circular business model innovation were excluded, as they fall outside the scope of this review.

Table 1. *Cont.*

Classification Identifier	Sub-Classification Identifiers	Criteria Description
Aim	Educate	Tools designed to raise awareness and provide fundamental knowledge on sustainability and circular economy strategies. This category includes educational tools that help organisations define circular strategic directions.
	Ideate	Resources that facilitate brainstorming and the creation of circular product concepts. Examples include decks of case study cards showcasing successful circular strategies and guided canvases with key questions to stimulate creative thinking.
	Implement	Tools focused on the practical implementation of circular concepts, aiding in prototyping and refining ideas.
	Assess	Tools aimed at supporting the assessment of circular solutions, specifically focusing on the evaluation of circularity performance, potential value retention, and associated costs.
	Communicate	Tools that support internal dissemination of circular economy concepts across different company teams, ensuring organisational alignment. This category also includes tools designed for external communication between companies and end users.

2.3. Mapping Tools to the NPD Process

The tools were mapped according to the main phases of the New Product Development (NPD) process to evaluate how circular design tools support product development. Specifically, the Stage-Gate Model (the Stage-Gate Model is a structured New Product Development (NPD) process introduced by Cooper to systematically guide innovation from ideation to market launch. It divides the development process into distinct stages separated by gates where go/no-go decisions are made. This approach enhances risk management, resource allocation, and cross-functional collaboration, ensuring a disciplined yet flexible pathway for successful product innovation [8,34]) was used as a reference, given its widespread adoption in industry. However, it is important to acknowledge that design practice often follows a more flexible, iterative, creative, and exploratory logic, which is well represented by the Double Diamond model [35]. This framework divides the design process into four key phases: Discover, Define, Develop, and Deliver. In this study, the two models were conceptually reconciled to enable the classification of tools within a coherent yet simplified framework (see Figure 2).

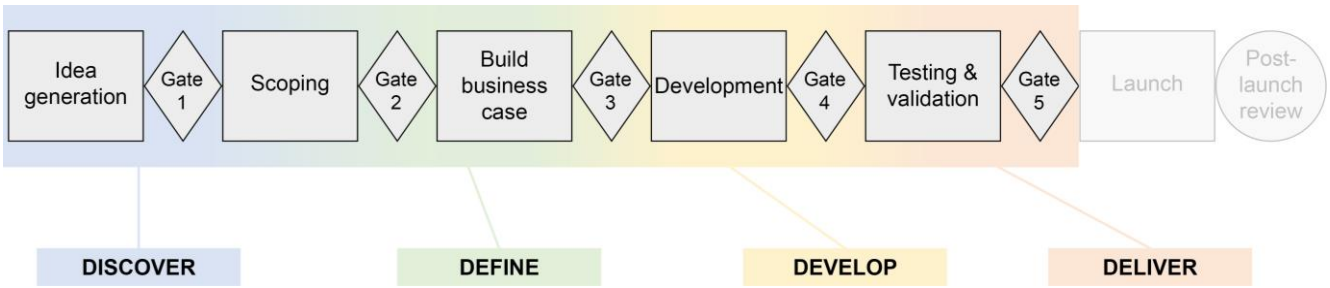

Figure 2. Four macro-phases (Discover, Define, Develop, Deliver) as a simplified structure to map circular design tools across the early stages of the New Product Development (NPD) process (Stage-Gate model adapted from [34]).

This choice was made while remaining aware of other well-established models, such as those proposed by Ulrich and Eppinger [36], Pahl and Beitz [37], and Nigel Cross [38], which offer more structured and engineering-focused perspectives on the product development process. Nonetheless, the Stage-Gate/Double Diamond combination was considered more appropriate for the purpose of this study: mapping a broad range of circular design tools that span both technical and strategic/creative dimensions, with particular attention to the early phases of NPD.

Table 2 shows how the tools are mapped across these phases, indicating the corresponding NPD stages, the aligned Double Diamond steps, and the main characteristics of the circular tools linked to each stage.

Table 2. Alignment between Stage-Gate NPD phases (with the relative description), Double Diamond stages, and key characteristics of the corresponding circular design tools used as criteria for the mapping.

Stage-Gate NPD Phase	Description of the NPD Phase [34]	Double Diamond Phase	Circular Tool Characteristics
Idea Generation	An initial phase focused on generating a wide range of potential ideas for exploring new opportunities. Activities may include technical research to identify emerging technologies, user research, competitive analysis, internal idea-gathering systems, strategic foresight exercises, and open innovation practices involving external collaborators.	Discover	Tools that support early exploration and opportunity identification for circular innovation. These include educative tools that raise awareness about circular economy principles and inspire initial engagement; contextual tools aimed at understanding the broader market, user needs, and sustainability-related challenges; idea generation tools for stimulating early-stage circular design concepts; and assessment tools for analyzing existing products and identifying preliminary circular strategies or interventions.
Scoping	An initial, low-cost exploratory phase aimed at assessing the technical and market feasibility of the project through secondary research. The main activities include a preliminary market analysis (to assess its size, potential, and user acceptance) and a technical evaluation (to assess feasibility, risks, and resource implications). The goal is to make early-stage business decisions with minimal effort and time.		
Build Business Case	A detailed investigation phase to refine the product concept and assess its feasibility before committing significant resources. Key activities include Voice-of-Customer research to understand user needs, competitive analysis, and concept testing to evaluate market reactions. The technical evaluation focuses on feasibility, including preliminary designs and cost assessments, while an operations review evaluates manufacturability and supply chain issues. A comprehensive business and financial analysis, including risk assessments, is conducted to justify the project and create a detailed project plan.	Define	Tools that help refine and validate the strategic direction of the project. They include tools for defining circular design strategies, supporting teams in aligning product development with circularity principles; tools for selecting circular business models, guiding decisions on how value will be created, delivered, and retained in a circular context; and prioritisation tools that assist in evaluating and ranking solution concepts based on environmental, economic, and technical feasibility criteria.

Table 2. *Cont.*

Stage-Gate NPD Phase	Description of the NPD Phase [34]	Double Diamond Phase	Circular Tool Characteristics
Development	At this stage, the product is physically developed according to plan, with laboratory, alpha, or internal testing to ensure compliance with the required specifications. The focus is on technical development, but marketing and operational activities proceed in parallel, with continuous market analysis and customer feedback. Detailed test plans, production strategies, and financial analyses are prepared, and legal or regulatory issues are resolved. The result is a proven prototype, ready for further evaluation and refinement.	Develop	Tools that support the transition from concept to detailed design. These include tools for detailed design and prototyping that help translate circular strategies into tangible product features; material selection tools that assist in choosing sustainable, recyclable, or bio-based materials; tools for packaging development to minimise environmental impact; and assessment tools to evaluate the circularity and sustainability of design decisions, ensuring alignment with both performance and environmental goals.
Testing and Validation	This phase ensures the project's viability by assessing the product, production process, customer acceptance, and economics. It involves in-house tests to check product performance, user trials to evaluate functionality in real-world conditions, and pilot operations to refine the production process. Pretest market trials are conducted to gauge customer reactions and estimate market potential. This phase confirms the product's readiness for launch.	Deliver	Tools that support design refinement through insights gained from testing activities and help ensure production readiness. Additionally, mature circularity assessment tools are employed to evaluate the product's circularity potential in a comprehensive manner before launch.

As shown in Figure 2, the four macro-phases—Discover, Define, Develop, and Deliver—are interconnected and reflect a simplified but functional representation of the NPD process, helping to classify the tools while recognising that, in practice, the process is often iterative and complex [39]. Given this fluidity, tools may apply to multiple phases rather than being confined to a single category.

3. Results and Interpretations

This section presents the findings from the classification and analysis of the 77 circular design tools identified through systematic review, snowballing, and web searching. For each resource identified through the grey literature (i.e., web searching), an additional verification was conducted to assess whether a related scientific publication existed. When available, the reference to the article and the link to the tool itself are included in the shared Circular design tools.xlsx file (https://polimi365-my.sharepoint.com/:x:/g/personal/10566981_polimi_it/EWC1VX5kC3xAlfN65vIvbEwBtjaAxFZxzwx6syT3mknHWA?e=xlIdXC&wdLOR=c677D0E97-7C86-4578-8984-77D4FAD08B70, accessed on 30 April 2025). All data are explained in detail in the following subsections.

3.1. Overview of Identified Tools

Among the seventy-seven tools analysed, seventy-five are freely available, while two offer limited-access demo versions. This highlights a strong trend toward open knowledge

sharing within the circular economy field, which might facilitate the widespread adoption of circular design practices.

The temporal distribution of circular design tools (Figure 3) shows a steady increase in interest over the past decade, with notable peaks in 2016, 2018, 2021, 2023, and 2024. This growth is in line with major regulatory milestones, particularly the adoption of the Circular Economy Action Plan (CEAP) by the European Commission in 2015, which likely stimulated more tool development. This trend also reflects the influence of evolving sustainability policies, such as the Ecodesign Regulation for Sustainable Products (ESPR) [5], which establishes design requirements for durability, reparability, and resource efficiency.

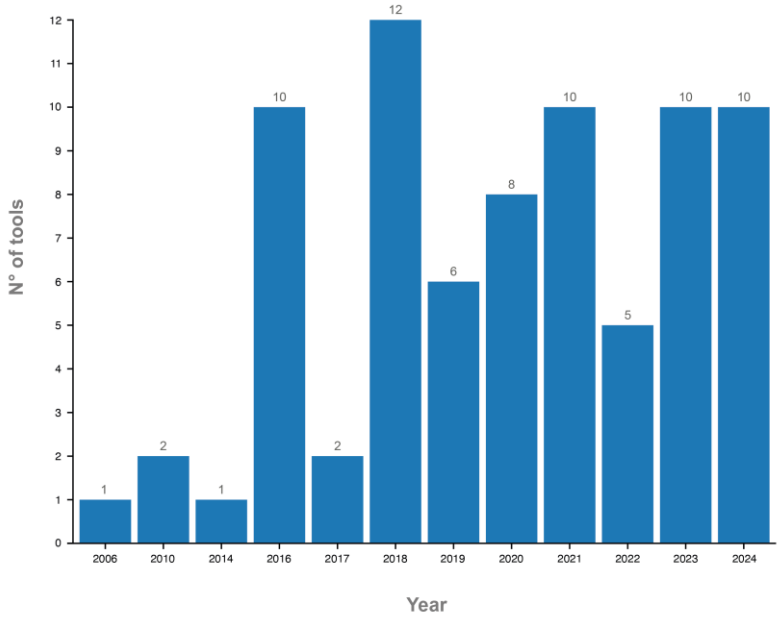

Figure 3. Distribution of tools over the years.

Most of the tools identified (77) are available in English, ensuring broad accessibility for international use. Only a limited number are offered in other languages, including Spanish (6), Dutch (2), German (2), French (2), Portuguese (1), Czech (1), Slovak (1), and Hungarian (1). This distribution reflects a strong English-centred approach, with minimal localisation efforts to support regional adoption.

3.2. Classification of Circular Design Tools

3.2.1. Tool Format

The tools are available in diverse formats, with physical tools (29) being the most prevalent, followed by digital tools (26) and hybrid tools (22).

Among physical tools, the most common formats include worksheets, canvases, cards, and interactive games, typically used in workshops to facilitate the implementation of circular strategies. A notable example is the "*Circular Design Guide*" [32], which offers multiple methods in the form of downloadable worksheets designed to be completed during cross-departmental workshops. Similarly, tools developed by the Danish Design Centre, such as "*Brainstorming Sudoku*", "*Circularity Storyboard*", "*Circular Strategy Wheel*", and "*Expanded Circular Storyboard*", are structured as canvases or worksheets [40]. These formats encourage in-person collaboration among stakeholders, allowing teams to easily share ideas, visualise opportunities and limitations, document decisions, and develop circular strategies.

On the other hand, digital tools often take the form of dashboards, spreadsheets, Miro/Mural boards, checklists, and case studies. For instance, many tools developed by

RISE Research Institutes of Sweden as part of the "*Future Adaptive Design Toolbox*" are provided in spreadsheet format for online use. These tools focus on combating premature obsolescence by supporting the design of more durable products [41].

Hybrid tools, such as those developed by EcoDesign Circle, offer both offline and online usability. Users can download documents for local use or access interactive versions via Mural online boards. This flexibility is beneficial for companies with multiple locations, enabling remote co-design sessions with suppliers, end users, or supply chain teams [42].

3.2.2. Data Type

The majority of the identified tools rely on qualitative data (60), while quantitative (6) and hybrid (11) approaches are less common. This distribution is closely linked to the format of the tools. Most quantitative tools fall under the digital category, often using spreadsheets or dashboards designed to evaluate circularity performance or assess the financial feasibility of a product or service. Examples include several tools from the Future Adaptive Design Toolbox, such as "*Assessing Concepts*, which helps compare design alternatives and reduce the risk of premature obsolescence, "*Investment Analysis*" and "*TCO analysis*" for investment and profitability analysis [41], and the *Circularity Calculator*, which evaluates the level of circularity of a product [43].

In contrast, qualitative tools are primarily physical or printable resources, such as worksheets, canvases for ideation, or strategy and case study cards. These tools facilitate brainstorming and guided exploration of circular design strategies. Notable examples include "*Cards for Circularity*" [44], "*Circularity Deck*" [45], and "*Sustainable Design Cards*" [46], all of which provide structured frameworks to support circular design thinking.

3.2.3. Industry Sector

The majority of the tools (71) are sector-agnostic, meaning they can be applied across various industries. However, only six tools are specifically tailored for particular sectors, including fashion, construction, electronics, and furniture (Figure 4). The limited availability of industry-specific tools highlights further customisation opportunities to address sector-specific circularity challenges.

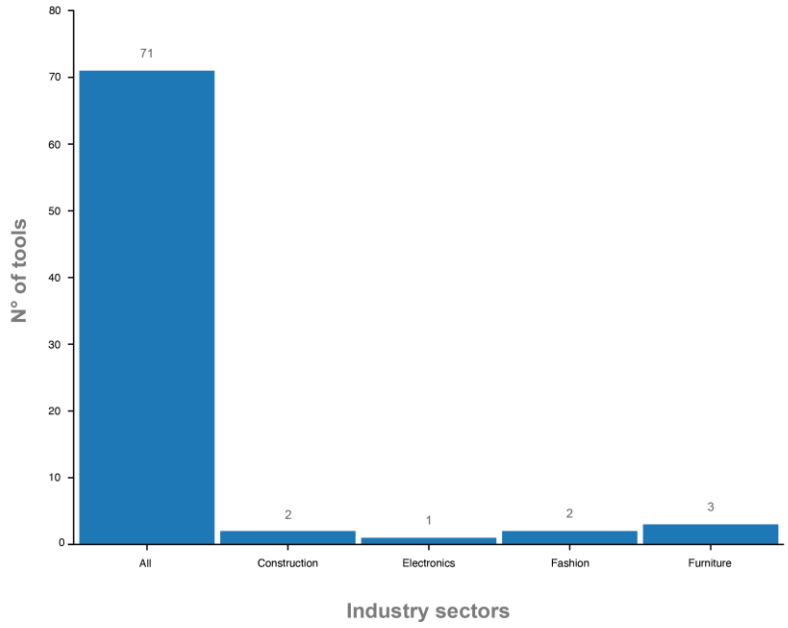

Figure 4. Industry sector of the tools.

For the fashion industry, notable examples include Nike's "*Circular Design Guide*" [47] and "*Close The Loop*", developed by Flanders DC and Circular Flanders [48], which provide practical guidance for integrating circular innovation into fashion products and business models.

Tools have been developed in the construction and furniture sectors through initiatives such as The Knowledge Alliance on Product-Service Development towards Circular Economy and Sustainability in Higher Education (KATCH_e), founded by the European Union (EU) [49].

For the electrical and electronic sectors, one key resource is the database provided by the European Commission, which serves as a reference for companies aiming to develop sustainable products aligned with EU policies and regulations on energy efficiency and ecodesign. This database categorises products into different sectors, including kitchen appliances, cleaning and drying devices, refrigeration, heating and ventilation systems, electronics, and lighting [50].

3.2.4. Circular Strategies Covered

Most identified tools (50) do not focus on a specific circular strategy but provide general guidance on circular design (Figure 5). Among those that address particular strategies, the most commonly addressed areas include design for durability (8), design for reusability (8), design for recyclability (6), and design for user behaviour (5). For example, design for durability, a core principle of circular design, is explicitly addressed by the "*Future Adaptive Design Toolbox*". As previously mentioned, this toolbox aims to counteract product obsolescence by promoting strategies for enhanced longevity, flexibility, and upgradability [41].

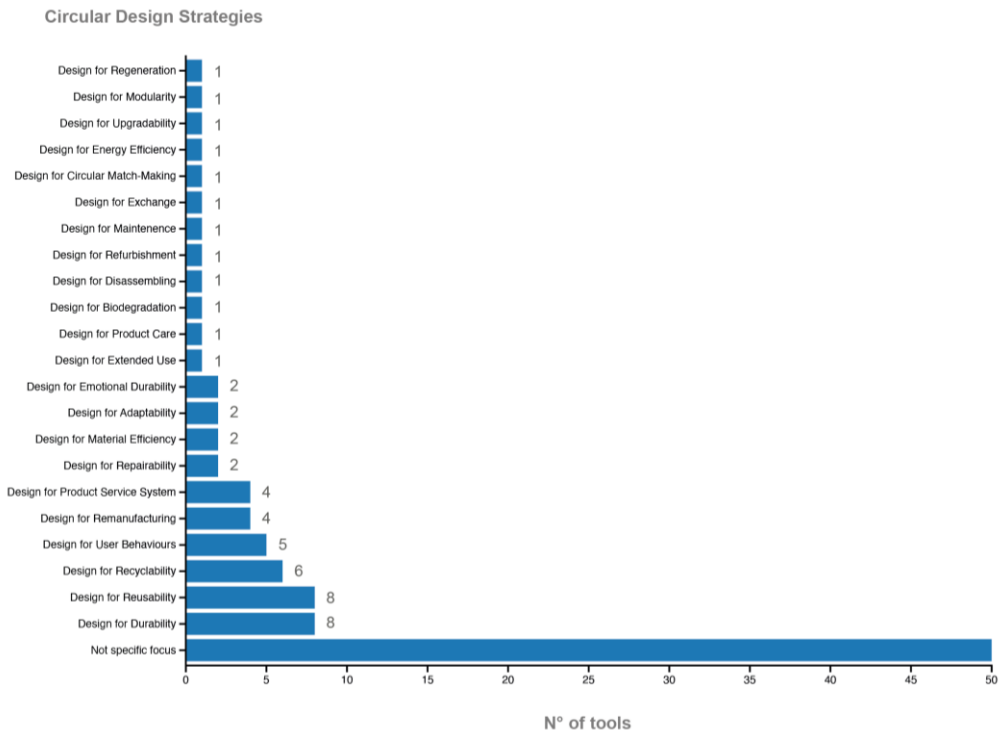

Figure 5. Circular strategies on which the tools are based.

A notable exception in the category of user-centred circular strategies is the "*Use2Use Toolkit*", the only tool that explicitly focuses on the user's role in circularity. This toolkit provides structured resources for conducting workshops on circular consumption. It introduces strategies such as Design for Circular Match-Making, Design for Exchange, Design

for Extended Use, and Design for User Behaviours, emphasising consumer engagement in extending product lifecycles [27].

However, many key strategies remain underrepresented, including remanufacturing, modularity, upgradeability, and disassembly. This suggests a gap in dedicated tools that could support these essential aspects of circularity, highlighting opportunities to develop future tools.

3.3. Tool Distribution Across NPD Phases

Mapping the tools across the New Product Development (NPD) process reveals an uneven distribution. This is illustrated in Figure 6, a Sankey diagram showing the relationships of the identified tools with their Innovation Focus, Aim, and the corresponding NPD phase in which they are most applicable. On the left side, tools are grouped based on their Innovation Focus—materials, packaging, product, or business model—and flow through their main Aim (i.e., Educate, Ideate, Implement, Assess, Communicate) to the corresponding NPD phases (Discover, Define, Develop, Deliver) on the right. This type of representation was chosen as it shows how tools flow across these categories, highlighting overlaps and interconnections. Each line represents a group of tools flowing from one category to another. The width of each band is proportional to the number of tools it represents. The diagram highlights that many tools are not limited to a single use or phase but instead support multiple stages of the development process, reflecting the integrated and interconnected nature of circular product development.

To enhance clarity and address potential complexity in interpreting the diagram, we added complementary tables in Appendix A (Figures A1–A3), which provide a detailed breakdown of the tools included in each category. These tables use the same colour scheme as the Sankey diagram to maintain visual consistency and show when tools are positioned across multiple categories by blending colours.

Specifically, the allocation of tools across NPD phases highlights the following:

- The Discover phase includes the highest number of tools (32), primarily supporting early-stage market analysis and ideation.
- The Define phase follows closely, with 42 tools, which mainly aid in concept development, strategy selection, and preliminary feasibility analysis.
- The Develop phase has 44 tools, highlighting a strong presence of implementation and assessment tools that support refining, prototyping, and evaluating circular solutions.
- The Deliver phase, with 23 tools, primarily includes resources for finalising design specifications, preparing for production, verifying compliance, and facilitating communication. The limited availability of tools for the Deliver phase indicates a clear gap in post-market circularity tracking and consumer engagement strategies.
- Classifying the tools by innovation focus revealed the following:
- Product-focused tools are predominately available across the Discover, Define, and Develop phases.
- Business model-oriented tools are concentrated mainly in the Discover and Define phases, aiding strategic planning and revenue model development.
- Material-focused tools appear mainly in the Develop and Deliver phases, specifically supporting material selection and sustainable resource management.
- Packaging-related tools are underrepresented, primarily appearing in the Develop and Deliver phases, suggesting the need for additional resources focused explicitly on sustainable packaging design.

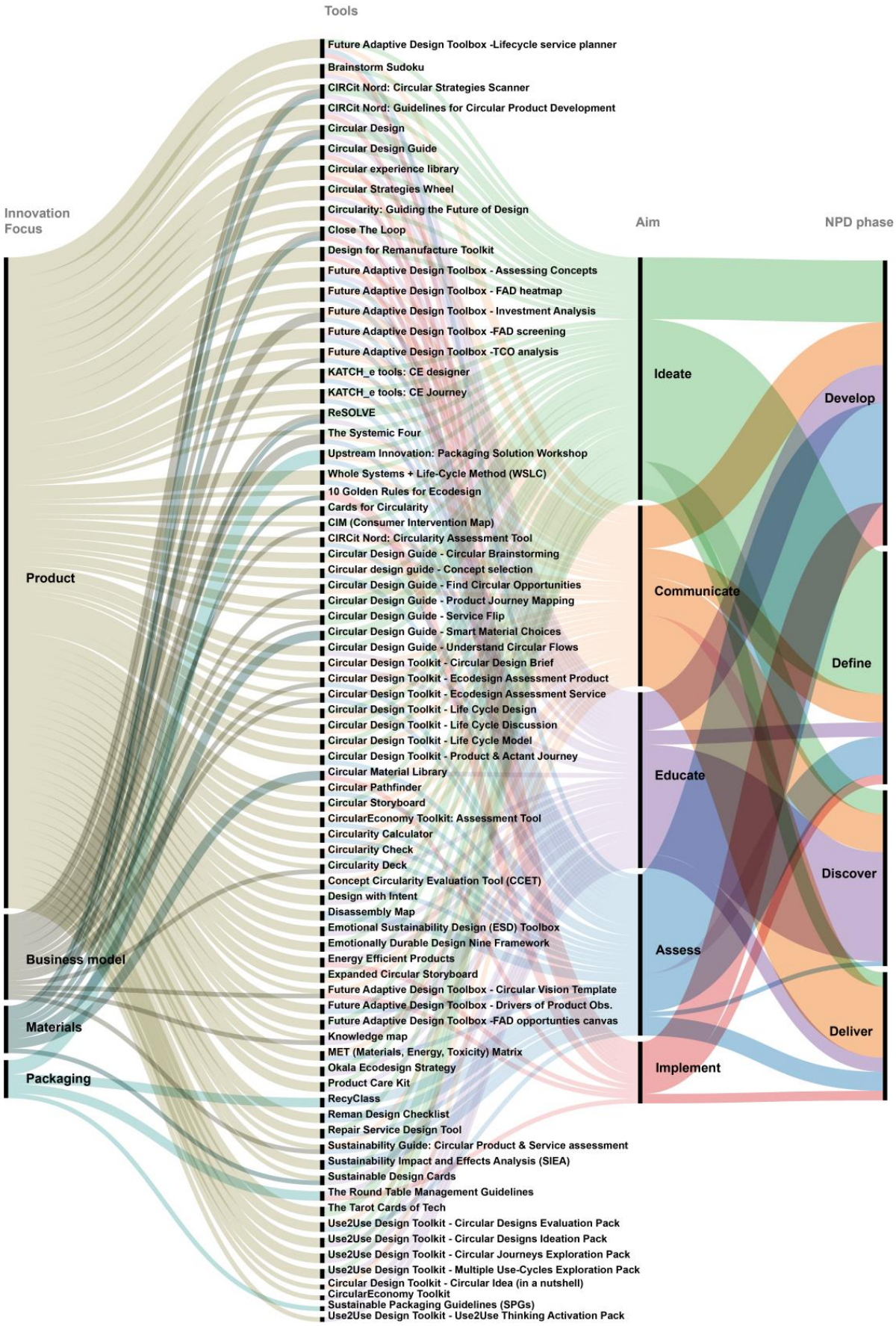

Figure 6. Distribution of tools by level of innovation, aim, and phase of the NPD process.

The classification of tools based on their objectives provided insights into their role in product development. The analysis showed that most Educate tools are directed towards Discover, as they aim to build a foundational understanding of circular economy principles, sustainability challenges, and best practices. Examples include "*Circular Design*" by Alessio Franconi (IUAV University), an open-source toolkit offering a collection of systemic design strategies and case studies, facilitating collaborative exploration and accelerating circularity integration [51]. Similarly, the "*Circular Economy Toolkit*" provides comprehensive resources and real-world cases to guide companies in adopting circular economy practices [52]. Another notable resource, the "*Knowledge Maps*" by Het Groene Brein, offers access to diverse circular economy knowledge, assisting businesses and policymakers in navigating complex sustainability topics [53].

A significant number of Ideation tools are used in the Define phase, facilitating creative exploration and brainstorming sessions to generate innovative circular solutions. Examples include "*Circular Brainstorming*" from the Circular Design Guide [54], which supports structured ideation around circular principles, and the "*Circular Strategies Wheel*", enabling teams to systematically explore circular economy strategies applicable to their products [55]. Additional creative tools in card format are the "*Sharing Economy Design Cards*", "*Sustainable Design Cards*", "*Emotionally Durable Design Nine Framework*", and "*The Tarot Cards of Tech*", each offering structured prompts and inspiration for comprehensive ideation and concept refinement [46,56–58].

The classification also highlights that Implementation tools are mainly applied in the Develop phase, guiding companies from conceptualisation to practical implementation and supporting the refinement of product concepts, material selection, and the integration of durability, repairability, and recyclability principles. Notable resources include the "*CIRCit Nord Guidelines for Circular Product Development*", which offer structured recommendations and real-life examples for incorporating circularity into product design [59]. Additionally, the "*Circular Experience Library*" provides 72 user experience (UX) design patterns, assisting companies in prototyping user-friendly circular services by addressing behaviours such as maintenance, repair, reuse, refurbishment, and recycling [60]. Material selection tools, such as the "*Circular Material Library*", help teams identify sustainable materials and resources to facilitate local and global circular design solutions [61].

Assess tools critically evaluate product concepts' feasibility and circularity. These tools are predominantly associated with the Develop phase, where the effectiveness of circular strategies needs to be measured before market implementation. Representative resources in this group are "*CIRCit Nord Circularity Assessment Tool*", "*MET (Materials, Energy, Toxicity) Matrix*", "*Disassembly Map*", and "*Reman Design Checklist*" [62–65]. These tools offer structured approaches to evaluate the ease of disassembly, component reuse, remanufacturing potential, and overall product circularity.

Finally, from the analysis, it emerged that the Communication tools are primarily used in the Develop and Deliver phases to facilitate internal and external communication regarding circular economy principles. Internally, they support alignment among multidisciplinary teams, including design, marketing, R&D, quality, customer care, and innovation. Externally, they enhance transparency in sustainability claims, ensure regulatory compliance, and promote consumer engagement in circular practices such as reuse, repair, and product take-back programs. Prominent examples include the "*Circular Design Toolkit–Circular Idea*", designed to communicate product concepts according to the triple bottom line (People, Planet, Prosperity), and Danish Design Centre tools, like the "*Circular Storyboard*" and "*Circular Strategies Wheel*", which visually map product lifecycle phases and circular strategies, fostering holistic communication and alignment among stakehold-

ers [40,66]. Notably, assessment tools frequently offer dashboards or visual summaries to facilitate internal communication and decision-making at critical NPD gates.

4. Discussion

This study provides a comprehensive analysis of circular design tools currently available in both the academic and grey literature. A key finding is the dominance of tools emerging from the grey literature—such as reports, guidelines, toolkits, and online platforms—over those found in peer-reviewed academic sources. This reflects circular design's practical and rapidly evolving nature, in which consultancies, design centres, and companies frequently create tools directly responding to emerging industry needs (e.g., design guides developed by Nike and IKEA that were collected [47]). By systematically including the grey literature, our analysis also highlights the often under-recognised contributions of non-academic actors to creating and disseminating circular design tools.

The temporal analysis reveals a growing interest in circular design and innovation, with notable peaks corresponding to policy milestones at the European level, such as the Circular Economy Action Plan (CEAP) and the Ecodesign for Sustainable Products Regulation (ESPR) [5].

Another important observation is the prevalence of physical tools among the resources identified. Physical tools—such as worksheets, cards, and printed canvases—are particularly effective in supporting stakeholder engagement during co-creation workshops, participatory design sessions, and preliminary ideation. Their tangible nature fosters collaboration, dialogue, and creative exploration, making them well suited for team-based activities in the Discover and Define phases of product development [67].

Digital tools, although less common, offer distinct advantages such as broad accessibility, ease of use, and the potential for regular updates to reflect regulatory changes, technological advancements, and user feedback. However, maintaining and updating digital tools requires significant resources in terms of time, costs, and infrastructure [68]. Many valuable tools developed in academic contexts for master's or doctoral projects remain static after their initial release, with little or no continued improvement (e.g., "*Circular Design*" and "*Circularity Deck*" [45,51]). These resources could instead be adapted and refined within the structured context of industrial workflows.

Accordingly, a balanced integration of digital and physical approaches, represented by hybrid tools, could better meet diverse company needs, balancing scalability and collaborative potential.

An explicit limitation of existing tools is the reliance primarily on qualitative data. While checklists, guidelines, and qualitative frameworks provide helpful initial guidance, they often lack quantitative rigour. Developing data-driven design tools with measurable metrics could enable designers to compare circularity performance at different scales (product, material, packaging, business model) and strengthen decision-making with objective criteria.

The analysis also reveals that a scarcity of sector-specific tools underlines the chance for customisation. Tailored methodologies addressing the unique challenges faced by industries such as fashion, electronics, construction, and furniture could enhance circular strategies' practical applicability and effectiveness within these sectors. Although our broad inclusion criteria (no restrictions on industry or language) ensured wide coverage, it may have led us to overlook some niche tools aimed at specific sectors or published in other languages.

An additional gap is a limited focus on user behaviour and consumer engagement. Despite recognition in the existing literature of consumers' critical role in circular practices, like maintenance, repair, reuse, sharing, and recycling [27], relatively few tools directly address

this dimension. Developing tools focused on consumer behaviours would strengthen circular consumption models such as product as a service, sharing platforms, and incentivised product-return schemes. This gap may also result from this study's focus: expanding the search to include the business and management literature might have revealed additional relevant methods.

This consumer behaviour-focused approach is particularly relevant for energy-using products, where much of the environmental impact occurs during use (for example, the energy consumed by smart devices) [69]. Integrating user experience (UX) and behaviour-change principles into circular design methods could encourage responsible usage patterns, reduce impacts during product use, and extend product lifetimes.

Furthermore, while digital transformation is accelerating across all sectors, this study did not identify any circular design tool explicitly addressing the sustainability or circularity implications of Industry 4.0 technologies—such as artificial intelligence (AI), the Internet of Things (IoT), digital twins, or blockchain systems [70]. Given the widespread integration of these technologies into industrial innovation strategies [71], tools guiding circular design, optimised use, and lifecycle management of digitally embedded or AI-enabled products are needed.

Finally, mapping tools across NPD phases revealed a considerable emphasis on circularity integration in early phases (Discover, Define, and Develop), consistent with previous findings indicating that early design stages strongly influence a product's lifecycle environmental impact [10,15]. However, the limited availability of tools for the Delivery phase, particularly regarding post-market circularity management, suggests directions for further research. That said, it is important to note that the Deliver phase overlaps with the final stages of the Stage-Gate process, where many decisions and strategies regarding product circularity have already been defined earlier in the process.

This study also acknowledges certain methodological limitations, including the exclusive use of the Scopus database for academic tool identification, potentially restricting resource coverage. This choice, while ensuring high-quality peer-reviewed sources, may have led to the exclusion of relevant tools indexed in other academic databases, such as Web of Science or Google Scholar. Moreover, despite efforts for systematic rigour, the classification inherently involves subjective judgments. Decisions on criteria like the innovation focus, aims, and NPD phase required an interpretative analysis by the authors, which, while grounded in a structured framework, may reflect certain biases.

5. Conclusions

This study provides a systematic classification of circular design tools, identifying current gaps and opportunities to guide future investigations. This helps contribute to reducing the growth of similar resources, which currently complicates tool navigation and adoption for industry professionals.

Compared to previous classification efforts [6,25,26], the present study broadens the scope of analysis, encompassing diverse circular design tools and strategies across multiple industries. For instance, while previous reviews by Royo et al. and Suppipat and Hu focused specifically on product lifetime extension and the electrical and electronics sector, respectively, this study addresses a broader spectrum of circular approaches. Moreover, this work introduces a novel analytical framework that integrates the Stage-Gate model with the Double Diamond design approach to map tools in the early stages of New Product Development (NPD). This dual perspective offers a comprehensive understanding of how circular design tools can facilitate innovation throughout the phases of NPD.

While the broad scope enabled the identification and structuring of a wide variety of tools, the aim of this study was not to provide an in-depth evaluation of each category. Instead, it establishes a foundational overview and classification framework that can support more detailed, category-specific analyses in future research. Follow-up studies will explore narrower groups of tools (e.g., ideation tools, assessment tools, or implementation tools) to examine features such as usability, required expertise, data integration, ease of implementation, and sector-specific applicability.

This research also underscores the need for tools addressing digitalisation, data-driven decision-making, and user behaviour—key elements for realising sustainable and circular Industry 4.0 objectives. Future research should prioritise validating existing tools through real-world industrial applications, ensuring their effectiveness and relevance. Enhanced collaboration between researchers and practitioners is crucial to developing targeted, sector-specific frameworks, offering concise and practical toolkits.

In this context, it is also essential to acknowledge the diversity of real-world organisational environments in which these tools are applied. Small- and medium-sized enterprises (SMEs), often characterised by limited resources and informal development structures, benefit from intuitive, easy-to-use tools that integrate seamlessly into multifunctional routines [72]. On the other hand, large enterprises typically operate within structured, digitalised NPD systems that require tools compatible with existing infrastructures (e.g., Product Lifecycle Management and Digital Twins) [73,74]. Tailoring toolkits to the operational maturity, digital readiness, and organisational structure of different companies is thus a future key challenge. Developing adaptable, scalable, and context-sensitive circular design tools will be crucial to ensuring their practical adoption and impact.

Finally, direct engagement of academic research with industry stakeholders will be essential for aligning circular design tools with existing organisational processes and strategic company objectives. In line with this, we also plan to periodically update and expand the tool database as part of future research efforts to ensure its continued relevance and practical value for both academic and industrial audiences.

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Data Availability Statement: The data presented in this study are openly available at Circular design tools.xlsx (https://polimi365-my.sharepoint.com/:x:/g/personal/10566981_polimi_it/EWC1VX5kC3xAlfN65vIvbEwBtjaAxFZxzwx6syT3mknHWA?e=xlIdXC&wdLOR=c677D0E97-7C86-4578-8984-77D4FAD08B70, (accessed on 24 March 2025)).

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

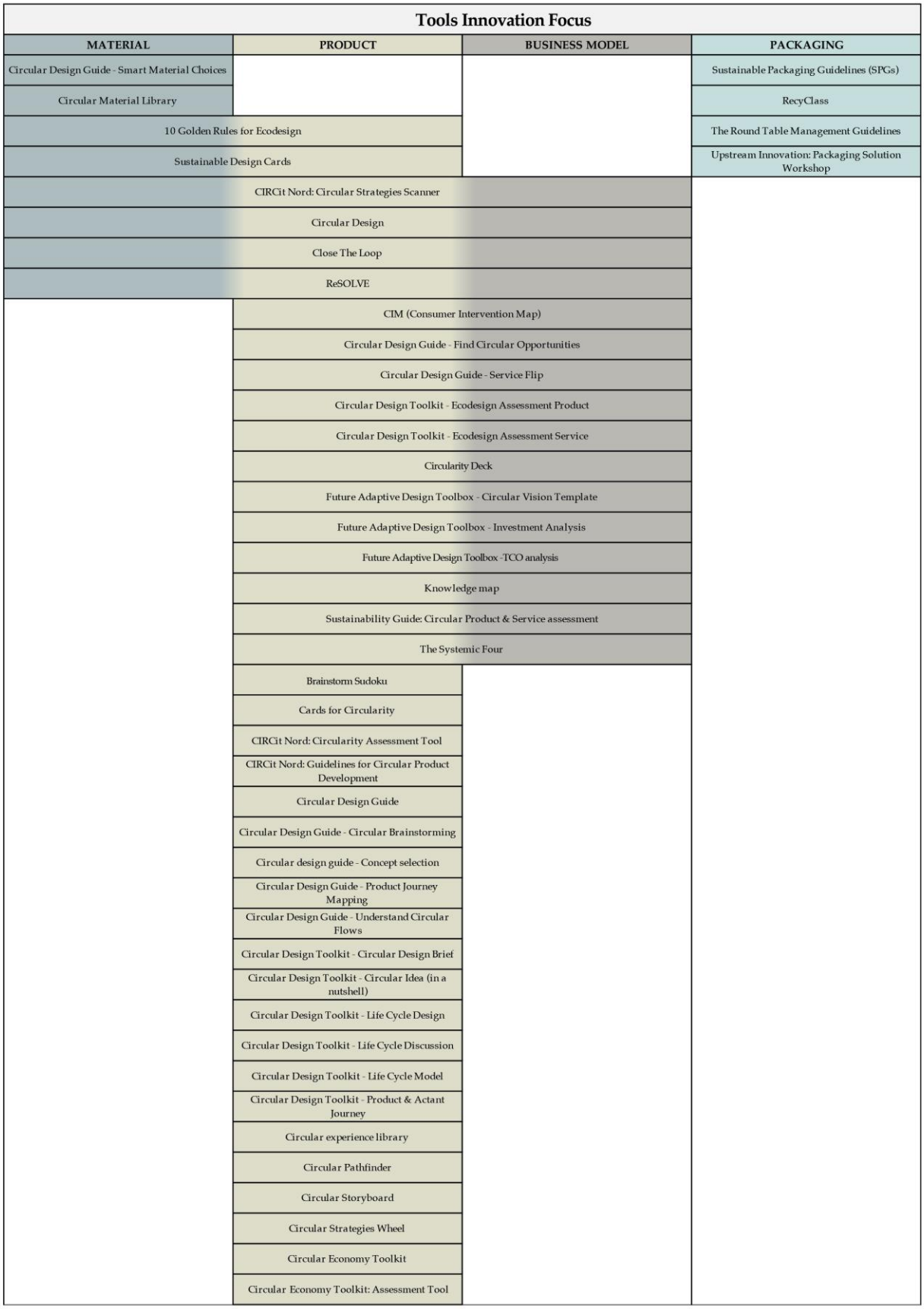

Figure A1. *Cont.*

Tools Innovation Focus			
MATERIAL	PRODUCT	BUSINESS MODEL	PACKAGING
	Circularity Calculator		
	Circularity Check		
	Circularity: Guiding the Future of Design		
	Concept Circularity Evaluation Tool (CCET)		
	Design for Remanufacture Toolkit		
	Design with Intent: 101 Patterns for Influencing Behaviour Through Design		
	Disassembly Map		
	Emotional Sustainability Design (ESD) Toolbox		
	Emotionally Durable Design Nine Framework		
	Energy Efficient Products		
	Expanded Circular Storyboard		
	Future Adaptive Design Toolbox - Assessing Concepts		
	Future Adaptive Design Toolbox - Drivers of Product Obsolescence		
	Future Adaptive Design Toolbox - FAD heatmap		
	Future Adaptive Design Toolbox -FAD opportunties canvas and ideation cards		
	Future Adaptive Design Toolbox -FAD screening		
	Future Adaptive Design Toolbox -Lifecycle service planner		
	KATCH_e tools: CE designer		
	KATCH_e tools: CE Journey		
	MET (Materials, Energy, Toxicity) Matrix		
	Okala Ecodesign Strategy		
	Product Care Kit		
	Reman Design Checklist		
	Repair Service Design Tool		
	Sustainability Impact and Effects Analysis (SIEA)		
	The Tarot Cards of Tech		
	Use2Use Design Toolkit - Circular Designs Evaluation Pack		
	Use2Use Design Toolkit - Circular Designs Ideation Pack		
	Use2Use Design Toolkit - Circular Journeys Exploration Pack		
	Use2Use Design Toolkit - Multiple Use-Cycles Exploration Pack		
	Use2Use Design Toolkit - Use2Use Thinking Activation Pack		
	Whole Systems + Life-Cycle Method (WSLC)		

Figure A1. Overview of circular design tools categorised by the innovation focus.

Tools Aim				
EDUCATE	**IDEATE**	**IMPLEMENT**	**ASSESS**	**COMMUNICATE**
Brainstorm Sudoku	Brainstorm Sudoku	10 Golden Rules for Ecodesign	CIRCit Nord: Circularity Assessment Tool	Brainstorm Sudoku
Cards for Circularity	Cards for Circularity	CIRCit Nord: Guidelines for Circular Product Development	Circular design guide - Concept selection	CIRCit Nord: Circularity Assessment Tool
CIM (Consumer Intervention Map)	CIM (Consumer Intervention Map)	Circular Design Guide	Circular Design Toolkit - Ecodesign Assessment Product	Circular Design Guide - Circular Brainstorming
CIRCit Nord: Circular Strategies Scanner	CIRCit Nord: Circular Strategies Scanner	Circular experience library	Circular Design Toolkit - Ecodesign Assessment Service	Circular design guide - Concept selection
CIRCit Nord: Guidelines for Circular Product Development	CIRCit Nord: Guidelines for Circular Product Development	Circular Material Library	Circular Design Toolkit - Product & Actant Journey	Circular Design Guide - Find Circular Opportunities
Circular Design	Circular Design	Circularity: Guiding the Future of Design	Circular Pathfinder	Circular Design Toolkit - Circular Design Brief
Circular Design Guide	Circular Design Guide	Close The Loop	CircularEconomy Toolkit: Assessment Tool	Circular Design Toolkit - Circular Idea (in a nutshell)
Circular Design Guide - Understand Circular Flows	Circular Design Guide - Circular Brainstorming	Design for Remanufacture Toolkit	Circularity Calculator	Circular Design Toolkit - Ecodesign Assessment Product
Circular Design Toolkit - Circular Design Brief	Circular Design Guide - Find Circular Opportunities	Energy Efficient Products	Circularity Check	Circular Design Toolkit - Ecodesign Assessment Service
Circular Material Library	Circular Design Guide - Product Journey Mapping	Future Adaptive Design Toolbox - Circular Vision Template	Concept Circularity Evaluation Tool (CCET)	Circular Design Toolkit - Life Cycle Design
Circular Strategies Wheel	Circular Design Guide - Service Flip	Future Adaptive Design Toolbox -Lifecycle service planner	Disassembly Map	Circular Design Toolkit - Life Cycle Discussion
Circular Economy Toolkit	Circular Design Guide - Smart Material Choices	The Round Table Management Guidelines	Future Adaptive Design Toolbox - Assessing Concepts	Circular Design Toolkit - Life Cycle Model
Circularity Deck	Circular Design Guide - Understand Circular Flows		Future Adaptive Design Toolbox - Drivers of Product Obsolescence	Circular experience library
Circularity: Guiding the Future of Design	Circular Design Toolkit - Life Cycle Design		Future Adaptive Design Toolbox - FAD heatmap	Circular Pathfinder
Close The Loop	Circular Design Toolkit - Life Cycle Discussion		Future Adaptive Design Toolbox - Investment Analysis	Circular Storyboard
Design for Remanufacture Toolkit	Circular Design Toolkit - Life Cycle Model		Future Adaptive Design Toolbox -FAD screening	Circular Strategies Wheel
Design with Intent: 101 Patterns for Influencing Behaviour Through Design	Circular Design Toolkit - Product & Actant Journey		Future Adaptive Design Toolbox -Lifecycle service planner	CircularEconomy Toolkit: Assessment Tool
Emotional Sustainability Design (ESD) Toolbox	Circular experience library		Future Adaptive Design Toolbox -TCO analysis	Circularity Calculator
Emotionally Durable Design Nine Framework	Circular Storyboard		KATCH_e tools: CE designer	Circularity Check
Energy Efficient Products	Circular Strategies Wheel		KATCH_e tools: CE Journey	Concept Circularity Evaluation Tool (CCET)
Future Adaptive Design Toolbox - Assessing Concepts	Circularity Deck		MET (Materials, Energy, Toxicity) Matrix	Expanded Circular Storyboard
Future Adaptive Design Toolbox - Drivers of Product Obsolescence	Circularity: Guiding the Future of Design		RecyClass	Future Adaptive Design Toolbox - Assessing Concepts
Future Adaptive Design Toolbox - FAD heatmap	Close The Loop		Reman Design Checklist	Future Adaptive Design Toolbox - Circular Vision Template
Future Adaptive Design Toolbox -FAD opportunties canvas and ideation cards	Design for Remanufacture Toolkit		Repair Service Design Tool	Future Adaptive Design Toolbox - FAD heatmap
Future Adaptive Design Toolbox -FAD screening	Design with Intent: 101 Patterns for Influencing Behaviour Through Design		Sustainability Guide: Circular Product & Service assessment	Future Adaptive Design Toolbox - Investment Analysis
Sustainable Packaging Guidelines (SPGs)	Emotional Sustainability Design (ESD) Toolbox		Sustainability Impact and Effects Analysis (SIEA)	Future Adaptive Design Toolbox -FAD screening
Knowledge map	Emotionally Durable Design Nine Framework		The Systemic Four	Future Adaptive Design Toolbox -Lifecycle service planner
Okala Ecodesign Strategy	Expanded Circular Storyboard		Upstream Innovation: Packaging Solution Workshop	Future Adaptive Design Toolbox -TCO analysis
Product Care Kit	Future Adaptive Design Toolbox -FAD opportunties canvas and ideation cards		Use2Use Design Toolkit - Circular Designs Evaluation Pack	KATCH_e tools: CE designer
ReSOLVE	Future Adaptive Design Toolbox -Lifecycle service planner		Whole Systems + Life-Cycle Method (WSLC)	KATCH_e tools: CE Journey
Sustainable Design Cards	KATCH_e tools: CE designer			MET (Materials, Energy, Toxicity) Matrix
The Round Table Management Guidelines	KATCH_e tools: CE Journey			Sustainability Guide: Circular Product & Service assessment
Use2Use Design Toolkit - Circular Designs Ideation Pack	Okala Ecodesign Strategy			The Systemic Four
Use2Use Design Toolkit - Circular Journeys Exploration Pack	Product Care Kit			Upstream Innovation: Packaging Solution Workshop
Use2Use Design Toolkit - Multiple Use-Cycles Exploration Pack	Repair Service Design Tool			Use2Use Design Toolkit - Circular Designs Evaluation Pack
Use2Use Design Toolkit - Use2Use Thinking Activation Pack	ReSOLVE			Whole Systems + Life-Cycle Method (WSLC)
	Sustainable Design Cards			
	The Systemic Four			
	The Tarot Cards of Tech			
	Upstream Innovation: Packaging Solution Workshop			
	Use2Use Design Toolkit - Circular Designs Ideation Pack			
	Use2Use Design Toolkit - Circular Journeys Exploration Pack			
	Use2Use Design Toolkit - Multiple Use-Cycles Exploration Pack			
	Whole Systems + Life-Cycle Method (WSLC)			

Figure A2. Overview of circular product development tools categorised by their intended aim.

NPD Phases			
DISCOVER	**DEFINE**	**DEVELOP**	**DELIVER**
Circular Design Toolkit - Circular Design Brief			
Circular Economy Toolkit			
Design with Intent: 101 Patterns for Influencing Behaviour Through Design			
Knowledge map			
Use2Use Design Toolkit - Circular Journeys Exploration Pack			
Use2Use Design Toolkit - Multiple Use-Cycles Exploration Pack			
Use2Use Design Toolkit - Use2Use Thinking Activation Pack			
Brainstorm Sudoku			
Cards for Circularity			
CIM (Consumer Intervention Map)			
CIRCit Nord: Circular Strategies Scanner			
Circular Design			
Circular Design Guide - Circular Brainstorming			
Circular Design Guide - Find Circular Opportunities			
Circular Design Guide - Service Flip			
Circular Design Guide - Understand Circular Flows			
Circular Design Toolkit - Life Cycle Design			
Circular Design Toolkit - Life Cycle Discussion			
Circular Design Toolkit - Life Cycle Model			
Circular Strategies Wheel			
Circularity Deck			
Emotional Sustainability Design (ESD) Toolbox			
Emotionally Durable Design Nine Framework			
Future Adaptive Design Toolbox -FAD opportunties canvas and ideation cards			
Okala Ecodesign Strategy			
Product Care Kit			
ReSOLVE			
Sustainable Design Cards			
The Systemic Four			
The Tarot Cards of Tech			
Use2Use Design Toolkit - Circular Designs Ideation Pack			
Close The Loop			
	Circular Design Toolkit - Circular Idea (in a nutshell)		
	Future Adaptive Design Toolbox - Circular Vision Template		
	10 Golden Rules for Ecodesign		
	Circular design guide - Concept selection		
	Circular Design Guide - Product Journey Mapping		
	Circular Design Guide - Smart Material Choices		
	Circular Design Toolkit - Product & Actant Journey		
	Circular Material Library		
	Circular Storyboard		
	Expanded Circular Storyboard		
	Future Adaptive Design Toolbox -Lifecycle service planner		
	KATCH_e tools: CE Journey		
	Use2Use Design Toolkit - Circular Designs Evaluation Pack		
	Whole Systems + Life-Cycle Method (WSLC)		

Figure A3. *Cont.*

NPD Phases			
DISCOVER	**DEFINE**	**DEVELOP**	**DELIVER**
	Circular experience library		
	Future Adaptive Design Toolbox - Investment Analysis		
	Future Adaptive Design Toolbox -TCO analysis		
		CIRCit Nord: Circularity Assessment Tool	
		CIRCit Nord: Guidelines for Circular Product Development	
		Circular Design Guide	
		Circularity: Guiding the Future of Design	
		Design for Remanufacture Toolkit	
		Energy Efficient Products	
		Future Adaptive Design Toolbox - Assessing Concepts	
		Sustainable Packaging Guidelines (SPGs)	
		Circular Design Toolkit - Ecodesign Assessment Product	
		Circular Design Toolkit - Ecodesign Assessment Service	
		Circular Pathfinder	
		CircularEconomy Toolkit: Assessment Tool	
		Circularity Calculator	
		Circularity Check	
		Concept Circularity Evaluation Tool (CCET)	
		Disassembly Map	
		Future Adaptive Design Toolbox - Drivers of Product Obsolescence	
		Future Adaptive Design Toolbox - FAD heatmap	
		Future Adaptive Design Toolbox -FAD screening	
		KATCH_e tools: CE designer	
		MET (Materials, Energy, Toxicity) Matrix	
		RecyClass	
		Reman Design Checklist	
		Repair Service Design Tool	
		Sustainability Guide: Circular Product & Service assessment	
		Sustainability Impact and Effects Analysis (SIEA)	
		The Round Table Management Guidelines	
		Upstream Innovation: Packaging Solution Workshop	

Figure A3. Overview of circular product development tools categorised by NPD phase.

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