

Article

Means and Meanings in Circular Economy: An MDA-Based Exploratory Analysis

Federico Barnabè *  and Riccardo Santoni 

Department of Business and Law, University of Siena, 53100 Siena, Italy; riccardo.santoni2@unisi.it

* Correspondence: federico.barnabe@unisi.it

Abstract

This study aims to examine how organizations disclose Circular Economy (CE) information through multimodal communication. While conventional reporting often fails to capture the complexity of CE, we adopt a Multi-Discourse Analysis (MDA) framework that integrates textual, numerical, visual, spatial, and sensory dimensions. The methodology involves a qualitative content analysis of non-financial reports from 13 Italian electronics firms, a sector with a high environmental impact and low circularity. Key findings show a dominance of textual narratives and increasing use of numerical indicators aligned with the European Union Taxonomy. Visual elements are underutilized and largely symbolic, reflecting a product-centric rather than systemic view of circularity. The spatial dimension, operationalized through ESRS E5 categories, reveals fragmented CE integration and limited forward-looking financial disclosures. The sensory dimension, assessed via integrated thinking, highlights a polarization between firms that embed CE into strategy and those that do not. Recommendations are provided to enhance the clarity, comparability, and strategic relevance of CE disclosures, with implications for corporate practice, regulatory development, and future research. Overall, this study advances the understanding of CE by applying MDA to reveal the interplay of communicative modes, the gaps in systemic representation, and the degree of strategic integration in sustainability reporting.

Keywords: circular economy (CE); financial and non-financial reporting; multimodal discourse analysis (MDA); means of communication; corporate sustainability disclosure; electronics sector



Academic Editor: Ja-Shen Chen

Received: 17 July 2025

Revised: 21 August 2025

Accepted: 22 August 2025

Published: 29 August 2025

Citation: Barnabè, F.; Santoni, R. Means and Meanings in Circular Economy: An MDA-Based Exploratory Analysis. *Sustainability* **2025**, *17*, 7768. <https://doi.org/10.3390/su17177768>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

There has been increasing concern that conventional corporate reporting fails to give stakeholders adequate information [1–3], especially when organizational activities generate impacts that go beyond the economic sphere of affairs or involve complex systems of resources and activities [4].

Acknowledging such factors, recent years have seen the development of several frameworks, regulations, and methodologies aimed at making both financial and non-financial information clearer and more holistic. For example, the European Union (EU) [5] stepped forward to address financial consultants' and investors' information needs to inspect non-financial information by promulgating Directive 2014/95/EU. Other notable initiatives include the Integrated Reporting framework [6], as well as the new guidelines and standards from bodies such as SASB and EFRAG.

Certainly, debate remains lively about how organizations should present holistically such data and information [7], particularly regarding sustainability activities [8–10] and, as in this study, Circular Economy (CE) [11,12].

Broadly, a Circular Economy is an economic system in which products and services are traded in closed-loop cycles [13], in contrast to the linear-oriented system that has traditionally characterized our production processes (so-called “linear economy”) [14]. At its core is the concept of “feedback loop” [15]. A feedback loop is generated by two or more variables circularly connected, e.g., A affects B, then B affects C, and C affects A, thereby closing the loop and determining a circular relationship among A-B-C [16]. Building on this, CE’s aim is to close loops, thereby (re)using properly the resources at disposal and minimizing both waste generation and the constant need for new virgin raw materials. In essence, it is a regenerative system by design, aimed at retaining as much value as possible of products, parts, and materials [17,18].

A wide segment of the literature has already examined the concept and boundaries of CE, offering numerous definitions [13,19,20], highlighting its multidimensional nature (i.e., encompassing environmental, social, and economic dimensions) [21,22], and outlining its underlying principles and processes. For example, Stahel’s seminal 1982 work [23] proposed a framework based on four processes: Reuse, Repair, Remanufacture, and Recycle. More recent studies have introduced broader frameworks, presenting additional loops [24,25]. Previous research also developed and proposed metrics and indicators to assess CE-related impacts [20,26,27].

Despite this growing body of literature, corporate reporting practices for disclosing CE information remain under scrutiny and represent a fertile area for research. A relatively unexplored topic concerns the combined use (and analysis) of multiple modes of language (e.g., text, visuals, and quantitative data) to convey CE-related information comprehensively and unambiguously.

This issue arises from three main factors.

The first concerns the reporting tools typically used by organizations to disclose CE-related information. Broadly, corporate communication in this context requires selecting and using appropriate reporting tools, such as annual reports or environmental reports, as well as other channels of communication (e.g., social media). Prior studies have examined the strengths and weaknesses of these modes, emphasizing the reasons for which they should (or should not) be used for CE disclosure [28,29]. Notably, and as aforementioned, although numerous international reporting frameworks and methodologies exist for non-financial and sustainability reporting [30], standardized guidelines for reporting CE information and data [11] remain under development, with bodies such as EFRAG and SASB playing key roles. This gap constitutes the first rationale for further research in the field.

The second factor refers to the means used to convey CE concepts clearly, concisely, and consistently. This requires identifying interconnections, hierarchies, and closed loops among relevant dimensions, decisions, and actions. Studies in the field of financial and non-financial reporting highlight that three main modes of communication—text [31], visuals [32], and metrics [33,34]—can be used either simultaneously or separately [35]. When used together, they may integrate to convey and enrich common underlying content; used separately, they may convey distinct content (partially or totally). However, research on how these modes of communication can be effectively combined for CE communication remains unexplored, representing the second gap addressed with this study.

Last, the third factor concerns the potential relationship between communication means and their intended audience. CE initiatives and reporting activities often target a wide array of stakeholders (e.g., shareholders, customers, citizens, etc.) with varying

backgrounds, interests, and needs [36]. The literature [37,38] in the domain of language and communication highlights several factors affecting and shaping interpretation and, subsequently, understanding: context (e.g., cultural and knowledge differences); semantics or syntax (e.g., how a sentence is constructed and the choice of words that are used can convey different meanings to different users); social and cultural factors (e.g., different norms, values, and practices characterizing a specific population can affect the interpretation and understanding of a document); technical jargon (e.g., when specialized terminology or vocabulary is used to convey specific information, not all the audience might be able to understand it); individual experiences, mental models, and biases (e.g., the unique set of past experiences, beliefs, and ideas that guide individuals might lead to an interpretation and understanding of content that could differ from individual to individual). Such variability can hinder consistent, homogeneous, and unambiguous understanding of CE disclosures. This situation reinforces the need for multiple communication modes and calls for further research in this context.

Overall, to address the research gaps aforementioned—which can be summarized as a general lack of understanding regarding how different communicative modes are used in combination to construct meaning in corporate disclosures—this study adopts an MDA framework to investigate how organizations communicate CE-related information through multiple semiotic modes. In doing so, it aims to offer both methodological and practical insights into the clarity, comparability, and strategic relevance of CE disclosures. To accomplish this, the study is guided by the following research questions:

RQ1: Which are the means of communication used by organizations to disclose relevant CE-related information?

RQ2: How might the combined use of different means of communication impact the meanings that are conveyed to the readers?

To address its research questions, this study conducted an exploratory analysis of 13 organizations in the electronics industry. This business sector was selected for its distinctive peculiarities, specifically when considering the effects and implications generated by its operations in terms of CE, such as the scarcity of resources at disposal, the difficulties in recycling waste, and the high environmental footprint of the activities carried out [39–41]. Interestingly, despite its potential to foster circular solutions in other sectors, the electronic sector currently exhibits low circularity levels [40]. Further information is provided in the Materials and Method Section.

Non-financial disclosure reports from the companies included in the sample were examined through manual content analysis [42], applying three codes (one per typology of communication means, i.e., qualitative/textual, visual, quantitative) to identify CE-related concepts and information. All the reports were retrieved online, stored, and analyzed by all the researchers involved in the study. Multi-discourse analysis (MDA) principles were used as the underpinning theoretical lenses for the analysis.

Rooted in social semiotics [43], MDA argues that meaning is not transmitted and conveyed through language alone but rather through a combination of semiotic modes, including text, visuals (e.g., images, diagrams, charts, symbols, spatial arrangements), and numerical representations (e.g., metrics, indexes, percentages).

These modes interact to construct meaning for the intended audience, allowing researchers to move beyond traditional content analysis, which typically focuses on isolated textual or numerical elements. Unlike conventional approaches, MDA enables the investigation of how multiple communicative forms co-exist, reinforce, or contradict each other within corporate disclosures. This analytical lens is particularly valuable in the context of CE reporting, where complexity and multidimensionality require a more holistic

understanding of how organizations convey strategic intent, operational practices, and stakeholder engagement.

Preliminary findings reveal varying degrees of integration among text, visuals, and metrics, with limited consistency in how organizations combine these modes to present a clear and coherent narrative. The analysis suggests that the interplay of communication modes appears to shape stakeholders' interpretation of CE concepts and may lead to fragmented understanding. These results underscore the need for more structured guidelines and further research on multimodal CE disclosure practices.

Unlike prior studies that have examined CE reporting through isolated textual, visual, or quantitative lenses, this study uniquely applies an MDA framework to explore how multiple semiotic modes interact to construct meaning in corporate disclosures. By focusing on the electronics industry—a sector characterized by high environmental impact and low levels of circularity—the study reveals how organizations communicate CE-related information across textual, numerical, visual, spatial, and sensory dimensions. This MDA approach offers novel insights into the strategic relevance, comparability, and clarity of CE disclosures, and contributes to both methodological advancement and practical understanding in sustainability reporting. The article is structured as follows. Section 2 presents the literature review about means of communication and the MDA approach for Circular Economy disclosure. Section 3, through its subsections, illustrates the materials and the method of this study, also commenting on the means of communication available to report CE information and describing the fundamentals of MDA for this specific domain. Section 4 reports the results of the content analysis, while Section 5 provides the discussion. The conclusion, the limitations of this study, and ideas for future research conclude this work.

2. Literature Review: Means of Communication and the MDA Approach for Circular Economy Disclosure

The prior literature shows that organizations employ a variety of tools to communicate and engage with their stakeholders, using quantitative metrics (both financial and non-financial), text, and various visual elements [31–34]. In this context, the growing complexity of the business environment and increasing stakeholder demands have stimulated organizations to move beyond “traditional” financial reporting toward formats such as non-financial, sustainability, CSR, and integrated reports [36]. In all cases, organizations aim to provide a comprehensive representation of their value creation processes and the resulting impacts, ultimately “guaranteeing” sustainable value creation in the economy, society, and the environment, as argued by Jawahir and Bradley [24] (p. 108).

This shift concerns not only the tools used to disclose information (the typology of documents) but also the “means” of communication and the content disclosed.

The “means” are the methods or channels through which CE-related information is conveyed, forming the first level of analysis for understanding how organizations address their audiences. Linked to the means of communication is the concept of “meanings” of the communication, referring both to the content of these communications and how they are interpreted and understood [44].

This aligns with the core principles of Multi-Discourse Analysis (MDA). Rooted in social semiotics [43], MDA holds that meaning is not conveyed through language alone; in other words, “language” is only one of many resources for making meaning [45]. Instead, meanings are conveyed through multiple semiotic modes, including written text, visuals, and quantitative data. In this context, “multimodality” refers to the study of communication occurring through multiple modes or channels beyond text alone. This entails analyzing and understanding how different modes—such as data, images, icons, and spatial arrangements—are combined and integrated with written text (or, in some

cases, spoken language) to construct meaning. MDA has been applied in diverse fields such as education [46] and advertising [47] and offers significant potential for investigating corporate reporting [48].

From this perspective, corporate reports (including sustainability and CE reports) can be conceived as multimodal communication artefacts. In this light, the combined use of multiple modes is a deliberate strategic choice, with each mode serving distinct communicative purposes and contributing to the construction of overall meaning.

Examples for each mode of communication are provided below.

- Quantitative data

In business, quantitative data remain the traditional form of communication. As Carnegie et al. [49] (p. 65) note, accounting is regarded as the official “language of business”, providing organizations with a common “vocabulary” and shared terms and meanings, thereby translating everyday operations into financial measurements [50]. Such accounting-generated data can be viewed as accurate, objective, and transparent, offering comprehensive records and representations of an organization’s activities. Accounting and accounting-based reports are therefore regarded as “neutral” tools or techniques [51,52]. The main content of these reports is provided by financial data, with numbers, metrics, indexes, and key performance indicators that may coexist within a single communication. Stated differently, this information is expressed through a homogeneous technical language and relies on quantitative data, even when financial activities, actions, and results are not strictly involved [52]. This is the case of sustainability reports that also provide non-financial—but still numerical and quantitative—information [53], such as physical data.

- Textual descriptions

Textual descriptions typically complement quantitative data with verbal narratives. As Chaplin [54] (p. 1) observes, “when we represent our world verbally to one another, we are using what has long been our most familiar and powerful form of communication. Indeed, language is sometimes referred to as ‘natural language’. (...) However, we do not rely on words alone—on the semantic character of the language—to accomplish the task of representing our realities to each other”. The joint use of numbers and text can serve different purposes but is commonly employed to enhance the credibility of information. As Hudson [55] (p. 135) notes, “numbers are most often encountered in relaying such matters as dates, incomes, prices, wealth or inheritance. Their use appears rarely to be questioned by academics analyzing the texts. Numbers and their context within broader grammatical or situating frames receive much less scrutiny than words, and the meaning or veracity of a quantified amount is rarely questioned”, thereby reinforcing the value of combining multiple communication modes. Nevertheless, prior research shows that organizations often rely heavily on textual descriptions in CE reports but fail to integrate them effectively with other communication modes [56].

- Visuals

Organizations may also rely on visual representations, thereby extending communication beyond text and numbers [32]. As Bell and Davison [57] (p. 167) note, “visual research is broadly defined to encompass a variety of forms, including pictures, graphs, film, web pages and architecture”.

Examining CE-related reports for such visual elements aligns with the management accounting literature [44,57–62], which shows how visuals can disclose data and illustrate relationships between an organization (and/or various organizational actors) and its stakeholders, mainly external ones.

Each communication mode has strengths and weaknesses, with choices shaped by factors such as content, target audience, and available technologies. We reinforce that prior

literature has demonstrated that all the modes aforementioned can function as alternatives or as complementary tools within an integrated approach to business [35] and CE communication [63]. Specifically, there is a resounding effect when using narrative, numerical, and visual formats together for reporting in the accounting field [64], whether to disclose the same content or to convey partially different information [56].

Notably, in sustainability and CE reporting—if compared to traditional financial reporting—organizations tend to rely more on principle-based reporting frameworks than prescriptive ones [65,66] and to favor narrative and visual formats over purely numerical data [67].

Last, prior research shows that organizations across different sectors and regions often employ multiple communication modes for different purposes, not always tied to specific CE content [68]. For example, Greenwood et al. [60] highlighted why corporations invest heavily in the visual design of organizational communications, recognizing the distinctive role and benefits of visual imagery and the rhetorical function of reports, and Ruggiero [69] correlated diverse communication forms in the public sector to the need for multidimensional performance information for various stakeholders.

While multimodal approaches in accounting and sustainability typically focus on textual, numerical, and visual modes, the MDA framework adopted here offers a broader analytical lens. It integrates two additional dimensions—spatial and sensory (presented in Sections 3.1.6 and 3.1.7)—that enable deeper exploration of how meaning is constructed in sustainability reporting. These dimensions, introduced by Giovannoni and Napier [62], are not merely metaphorical extensions but are operationalized in the following sections to assess the scope of CE-related disclosures and their strategic integration. By doing so, MDA extends conventional multimodal approaches, enabling a more holistic understanding of corporate communication practices.

3. Materials and Methods: A Multi-Discourse Content Analysis of Circular Economy Disclosures

3.1. Research Methodology

This section outlines the methodological approach adopted in this study. As previously introduced, the analysis draws on Multi-Discourse Analysis (MDA), a theoretical and operational framework rooted in semiotics [43], which examines the different modes through which companies communicate complex content, such as CE performance in sustainability reports.

Sustainability reports are widely recognized as multimodal artefacts [48], where meaning emerges from the simultaneous or even integrated use of numerical, textual, and visual components. To investigate how these modes are employed and how they influence conveyed meanings, this study applies content analysis—defined as “a research technique for the objective, systematic and quantitative description of the manifest content of communication” [70] (p. 403).

From a technical viewpoint, Guthrie et al. [71] (p. 287) underline that content analysis can be used with either qualitative or quantitative data and allows for organizing “the text of writing into various groups or categories based on selected criteria”. The prior literature shows that content analysis is well established in sustainability research [72–74], as well as in integrated reporting practices [75,76] and CE disclosure [77,78].

To operationalize the three-layer MDA structure described in Section 2—textual, numerical, and visual—this research adapted an established coding method. This method consists of a standardized coding scheme developed by Opferkuch et al. [56] for examining “how CE is emerging within the sustainability reports of companies listed in sustainability rankings” [56] (p. 1). To meet the specific needs of this research, characterized by a greater

level of detail to be achieved on a smaller sample of reports, the original textual and numerical coding procedures are expanded and integrated with the multimodal framework of Giovannoni and Napier [62] to incorporate visual and other semiotic elements.

The following subsections present each content analysis layer and the specific adaptations made to the original coding framework by Opferkuch et al. [56].

3.1.1. Textual Analysis

For the textual component, the method adopted by Opferkuch et al. [56] involved identifying occurrences of the term “circular*” in sustainability reports to locate and count CE references. In this study, the approach is expanded through a two-level process.

First, each extract or paragraph containing “circular*” is recorded with its page number and report section (e.g., materiality analysis, CEO’s message).

Second, an iterative coding process—drawing on axial coding principles from grounded theory—is applied to develop new codes [79]. This involves identifying direct references to CE initiatives or topics within the initial extracts and using them to trace further information related to actions, strategies, objectives, and instruments through which CE is implemented in business contexts.

This approach—termed “snowball coding”—enables the capture of broader CE-related content beyond the initial keyword matches [79]. For instance, in the sustainability report of De Longhi S.p.A., the term “circular economy” was initially found in a section describing the company’s sustainability strategy (page 21). This extract, coded as Textual 1, stated:

“With a view to a circular economy the use of recycled materials and the recovery of manufacturing byproducts is crucial as it makes it possible to save on the cost of the raw materials used and reduce waste.”

From this starting point, the snowball coding process led to the identification of additional CE-related concepts, such as “recycled materials” and “recovery of manufacturing byproducts”. Although these expressions did not repeat the term “circular economy”, they were explicitly described as CE actions and thus coded as Textual 2 by extracting the sentences containing the terms “recycl*” and “recover*” and referring to the above-mentioned themes.

In this way, the snowball coding approach offers two main advantages. First, it identifies activities not explicitly labeled under the term “circular economy” but indirectly related to it, thereby enabling a broader exploration of the text, capturing implicit references, and expanding the coding through iterative extraction. Second, it allows excluding activities that, while using CE-related terminology (e.g., recycling), may still be part of a linear development model. To this end, the method requires companies to explicitly frame such activities within their CE strategy, subsequently developing second-level codes.

This approach ensures that identified initiatives are interpreted within the company’s strategic narrative. For example, while many firms report actions such as emissions reduction or waste recycling, these practices, although relevant to sustainability and consistent with certain R-principles of CE [80], do not necessarily reflect a truly circular approach and may still reflect linear models [81].

3.1.2. Quantitative Data Analysis

For the quantitative component, the content analysis adopts a two-step approach adapted from Opferkuch et al. [56] (p. 441) for identifying “targets and indicators for CE”.

First, all targets and indicators explicitly containing the term “circular*” were extracted from the reports, capturing direct references to CE-related metrics and performance indicators.

Second, additional targets and indicators were identified through a more detailed review of the extracts and references gathered during the textual analysis. This phase was

conducted iteratively, with continuous cross-referencing and updates as new quantitative data emerged.

This dual approach enables a comprehensive mapping of the CE-related quantitative disclosures, capturing both explicitly labeled indicators and those embedded in broader reporting narratives or visuals, and assessing their contextual relevance and alignment with the overall CE strategy.

3.1.3. Visual Analysis

The visual dimension of the analysis draws inspiration from the work of Giovannoni and Napier [62]. The authors propose a multimodal framework for interpreting material and communicative artifacts, emphasizing the interplay of visual, verbal, numerical, spatial, sensory, and aural dimensions in meaning-making. Sustainability reports, in this view, are “messy objects”, i.e., objects composed of homogeneous elements, where meaning is not fixed but emerges through dynamic and multimodal interactions.

In our study, the focus is on visuals that convey key CE concepts—such as loops, feedback mechanisms, flowcharts, closed cycles, and circularity symbols and icons—which are considered not merely as visual representations but as integral to meaning-making in organizations’ communications about CE strategies and performance.

As with the textual and numerical analysis, for visuals, the process occurs in two phases. First, visuals explicitly depicting CE-related concepts are identified and catalogued. Second, visuals referenced or described in the other dimensions (textual and numerical) are individually traced and classified. This cross-dimensional approach ensures that visuals are not analyzed in isolation but are contextualized within the broader communicative framework of the report.

3.1.4. Phase 1: Coding Process and Data Triangulation

Table 1 summarizes the information collection process for each report. Each coding step is associated either with a direct code (e.g., loops or circular*, where the asterisk indicates the stem of the term being searched) or an indirect reference (e.g., a link to another ID number). For each extract, a unique ID is assigned, together with the page number, report section, and a space for researcher annotations. These fields ensure data traceability, facilitate triangulation across communication modes, and support inter-coder reliability.

Table 1 represents the first phase of the content analysis, focusing on the systematic coding of information across the three dimensions identified in the MDA literature on CE disclosure. To ensure the robustness of the analysis, all authors independently coded each report. Results were compared and discussed, and in cases of divergence—particularly during the more interpretive second step of each phase (e.g., snowball coding or the classification of indicators as CE-related)—the relevant extracts were jointly reviewed to reach consensus (on whether to include or exclude a given code). This process produced a shared and validated coding document at the end of the first phase.

Table 1. Coding table.

Step	Code	ID	Page	Extract	Report Section	Researcher Notes
Textual 1	circular*	#	#	Text	...	...
Textual 2	Derived by snowball coding	#	#	Text	...	...
Numerical 1	circular*	#	#	Target or indicator	...	...

Table 1. *Cont.*

Step	Code	ID	Page	Extract	Report Section	Researcher Notes
Numerical 2	#ID ref	#	#	Target or indicator	...	...
Visual 1	loops, feedback, flowcharts, closed cycles, circularity symbols and icons	#	#	Image	...	...
Visual 2	#ID ref	#	#	Image	...	...

Source: authors' elaboration.

The next sections present how the coded data were interpreted and classified during the second phase of the analysis.

3.1.5. The Spatial Dimension

As noted by Giovannoni and Napier [62] (p. 408), visual, verbal, and numerical modes represent only the most acknowledged dimensions in accounting communication. To move beyond this conventional boundary, their analysis (originally applied to the physicality of a building) introduces additional dimensions, including spatial (e.g., magnificence, distribution of space between student and staff rooms and public rooms), sensual (e.g., heating, brightness), and aural (e.g., quietness) dimensions. While directly translating such dimensions from architectural contexts to corporate reporting poses interpretive challenges, it is clear that communication exchange often extends beyond the sum of textual, numerical, and visual components.

In this study, the spatial dimension is used to interpret the breadth and coverage of CE-related information disclosed in corporate reports. For this purpose, data from the first phase of content analysis are classified according to the disclosure requirements of the European Sustainability Reporting Standard (ESRS) E5 on resource use and circular economy [82]. These include (1) policies related to resource use and circular economy (hereinafter, “policies”); (2) actions and resources related to resource use and circular economy (“actions”); (3) targets related to resource use and circular economy (“targets”); (4) resource inflows; (5) resource outflows; and (6) anticipated financial effects from material resource use and circular economy-related risks and opportunities (“anticipated financial effects”). Each coded element may align with one, several, or none of these categories. For example, a paragraph may describe a CE policy (Category 1), a target related to resource inflows (Categories 3 and 4), or general definitions that fall outside of those categories.

It is important to note that this classification is not intended to assess compliance with the ESRS E5 standard [82], as the reports analyzed refer to fiscal year 2023, while the standard entered into force in 2024. This operationalization of the spatial dimension allows us to interpret spatiality as a proxy for the breadth and distribution of CE-related information within corporate reports. In this way, the spatial dimension is not merely a conceptual extension borrowed from architectural analysis but a structured analytical tool that enables us to assess how comprehensively organizations address circularity across strategic and operational domains.

3.1.6. Integrated Thinking as the Sensory Dimension

The sensual and aural dimensions proposed by Giovannoni and Napier [62] cannot be directly transposed to tangible features of sustainability reports, given the absence of physical or auditory interaction. In sustainability accounting, however, the concept of “integrated thinking” offers a meaningful proxy for capturing these intangible communicative aspects.

As clarified by IIRC [6] (p. 3), integrated thinking is “the active consideration by an organization of the relationships between its various operating and functional units and the capitals that the organization uses or affects”. Although difficult to define precisely—some scholars have even referred to it as “mythical” [83]—integrated thinking is widely acknowledged as a multidimensional and forward-looking approach that embraces multiple perspectives and domains of knowledge to support informed decision-making [84].

Few studies have attempted to provide measures for integrated thinking, either through qualitative assessments of report content [76] or through quantitative evaluations of business model variables [85]. For this research, we adopt the four main components of integrated thinking identified by Malafronte and Pereira [85] to assess the degree of CE integration in each report [86]: the first three, i.e., (1) declared commitment to CE, (2) presence of CE-related policies, and (3) presence of CE monitoring measures, capture the current level of CE integration, while the fourth (4) assesses the presence of future (forward-looking) CE objectives.

Unlike the previous dimensions, the sensory dimension does not refer to individual extracts but involves a holistic assessment at the report level. Each of the four components is evaluated using a coding scheme based on its total presence (Y), partial presence (P), or absence (N) in the document.

This operationalization of the sensory dimension translates intangible communicative aspects into a structured framework based on integrated thinking for assessing CE-related strategic integration. The four components [85] serve as proxies for the cognitive and organizational embedding of circularity, representing how deeply circular principles are internalized within the company’s strategic narrative.

3.1.7. Coding Strategy and Inter-Coder Reliability

Table 2 provides a comprehensive overview of the coding structure used in this study, integrating all five analytical dimensions: textual, numerical, visual, spatial, and sensory.

The coding process followed a combined deductive–inductive approach. In particular, the first-level codes for textual, numerical, and visual dimensions (named Textual 1, Numerical 1, and Visual 1) were developed deductively, based on the prior literature and existing frameworks [56,62]. After that, the second-level codes (named Textual 2, Numerical 2, and Visual 2) relied on inductive and iterative processes of snowball coding and the identification of cross-references, enabling spotting CE-related content that was not explicitly labeled as such in the original reports.

Differently, a purely deductive approach, based on predefined classification schemes, was used for the spatial and sensory dimensions. For the spatial dimension, we relied on the six disclosure requirements of the ESRs E5 standard [82]. For the sensory dimension, we adapted the four components of integrated thinking proposed by Malafronte and Pereira [85] to the CE context.

To ensure inter-coder reliability, all reports were independently coded by both authors. Divergences were discussed and resolved through a collaborative triangulation process to ensure consistency. This iterative process contributed to the overall trustworthiness in several ways: credibility was ensured through independent coding and iterative refinement, dependability through a transparent and replicable coding protocol, confirmability via

traceable coding tables and annotations, transferability by providing detailed contextual information on the sample and coding framework.

Table 2. Complete coding table.

Step	Code	ID	Page	Extract	Report Section	Researcher Notes	Spatial
Textual 1	circular*	#	#	Text	...	...	ESRS E5 Disclosure Requirements
Textual 2	Derived by snowball coding	#	#	Text	...	...	=
Numerical 1	circular*	#	#	Target or indicator	...	...	=
Numerical 2	#ID ref	#	#	Target or indicator	...	...	=
Visual 1	loops, feedback, flowcharts, closed cycles, circularity symbols and icons	#	#	Image	...	...	=
Visual 2	#ID ref	#	#	Image	...	...	=
Sensory Dimension	(1) declared commitment to CE: Y/P/N						
	(2) presence of CE-related policies: Y/P/N						
	(3) presence of CE monitoring measures: Y/P/N						
	(4) presence of future CE objectives: Y/P/N						

Source: authors' elaboration.

3.2. Research Sample

To achieve the objectives of this study, we conducted an exploratory analysis of 13 corporate reports published by large Italian companies in the electronics industry. The sample was selected through a structured, multi-step approach.

First, the sector of analysis was chosen based on a review of both the scientific and non-scientific literature addressing the challenges of linear practices across industries. The electronics sector emerged as particularly relevant for several reasons: electronic products incorporate a wide range of materials, including critical and rare-earth elements [38]; the sector is characterized by rapid technological turnover and significant e-waste generation, requiring the recovery and reintegrating of materials into production loops [87]; despite its potential to enable circular solutions in other sectors, it currently shows low levels of circularity [40]; and it is increasingly subject to regulatory pressure concerning circular economy and material traceability along the entire electronics supply chain [39].

Second, the scope was narrowed to European companies for two reasons linked to the normative requirements on sustainable disclosure. On one hand, Directive 2014/95/EU [5] requires large companies to disclose non-financial information annually. On the other hand, the transition to the new ESRS standards [82]—including ESRS E5 on Resource Use and Circular Economy—marks a significant shift in disclosure expectations. Analyzing reports from the year preceding ESRS implementation provides a timely benchmark for assessing CE-related reporting in the absence of binding guidelines.

Third, given the complexity of the multidimensional content analysis, a manageable sample size was required to allow for manual coding, iterative refinement, and data triangulation. Drawing on prior studies employing innovative deep manual content

analysis methods, a minimum of 7 reports was deemed methodologically adequate [76]. To reduce variability and ensure comparability, the study was limited to a single country. Following an assessment of non-financial disclosure availability across major European countries (Germany, France, Italy, and Spain), Italy was selected due to the accessibility and comprehensiveness of the “Osservatorio DNF” database.

The Osservatorio DNF, hosted by a consortium of institutional and academic partners, was identified as the most suitable source for three reasons: (1) it provides open access to full PDF versions of reports; (2) it offers advanced filters for publication year and industry; and (3) it provides a transparent and user-friendly interface.

Applying the combined filters “electronics industry” and “fiscal year 2023”, 13 reports were retrieved, meeting the target sample size and dimensional criteria.

Table 3 presents the list of organizations included, along with relevant information about the type of document and the number of pages. Where the non-financial disclosure (NFD) is included within a broader document, the number of NFD-specific pages is indicated in brackets.

Table 3. Overview of the sample.

Organization Name	Document Type	Number of Pages (NFD-Specific)
Beghelli S.p.A.	Sustainability report and Consolidated non-financial statement	90
Carel Industries S.p.A.	Consolidated non-financial statement	162
Cembre S.p.A.	Sustainability report and Consolidated non-financial statement	91
Datalogic S.p.A.	Consolidated non-financial statement	100
De Longhi S.p.A.	Sustainability Report	84
El.En. S.p.A.	Sustainability report and Consolidated non-financial statement	204
Elica S.p.A.	Sustainability Report	148
Gefran S.p.A.	Sustainability report and Consolidated non-financial statement	234
Indel B S.p.A.	Financial Statement	381 (120)
IRCE S.p.A.	Financial Statement	198 (43)
Retelit S.p.A.	Sustainability Report	110
SAES Getters S.p.A.	Consolidated non-financial statement	120
Sit S.p.A.	Sustainability report and Consolidated non-financial statement	213

Source: authors’ elaboration.

The selected sample offers a robust foundation for exploring how organizations operating under similar regulatory and industrial conditions disclose CE-related information across textual, numerical, visual, spatial, and sensory dimensions, and how these modes interact to construct and convey meaning.

4. Results

4.1. Results Overview: Textual, Numerical, and Visual Information in the Reports

The content analysis of the 13 non-financial disclosures reveals a heterogeneous distribution of CE-related information, both across companies and within different sections of the documents.

In terms of communication modes, Table 4 (where percentages are rounded) shows that textual content is the most frequently used, accounting for approximately 60% of all coded extracts—split between direct references to CE (Textual 1: around 32%) and indirect references (Textual 2: around 29%). Numerical content follows, representing one third

of the total, with 17% of extracts referring to targets explicitly labeled as CE-related and 16% to indirect indicators and targets (e.g., recycled inputs, eco-design projects). Visual content is the least common (7% of the total), of which 5% consists of loops, icons, and symbols directly associated with CE, and 2% comprises visual elements supporting textual or numerical disclosures (e.g., infographics).

Table 4. Number and percentage of occurrences divided per content analysis step.

Occurrences	Individual		Aggregated (Textual, Numerical, and Visual)	
	#	%	#	%
Textual 1	146	32%	278	60%
Textual 2	132	29%		
Numerical 1	77	17%	152	33%
Numerical 2	75	16%		
Visual 1	23	5%	31	7%
Visual 2	8	2%		
Total	461	100%	461	100%

Source: authors' elaboration.

This distribution reflects the narrative nature of the analyzed documents, which tend to prioritize qualitative descriptions of strategies and initiatives. Nonetheless, the presence of numerical data, particularly those linked to the EU Taxonomy, indicates a growing emphasis on quantification and standardization.

About this point, Table 5 (where percentages are rounded) shows the central role played by the EU Taxonomy for stimulating the inclusion of CE-related content in sustainability disclosures. Approximately 26% of all CE-related extracts appear in the sections dedicated to the EU Taxonomy. With the exception of De Longhi S.p.A. and Retelit S.p.A., all companies disclose on activities deemed eligible or aligned with the EU Taxonomy, even when no positive contributions are reported for CE-related turnover, CapEx, or OpEx. This suggests that the Taxonomy not only shapes strategic orientation but also enforces a standardized disclosure format that encourages companies to quantify their CE-related activities. The trend is reinforced by the finding that 100% of the targets and indicators explicitly labeled as CE-related (i.e., Numerical 1 step) relate to the EU Taxonomy, while all other numerical data (i.e., Numerical 2 step) address indirect CE aspects without being formally categorized as CE indicators.

In parallel, a notable concentration of CE-related disclosure is found in the “Products and supply chain” sections, which account for 37% of all coded content. These sections show particularly high proportions of indirect numerical (Numerical 2: 67%) and indirect textual (Textual 2: 64%) content. This pattern suggests that, after introducing CE in the opening sections of the report (e.g., CEO’s message, materiality analysis), companies tend to cross-reference and elaborate on CE-related practices in the product and supply chain sections. Disclosures here often concern recycled materials, eco-design principles, product durability, and repairability, indicating a product-centric interpretation of CE.

Although limited in volume, visual content primarily serves to reinforce strategic discourses. In most cases, visuals consist of SDG icons, recycling symbols, or other graphical elements that accompany textual or numerical content. These elements are typically located in sections addressing sustainability strategy, materiality, and product-related disclosures.

Only one case in the sample, Datalogic S.p.A.’s 2023 non-financial disclosure [88] (p. 50) contains a visual representation of a complete circular process. This visual representation outlines a circular process involving the return, health check, and reconditioning of old devices, which are either refurbished and redistributed or dismantled for spare parts and

waste management. It distinguishes material and financial flows and highlights the role of multiple actors, including customers, suppliers, and repair centers.

Table 5. Distribution of CE-related content by report section and communication mode.

Report Section	Textual 1	Textual 2	Numerical 1	Numerical 2	Visual 1	Visual 2	Total
Analysis of the context	2%	0%	0%	0%	0%	0%	1%
CEO's message	2%	4%	0%	0%	0%	0%	2%
EU Taxonomy	33%	1%	100%	5%	7%	0%	26%
Governance	1%	0%	0%	0%	7%	0%	1%
Materiality	15%	5%	0%	0%	27%	29%	9%
Others	3%	4%	0%	0%	0%	0%	2%
Partnerships	1%	1%	0%	0%	0%	0%	1%
Products and supply chain	20%	64%	0%	67%	27%	14%	37%
Results	1%	1%	0%	3%	20%	0%	2%
Risk management	3%	4%	0%	0%	0%	0%	2%
Stakeholder letter	4%	0%	0%	0%	0%	0%	1%
Strategy	13%	4%	0%	13%	7%	57%	9%
Waste management	2%	14%	0%	13%	7%	0%	7%

Source: authors' elaboration.

This finding confirms that visual elements, while present, remain relatively uncommon in CE-related disclosures. Their use is concentrated in specific sections of reports and is limited to a small subset of companies.

4.2. The Spatial Dimension: Findings Related to the ESRS E5 Disclosure Requirements

The spatial analysis was conducted according to the Disclosure Requirements set out in the ESRS E5 standard [82]. This framework organizes CE-related disclosures into six categories: Policies, Actions, Targets, Resource Inflows, Resource Outflows, and Anticipated Financial Effects. This categorization also allowed for the examination of how textual, numerical, and visual modes are employed across different areas of disclosures.

As shown in Table 6 (where percentages are rounded), textual information is predominantly used to convey the more strategic aspects of CE disclosure. The “Policies” and “Actions” categories account for 17% and 24% of all CE-related extracts, respectively, with the vast majority of content in these categories presented in textual form (15% out of 17% for Policies and 21% out of 24% for Actions). These are distributed between direct textual references (Textual 1: 9% and 10%) and indirect references derived through snowball coding (Textual 2: 6% and 11%). This pattern suggests that organizations favor narrative formats to communicate both strategic orientation and operational engagement with CE.

By contrast, the “Targets” category is dominated by numerical data, as expected. It represents 27% of the total CE-related extracts, with 8% corresponding to Numerical 1 data (previously shown to be linked to EU Taxonomy disclosures) and another 8% to Numerical 2 data. The remaining 11% consists of textual and visual references to targets, including qualitative descriptions and symbolic representations.

“Resource Inflows” and “Resource Outflows” represent 14% and 18% of the total content, respectively. These categories are generally associated with descriptions of measurements of interventions aimed at improving the circularity of material inputs and outputs. Accordingly, disclosures in these areas combine textual and numerical modes, while visual content plays a marginal role.

Table 6. Spatial distribution of CE-related content by communication mode.

Spatial Dimension (ESRS E5)	Textual 1	Textual 2	Numerical 1	Numerical 2	Visual 1	Visual 2	Total
Policies	0%	0%	9%	6%	2%	1%	17%
Actions	0%	1%	10%	11%	1%	0%	24%
Targets	8%	8%	3%	5%	1%	1%	27%
Resource Inflows	6%	2%	3%	3%	0%	0%	14%
Resource Outflows	3%	4%	6%	3%	1%	0%	18%
Anticipated Financial Effects	0%	0%	0%	0%	0%	0%	0%

Source: authors' elaboration.

No material was identified under “Anticipated Financial Effects”. This gap reflects ESRS E5 Disclosure Requirement 6, which focuses on the anticipated financial impacts of CE-related risks and opportunities. In line with this, monetary quantifications of CapEx and OpEx were excluded from the analysis, as they refer to past or current expenditures rather than forward-looking financial effects.

To exemplify how the spatial categorization was performed, we include below an excerpt from El.En. S.p.a. (page 157—available at <https://www.osservatoriodnf.it/production/dashboard/pdf6/88.pdf> access on: 1 July 2025), which was coded as Textual 1 and categorized under Actions (i.e., implementation of packaging-related interventions), Targets (the adverb “completely”, a textual form of target), and Resource Outflows (since it refers to packaging):

“Completely eliminating plastic from the packaging of spare parts is an excellent result in terms of sustainability and also circularity (only a few special packaging for particular materials remain in place to avoid noncompliance) and is only the beginning of a path that will see us committed in the coming years to increasingly circular solutions at all Group companies”.

4.3. The Sensory Dimension: Findings Related to the Integrated Thinking Concept

The analysis of the sensory dimension, here used as a proxy for integrated thinking in CE-related disclosures, examined the presence of four key components: (1) declared commitment to CE, (2) presence of CE-related policies, (3) presence of CE monitoring measures, and (4) presence of future CE objectives.

This analysis does not aim to assess the depth, quality, or effectiveness of disclosures; rather, it maps the presence of these elements across the sample, providing a comparative view of how companies structure their CE-related narratives.

The results, summarized in Table 7, reveal a marked polarization. One group of companies (Beghelli, Carel, Cembre, Indel B, Irce, and Retelit) fails to fully meet any of the four components, showing limited or no integration of CE principles into their strategic or operational frameworks. Their approach to the reduction of emissions and sustainability remains largely rooted in linear models.

In contrast, a substantial number of companies (De Longhi, El.En, Elica, Gefran, and SIT) present all four components, consistently embedding CE into strategic declarations, policies, indicators, and forward-looking objectives. This reflects a more structured and articulated approach to circularity.

Table 7. Sensory analysis of CE-related content by organizations.

Organization	Declared Commitment to CE	Presence of CE-Related Policies	Presence of CE Monitoring Measures	Presence of CE Future Objectives
Beghelli S.p.A.	P	N	N	N
Carel S.p.A.	N	P	P	N
Cembre S.p.A.	P	N	N	N
Datalogic S.p.A.	Y	Y	Y	P
De Longhi	Y	Y	Y	Y
El.En S.p.A.	Y	Y	Y	Y
Elica S.p.A.	Y	Y	Y	Y
Gefran S.p.A.	Y	Y	Y	Y
Indel B S.p.A.	N	N	N	N
Irce S.p.A.	N	N	N	N
Retelit S.p.A.	N	N	N	N
Saes Getters	Y	Y	N	P
SIT	Y	Y	Y	Y

Legend: Y = Yes; P = Partially; N = No. Source: authors' elaboration.

A single intermediate case emerges: Saes Getters, which shows a declared commitment and active policies but lacks evidence of monitoring mechanisms and long-term planning. This suggests an emerging, yet still consolidating, approach to CE integration.

An example of excerpts that guided the evaluation of the sensory dimension can be found in the report from Elica S.p.A.: the declared commitment to CE can be found in the materiality assessment, on page 49:

“Manufacturing companies can help reduce the environmental impact of their products by using recycled materials, furthering the development of a circular economic model.”

As concerns the presence of CE-related policies, an example is the declaration on page 39:

“Process and product-related goals can be achieved [...] by fostering the combination of innovation and sustainability of products and their Design with a view towards circularity.”

The company also discloses monitoring measures, with reference to the European Taxonomy. Indeed, on page 143, it declares that the economic activity “Manufacture of electrical and electronic equipment” is eligible for the following proportions of turnover (76%), CapEx (56.2%), and OpEx (61.5%).

Finally, the presence of future objectives is identified through snowball coding on page 131:

“The Group launched and is currently overseeing the adoption of a project that will guarantee the use of polymers containing up to 30% recycled materials (recovered from post-consumer and post-industrial circuits).”

In sum, the results across the textual, numerical, visual, spatial, and sensory dimensions provide a comprehensive picture of how CE-related information is currently distributed within corporate non-financial disclosures.

Although the predominance of specific modes varies by company and report section, these findings form the empirical foundation for the subsequent discussion, which offers interpretative insights and implications.

5. Discussion

Drawing on the theoretical lenses of the MDA approach [43] and the extant literature, this section discusses the results of the content analysis concerning the study's two research questions:

RQ1: Which are the means of communication used by organizations to disclose relevant CE-related information?

RQ2: How might the combined use of different means of communication impact the meanings that are conveyed to the readers?

By examining report content through both the academic literature and the five analytical dimensions (textual, numerical, visual, spatial, and sensory), the discussion outlines theoretical, practical, and regulatory implications. These insights highlight both opportunities and risks in current CE disclosure practices, while outlining potential trajectories for CE reporting and areas for further research.

5.1. Textual and Numerical Dominance: Between Narrative Flexibility and Regulatory Standardization

The content analysis reveals a clear predominance of textual communication in representing CE-related activities and performance. This finding aligns with the prior literature on sustainability reporting [56], which identifies verbal language as the most familiar and powerful form of communication [54]. Words enable companies to construct complex narratives, articulate strategic perspectives, and legitimize business actions, particularly in emerging and uncertain domains such as CE [55].

The significant presence of content identified through snowball coding (“Textual 2”) further suggests that many CE-related elements are not explicitly framed as such but embedded within broader sustainability narratives. These often focus on product eco-design and waste management strategies, reinforcing the view that CE frequently appears in implicit and unstructured forms within corporate disclosures [56].

Numerical content, particularly the direct CE indicators captured under “Numerical 1”, highlights the central role of the EU Taxonomy. All indicators explicitly referring to CE were directly linked to the Taxonomy, underscoring its influence on disclosure practices and performance measurement [9,11].

This is especially notable given the recent adoption (27 June 2023) of Commission Delegated Regulation (EU) 2023/2486, which establishes technical screening criteria for determining whether an economic activity contributes substantially to the circular economy. Despite its novelty, only two companies in the sample omitted any mention of the EU Taxonomy, while four reported 0% alignment. The remaining companies indicated progress in identifying eligible and aligned activities, in some cases quantifying investments, or explicitly acknowledged the Taxonomy as a guide for strategic alignment. One even reported a high degree of alignment between its activities and the Taxonomy.

These insights represent a first contribution of this study, offering preliminary evidence that the new regulation is already shaping accounting and disclosure practices, while also highlighting its potential to influence broader climate and sustainability discourses [12]. They also extend previous calls for further research with a more specific agenda: to assess whether future reports will demonstrate a deeper strategic integration of CE principles—such as business processes improvements—or remain confined to a compliance-driven logic of mapping existing processes to Taxonomy requirements.

About this, the methodology developed in this study demonstrates strong potential for examining the dual logic that characterizes CE-related disclosure. On one side lies an externally oriented and standardized logic, driven by regulatory requirements (captured by “Numerical 1”); on the other lies a more internally driven and flexible logic, expressed

through narrative elements and indirect indicators (“Textual 2” and “Numerical 2”). By capturing both, this study contributes methodologically to the ongoing debate on the benefits and trade-offs between standardized, comparable disclosures and more strategically aligned and context-sensitive reporting practices [8].

From a practical standpoint, organizations should be encouraged to move beyond regulatory alignment and adopt integrated reporting strategies that reflect the complexity and systemic nature of circularity. This means embedding CE principles into business models, governance structures, and performance management systems rather than confining them to isolated metrics or symbolic references.

From a policy perspective, the findings show how regulatory frameworks—exemplified by the EU Taxonomy—can play a pivotal role in shaping disclosure practices. To foster meaningful transitions, however, the new standards being introduced (e.g., ESRS E5 [82]) should be supported by capacity-building initiatives and sector-specific guidelines that help companies operationalize CE in a strategic and cross-functional manner. Policymakers should also consider mechanisms to incentivize the integration of CE into long-term planning and investment decisions, thereby ensuring that disclosure requirements align with broader sustainability goals.

5.2. *Visuals as Underused Tools: A Symptom of Product-Centric Circularity*

The content analysis shows that visual elements play only a marginal role in CE disclosures. Yet, assessing this solely by frequency would be reductive. As noted in the literature, visuals can convey substantial information when effectively integrated in accounting and reporting practices [44,59]. Accordingly, the analysis also examined the messages they convey.

Only one report used a diagram to depict a complete circular process, clearly linking CE to corporate strategy and offering accessible and immediate understanding without requiring additional text.

In the remaining cases, visual communication was underused: some reports relied entirely on text, while others included visuals that—although well-developed—were unrelated to CE. When CE was depicted, it was mainly through recycling icons and SDG 12 symbols. Last, other visuals (“Visual 2”) took the form of infographics supporting textual or numerical disclosures, but without adding distinct or supplementary information.

Beyond coded findings, many CE-related visuals were photographs of company products—likely serving marketing aims but reinforcing a product-centric view of circularity. Such a perspective risks reducing CE to product optimization and resource efficiency, overlooking its systemic potential [24,25,35].

This product-centric orientation of CE disclosures raises important concerns, considering the broader debate on CE transitions, since true circularity requires systemic changes that go beyond isolated product-level interventions [19] to impact and change organizational processes, value chains, and stakeholder networks [81]. Underuse of visual and integrative elements may thus reflect not just communication choices but also limited organizational capacity to represent CE as a systemic transformation.

This lack of systemic thinking suggests that CE is often framed as a technical or compliance-driven issue rather than a strategic, cross-functional priority. While the findings reinforce the need for enhancing corporate communication and better depicting CE processes, one notable exception is SIT S.p.A. This company used a visual to present “a concrete example of an innovative and circular management model”, extending CE principles beyond product and material flows, thereby demonstrating their multidimensional relevance for organizational governance and social performance, encompassing the entire organizational structure [21,22].

These insights underscore the potential of visuals to shift the focus from product-centric to more integrated, systemic perspectives of circularity [16], aligning with calls for holistic approaches that embed circularity into strategy, operations, and communication. In this view, CE reporting should function not only as a disclosure requirement but as a tool for strategic decision-making and stakeholder accountability.

5.3. Sensory and Spatial Dimensions: Integrated Thinking and ESRS E5 in a Fragmented Landscape

The sensory dimension, introduced in Section 2 as a proxy for CE-related integrated thinking, reveals a fragmented landscape. Companies split into two groups: those meeting all four components of integrated thinking—declared commitment, specific policies, monitoring mechanisms, and future objectives—and those showing no clear evidence of CE integration in strategy or communication.

This distribution reflects varying levels of maturity in adopting CE, both strategically and operationally, as well as different preparedness for the European Sustainability Reporting Standards, including ESRS E5 [82]. The findings suggest that some companies treat CE as a non-material issue, while others demonstrate readiness across key spatial dimensions: conceptualization (Policies), operationalization (Actions), and measurement (Targets), including Resource Inflows and Outflows.

A critical gap, however, remains and prevents full ESRS E5 alignment: none of the reports quantified the Anticipated Financial Effects of CE nor provided forward-looking financial estimates—as required by the Disclosure Requirement E5-6. This omission undermines both compliance and the translation of circular strategies into financial metrics—essential for stakeholder engagement and improved financial performance [9].

Integrating sensory and spatial dimensions enriches understanding of how CE is internalized and communicated, distinguishing symbolic alignment from operational readiness. From a regulatory perspective, these findings support Malafronte and Pereira's [85] view that integrated thinking requires embedding disclosure subjects into corporate strategy and operations. This perspective positions regulatory processes as true drivers of sustainability advancement.

From a methodological standpoint, this study extends Giovannoni and Napier's [62] multimodal analysis framework to sustainability accounting. By incorporating sensory and spatial dimensions, it shows the value of a multimodal analysis in examining CE disclosures and highlights the need for a holistic approach to advance circular and sustainable business models.

6. Conclusions, Limitations, and Further Research

This study investigated how organizations disclose CE information through multiple communicative modes by applying an MDA framework to a sample of sustainability reports from the Italian electronics sector. The analysis was guided by two research questions:

- RQ1: Which are the means of communication used by organizations to disclose relevant CE-related information?
- RQ2: How might the combined use of different means of communication impact the meanings conveyed to the readers?

In response to RQ1, our findings show that:

1. Textual and numerical means dominate: CE-related corporate reports, in this case about the electronics industry, are dominated by flexible textual narratives and are influenced by regulatory numerical frameworks such as the EU Taxonomy.

2. Visuals are underused means of communication: Visual communication, by contrast, remains marginal and largely product-centric in CE-related reports, offering limited support for more systemic and organizational representations of circularity.
3. Sensory and spatial dimensions: CE-related information is also conveyed through less conventional modes. The spatial dimension reflects the breadth and coverage of CE disclosures across categories such as policies, actions, targets, resource flows, and anticipated financial effects, based on the ESRS E5 framework. The sensory dimension, interpreted through the lens of integrated thinking, captures the degree to which CE principles are embedded into the strategic and operational fabric of the organization. It includes declared commitments, CE-related policies, monitoring mechanisms, and future objectives. Together, these dimensions offer insights into the organizational maturity and strategic alignment of CE communication.

In response to RQ2, the study reveals that the interplay of these modes often results in fragmented and product-centric representations of circularity rather than systemic ones. The spatial dimension highlights uneven levels of readiness for ESRS E5 compliance, particularly due to the general absence of quantified financial projections. The sensory dimension reveals a strong polarization between companies that embed CE across past and future initiatives and those that do not adopt holistic reporting approaches.

6.1. Contributions and Implications

This study contributes to the literature by extending the application of MDA to the domain of sustainability and CE reporting. It offers a replicable coding framework that integrates five analytical dimensions—textual, numerical, visual, spatial, and sensory—thus enabling a deeper understanding of how meaning is constructed in corporate disclosures. By doing so, it enriches the methodological toolkit available for analyzing multimodal sustainability communication and supports future research on the rhetorical and strategic functions of CE reporting.

As concerns implications:

For practitioners: organizations should move beyond compliance-driven reporting and adopt integrated strategies that embed CE principles into governance, business models, and performance systems. Enhancing the use of visual and systemic representations can improve stakeholder understanding and support strategic alignment.

For policymakers: regulatory frameworks such as the EU Taxonomy and ESRS E5 play a pivotal role in shaping disclosure practices. To foster meaningful transitions, these should be complemented by sector-specific guidelines, capacity-building initiatives, and incentives that promote long-term CE integration.

For researchers: this study opens new avenues for investigating CE disclosures through multimodal and longitudinal lenses. It encourages further exploration of how different communicative modes interact to shape perceptions of circularity and how these evolve over time and across contexts.

In conclusion, by integrating MDA into CE reporting, this study advances the theoretical understanding of sustainability communication by demonstrating how meaning is constructed through the interplay of textual, numerical, visual, spatial, and sensory dimensions. Rather than treating these as isolated communicative modes, as is common in conventional discourse or content analysis, the MDA framework offers a systemic lens that captures their interconnections. This approach enables a richer interpretation of CE disclosures, highlighting strategic alignment and supporting the development of more integrated and impactful sustainability narratives.

6.2. Limitations and Future Research

This study is based on a relatively small sample of companies within a single industry and country, which limits the generalizability of the findings. While this choice allowed for a focused and in-depth comparison of CE reporting practices under similar regulatory and industrial conditions, it also restricts the applicability of the results to broader contexts.

Future research should aim to extend the analysis to different industries, particularly those characterized by distinct material flows, stakeholder expectations, and sustainability challenges. Moreover, applying the methodology to different geographical regions—including countries with varying regulatory environments, cultural contexts, and levels of CE maturity—would enhance the robustness and transferability of the findings. Comparative studies across European and non-European contexts could reveal how institutional settings influence the multimodal construction of CE meanings.

In addition, longitudinal analyses could track how CE disclosures evolve, especially in response to new regulatory standards such as ESRS E5 or shifts in corporate strategy. This would help assess whether organizations move toward more integrated and systemic representations of circularity or remain anchored to compliance-driven approaches.

Finally, future research could explore the interactions between communicative modes in greater depth, investigating how textual, numerical, visual, spatial, and sensory elements co-evolve and reinforce—or contradict—each other in shaping stakeholder perceptions and organizational accountability.

Author Contributions: Conceptualization, F.B. and R.S.; Data curation, R.S.; Formal analysis, F.B. and R.S.; Investigation, F.B. and R.S.; Methodology, F.B. and R.S.; Writing—original draft, F.B. and R.S.; Writing—review and editing, F.B. and R.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data supporting reported results can be viewed by contacting the corresponding author.

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

Abbreviations

The following abbreviations are used in this manuscript:

CE	Circular Economy
CEO	Chief Executive Officer
CSR	Corporate Social Responsibility
DNF	Dichiarazione Non Finanziaria (Italian for “Non-Financial Disclosure”)
EFRAG	European Financial Reporting Advisory Group
EMF	Ellen MacArthur Foundation
ESRS	European Sustainability Reporting Standards
EU	European Union
IIRC	International Integrated Reporting Council
MDA	Multi-discourse analysis
NFD	Non-Financial Disclosure
SASB	Sustainability Accounting Standards Board
SDG	Sustainable Development Goal

References

- Adams, R.B.; Licht, A.N.; Sagiv, L. Shareholder and stakeholders: How do Directors decide? *Strateg. Manag. J.* **2011**, *32*, 1331–1355. [CrossRef]
- Cohen, J.L.; Holder-Webb, L.; Nath, L.; Wood, D. Corporate Reporting on Nonfinancial Leading Indicators of Economic Performance and Sustainability. *Account. Horiz.* **2012**, *26*, 65–90. [CrossRef]
- Gray, R.; Adams, C.A.; Owen, D. *Accountability, Social Responsibility and Sustainability: Accounting for the Society and the Environment*; Pearson: Harlow, UK, 2014.
- Eccles, R.G.; Krzus, M.P. *One Report: Integrated Reporting for a Sustainable Strategy*; Wiley: New York, NY, USA, 2011.
- EU (European Union) Directive, 2014/95/EU. Non-Financial Reporting. Available online: https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/non-financial-reporting_en (accessed on 15 July 2025).
- IIRC. *International Integrated Reporting Framework*; International Integrated Reporting Council: London, UK, 2021.
- Watchman, P.; Papa, M. Need for a holistic approach to enhancing corporate disclosure requirements. *Schmalenbach Bus. Rev.* **2019**, *71*, 255–261. [CrossRef]
- Carungu, J.; Di Pietra, R.; Molinari, M. Mandatory vs voluntary exercise on non-financial reporting: Does a normative/coercive isomorphism facilitate an increase in quality? *Meditari Account. Res.* **2021**, *29*, 449–476. [CrossRef]
- Cupertino, S.; Vitale, G.; Ruggiero, P. Performance and (non) mandatory disclosure: The moderating role of the Directive 2014/95/EU. *J. Appl. Account. Res.* **2022**, *23*, 163–183. [CrossRef]
- Pigatto, G.; Cinquini, L.; Tenucci, A.; Dumay, J. Disclosing value creation in integrated reports according to the six capitals: A holistic approach for a holistic instrument. *Sustain. Account. Manag. Policy J.* **2023**, *14*, 90–123. [CrossRef]
- Opferkuch, K.; Walker, A.M.; Roos Lindgreen, E.; Caeiro, S.; Salomone, R.; Ramos, T.B. Towards a framework for corporate disclosure of circular economy: Company perspectives and recommendations. *Corp. Soc. Responsib. Environ. Manag.* **2023**, *30*, 2457–2474. [CrossRef]
- Tettamanzi, P.; Gotti Tedeschi, R.; Murgolo, M. The European Union (EU) green taxonomy: Codifying sustainability to provide certainty to the markets. *Environ. Dev. Sustain.* **2024**, *26*, 27111–27136. [CrossRef]
- Kirchherr, J.; Yang, N.H.N.; Schulze-Spüntrup, F.; Heerink, M.J.; Hartley, K. Conceptualizing the circular economy (revisited): An analysis of 221 definitions. *Resour. Conserv. Recycl.* **2023**, *194*, 107001. [CrossRef]
- Millar, N.; McLaughlin, E.; Börger, T. The circular economy: Swings and roundabouts? *Ecol. Econ.* **2019**, *158*, 11–19. [CrossRef]
- Richardson, G.P. *Feedback Thought in Social Science and Systems Theory*; Pegasus Communications: Waltham, MA, USA, 1999.
- Sterman, J.D. *Business Dynamics. System Thinking and Modeling for a Complex World*; McGraw-Hill: Boston, MA, USA, 2000.
- EMF. *Towards the Circular Economy. Opportunities for the Consumer Goods Sector*; Ellen MacArthur Foundation: Isle of Wight, UK, 2013; Volume 2.
- EMF. *Delivering the Circular Economy—A Toolkit for Policymakers*; Ellen MacArthur Foundation: Isle of Wight, UK, 2015.
- Kirchherr, J.; Reike, D.; Hekkert, M. Conceptualizing the circular economy: An analysis of 114 definitions. *Resour. Conserv. Recycl.* **2017**, *127*, 221–232. [CrossRef]
- Moraga, G.; Huysveld, S.; Mathieux, F.; Blengini, G.A.; Alaerts, L.; Van Acker, K.; de Meester, S.; Dewulf, J. Circular economy indicators: What do they measure? *Resour. Conserv. Recycl.* **2019**, *146*, 452–461. [CrossRef]
- Corona, B.; Shen, L.; Reike, D.; Carreón, J.R.; Worrell, E. Towards sustainable development through the circular economy—A review and critical assessment on current circularity metrics. *Resour. Conserv. Recycl.* **2019**, *151*, 104498. [CrossRef]
- Nouri, F.A.; Nikabadi, M.S.; Olfat, L. Developing the framework of sustainable service supply chain balanced scorecard (SSSC BSC). *Int. J. Product. Perform. Manag.* **2019**, *68*, 148–170. [CrossRef]
- Stahel, W.R. The product life factor. In *An Inquiry Into the Nature of Sustainable Societies: The Role of the Private Sector*; Mitchell Prize Papers; NARC: Islamabad, Pakistan, 1982.
- Jawahir, I.S.; Bradley, R. Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing. *Procedia CIRP* **2016**, *40*, 103–108. [CrossRef]
- Reike, D.; Vermeulen, W.J.; Witjes, S. The circular economy: New or refurbished as CE 3.0?—Exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. *Resour. Conserv. Recycl.* **2018**, *135*, 246–264. [CrossRef]
- EMF Circularity Indicators. An Approach to Measuring Circularity, Project Overview, Ellen MacArthur Foundation, May 2015. Available online: <https://content.ellenmacarthurfoundation.org/m/5df196c8314ff61f/original/Circularity-Indicators-Project-Overview.pdf> (accessed on 1 July 2025).
- Kristensen, H.S.; Mosgaard, M.A. A review of micro level indicators for a circular economy—moving away from the three dimensions of sustainability? *J. Clean. Prod.* **2020**, *243*, 118531. [CrossRef]
- L'Abate, V.; Raimo, N.; Albergo, F.; Vitolla, F. Social media to disseminate circular economy information. An empirical analysis on Twitter. *Corp. Soc. Responsib. Environ. Manag.* **2024**, *31*, 528–539. [CrossRef]

29. Pozzoli, M.; Nastari, R.; Pisano, S.; Venuti, M. How circular economy disclosure responds to institutional determinants empirical evidences in non-financial European firms. *Sustainability* **2023**, *15*, 16069. [\[CrossRef\]](#)
30. Thijssens, T.; Bollen, L.; Hassink, H. Managing sustainability reporting: Many ways to publish exemplary reports. *J. Clean. Prod.* **2016**, *136*, 86–101. [\[CrossRef\]](#)
31. De Groot, E. Corporate communication and the role of annual reporting: Identifying areas for further research. In *The Routledge Handbook of Language and Professional Communication*; Routledge: London, UK, 2014; pp. 237–253.
32. Justesen, L.; Mouritsen, J. The triple visual: Translations between photographs, 3-D visualizations and calculations. *Account. Audit. Account. J.* **2009**, *22*, 973–990. [\[CrossRef\]](#)
33. Bayne, L.; Wee, M. Non-financial KPIs in annual report narratives: Australian practice. *Account. Res. J.* **2019**, *32*, 7–19. [\[CrossRef\]](#)
34. Wagenhofer, A. Sustainability reporting: A financial reporting perspective. *Account. Eur.* **2024**, *21*, 1–13. [\[CrossRef\]](#)
35. Kunc, M.; Barnabè, F.; Giorgino, M.C. Uncovering dynamic complexity in annual reports: A methodological approach using resource mapping. *Syst. Dyn. Rev.* **2023**, *39*, 299–335. [\[CrossRef\]](#)
36. Baret, P.; Helfrich, V. The “trilemma” of non-financial reporting and its pitfalls. *J. Manag. Gov.* **2019**, *23*, 485–511. [\[CrossRef\]](#)
37. Demestichas, K.; Daskalakis, E. Information and communication technology solutions for the circular economy. *Sustainability* **2020**, *12*, 7272. [\[CrossRef\]](#)
38. Keskin, H.; Esen, E. Themes and readability of integrated reports of banks from a circular economy perspective. *Int. J. Bank Mark.* **2025**, *43*, 321–340. [\[CrossRef\]](#)
39. Pajunen, N.; Holuszko, M.E. Circular Economy in Electronics and the Future of e-Waste. In *Electronic Waste: Recycling and Reprocessing for a Sustainable Future*; John Wiley & Sons, Inc.: Hoboken, NJ, USA, 2022; pp. 299–314. [\[CrossRef\]](#)
40. Deviatkin, I.; Rousu, S.; Ghoreishi, M.; Naji Nassajfar, M.; Horttanainen, M.; Leminen, V. Implementation of circular economy strategies within the electronics sector: Insights from Finnish companies. *Sustainability* **2022**, *14*, 3268. [\[CrossRef\]](#)
41. Singh, H.; Aggarwal, R.; Garg, P. Circular economy implementation in the electronics sector: A systematic literature review and future research directions. *Cogent Bus. Manag.* **2025**, *12*, 2509794. [\[CrossRef\]](#)
42. Krippendorff, K. Reliability in content analysis: Some common misconceptions and recommendations. *Hum. Commun. Res.* **2004**, *30*, 411–433. [\[CrossRef\]](#)
43. Kress, G.; van Leeuwen, T. *Multimodal Discourse: The Modes and Media of Contemporary Communication*; Arnold: London, UK, 2001.
44. Busco, C.; Granà, F.; Izzo, M.F. Beyond persuasive representations of facts: “figuring out” what sustainable value creation means in practice. *Account. Audit. Account. J.* **2024**, *37*, 393–426. [\[CrossRef\]](#)
45. Kress, G.; Bezemer, J. Multimodal discourse analysis. In *The Routledge Handbook of Discourse Analysis*; Routledge: London, UK, 2023; pp. 139–155.
46. Kress, G. Discourse analysis and education: A multimodal social semiotic approach. In *An Introduction to Critical Discourse Analysis in Education*; Routledge: London, UK, 2011; pp. 205–226.
47. Ly, T.H.; Jung, C.K. Multimodal discourse: A visual design analysis of two advertising images. *Int. J. Contents* **2015**, *11*, 50–56. [\[CrossRef\]](#)
48. Ruggiero, P.; Bachiller, P. Seeing more than reading: The visual mode in utilities’ sustainability reports. *Util. Policy* **2023**, *83*, 101610. [\[CrossRef\]](#)
49. Carnegie, G.; Parker, L.; Tsahuridu, E. It’s 2020: What is accounting today? *Aust. Account. Rev.* **2021**, *31*, 65–73. [\[CrossRef\]](#)
50. Roberts, J.; Scapens, R. Accounting systems and systems of accountability—Understanding accounting practices in their organisational contexts. *Account. Organ. Soc.* **1985**, *10*, 443–456. [\[CrossRef\]](#)
51. Solomons, D. Accounting and social change: A neutralist view. *Account. Organ. Soc.* **1991**, *16*, 287–295. [\[CrossRef\]](#)
52. Bhimani, A.; Langfield-Smith, K. Structure, formality and the importance of financial and non-financial information in strategy development and implementation. *Manag. Account. Res.* **2007**, *18*, 3–31. [\[CrossRef\]](#)
53. Raucci, D.; Tarquinio, L. A study of the economic and non-financial performance indicators in corporate sustainability reports. *J. Sustain. Dev.* **2015**, *8*, 216–230. [\[CrossRef\]](#)
54. Chaplin, E. *Sociology and Visual Representation*; Routledge: London, UK, 2002.
55. Hudson, P. Numbers and Words: Quantitative Methods for Scholars of Texts. In *Research Methods for English Studies*, 2nd ed.; Griffin, G., Ed.; Edinburgh University Press: Edinburgh, UK, 2013; pp. 133–159.
56. Opferkuch, K.; Caeiro, S.; Salomone, R.; Ramos, T.B. Circular economy disclosure in corporate sustainability reports: The case of European companies in sustainability rankings. *Sustain. Prod. Consum.* **2022**, *32*, 436–456. [\[CrossRef\]](#)
57. Bell, E.; Davison, J. Visual management studies: Empirical and theoretical approaches. *Int. J. Manag. Rev.* **2013**, *15*, 167–184. [\[CrossRef\]](#)
58. Davison, J. Visual rhetoric and the case of intellectual capital. *Account. Organ. Soc.* **2014**, *39*, 20–37. [\[CrossRef\]](#)
59. Davison, J. Visualising accounting: An interdisciplinary review and synthesis. *Account. Bus. Res.* **2015**, *45*, 121–165. [\[CrossRef\]](#)
60. Greenwood, M.; Jack, G.; Haylock, B. Toward a methodology for analyzing visual rhetoric in corporate reports. *Organ. Res. Methods* **2019**, *22*, 798–827. [\[CrossRef\]](#)

61. Quattrone, P. Embracing ambiguity in management controls and decision-making processes: On how to design data visualisations to prompt wise judgement. *Account. Bus. Res.* **2017**, *47*, 588–612. [\[CrossRef\]](#)
62. Giovannoni, E.; Napier, C.J. Multimodality and the messy object: Exploring how rhetoric and materiality engage. *Organ. Stud.* **2022**, *44*, 401–425. [\[CrossRef\]](#)
63. Knight, L.; Goldsworthy, K.; Visser, S.; Hall, C. Thinking beyond circles: Developing visual research methods for circularity in design education. In Proceedings of the PLATE Conference 2023: The 5th Product Lifetimes and the Environment Conference—Aalto University, Helsinki, Finland, 2 June 2023.
64. Mouritsen, J.; Larsen, H.T.; Bukh, P.N. Intellectual capital and the ‘capable firm’: Narrating, visualising and numbering for managing knowledge. *Account. Organ. Soc.* **2001**, *26*, 735–762. [\[CrossRef\]](#)
65. Pesce, M.; Tamai, I.; Guo, D.; Critto, A.; Brombal, D.; Wang, X.; Cheng, H.; Marcomini, A. Circular economy in China: Translating principles into practice. *Sustainability* **2020**, *12*, 832. [\[CrossRef\]](#)
66. Velte, P.; Stawinoga, M. Integrated reporting: The current state of empirical research, limitations and future research implications. *J. Manag. Control.* **2017**, *28*, 275–320. [\[CrossRef\]](#)
67. Abeysekera, I. A template for integrated reporting. *J. Intellect. Cap.* **2013**, *14*, 227–245. [\[CrossRef\]](#)
68. Rose, G. Visual methodologies. In *Research Methods for English Studies*, 2nd ed.; Griffin, G., Ed.; Edinburgh University Press: Edinburgh, UK, 2013; pp. 69–92.
69. Ruggiero, P. No Longer Only Numbers: An Exploratory Analysis of the Visual Turn in Reporting of Public Sector Organisations. In *New Trends in Public Sector Reporting. Public Sector Financial Management*; Manes-Rossi, F., Levy Orelli, R., Eds.; Palgrave Macmillan: Cham, Switzerland, 2020. [\[CrossRef\]](#)
70. Krippendorff, K. Content analysis. *Int. Encycl. Commun.* **1989**, *1*, 403–407.
71. Guthrie, J.; Petty, R.; Yongvanich, K.; Ricceri, F. Using content analysis as a research method to inquire into intellectual capital reporting. *J. Intellect. Cap.* **2004**, *5*, 282–293. [\[CrossRef\]](#)
72. Milne, M.J.; Adler, R.W. Exploring the reliability of social and environmental disclosures content analysis. *Account. Audit. Account. J.* **1999**, *12*, 237–256. [\[CrossRef\]](#)
73. Guthrie, J.; Abeysekera, I. Content analysis of social, environmental reporting: What is new? *J. Hum. Resour. Costing Account.* **2006**, *10*, 114–126. [\[CrossRef\]](#)
74. Torelli, R.; Balluchi, F.; Furlotti, K. The materiality assessment and stakeholder engagement: A content analysis of sustainability reports. *Corp. Soc. Responsib. Environ. Manag.* **2020**, *27*, 470–484. [\[CrossRef\]](#)
75. Pistoni, A.; Songini, L.; Bavagnoli, F. Integrated reporting quality: An empirical analysis. *Corp. Soc. Responsib. Environ. Manag.* **2018**, *25*, 489–507. [\[CrossRef\]](#)
76. Santoni, R. Integrated Reporting come sistema manageriale per raggiungere obiettivi di sviluppo sostenibile: Una verifica empirica. *Manag. Control.* **2023**, *1*, 43–68. [\[CrossRef\]](#)
77. Barnabè, F.; Nazir, S. Investigating the interplays between integrated reporting practices and circular economy disclosure. *Int. J. Product. Perform. Manag.* **2021**, *70*, 2001–2031. [\[CrossRef\]](#)
78. Prieto-Sandoval, V.; Jaca, C.; Ormazabal, M. Towards a consensus on the circular economy. *J. Clean. Prod.* **2018**, *179*, 605–615. [\[CrossRef\]](#)
79. Strauss, A.; Corbin, J. *Basics of Qualitative Research*; Sage: Newbury Park, CA, USA, 1990; Volume 15, pp. 61–110.
80. Esposito, B.; Raimo, N.; Malandrino, O.; Vitolla, F. Circular economy disclosure and integrated reporting: The role of corporate governance mechanisms. *Bus. Strategy Environ.* **2023**, *32*, 5403–5419. [\[CrossRef\]](#)
81. Voulvoulis, N. Transitioning to a sustainable circular economy: The transformation required to decouple growth from environmental degradation. *Front. Sustain.* **2022**, *3*, 859896. [\[CrossRef\]](#)
82. EFRAG. ESRS E5 Delegated-act-2023-5303-annex-1. Available online: https://www.efrag.org/sites/default/files/sites/webpublishing/SiteAssets/ESRS%20E5%20Delegated-act-2023-5303-annex-1_en.pdf (accessed on 15 July 2025).
83. Gibassier, D.; Rodrigue, M.; Arjaliès, D.L. “Integrated reporting is like God: No one has met Him, but everybody talks about Him” the power of myths in the adoption of management innovations. *Account. Audit. Account. J.* **2018**, *31*, 1349–1380. [\[CrossRef\]](#)
84. Dimes, R.; de Villiers, C. Hallmarks of integrated thinking. *Br. Account. Rev.* **2024**, *56*, 101281. [\[CrossRef\]](#)
85. Malafronte, I.; Pereira, J. Integrated thinking: Measuring the unobservable. *Meditari Account. Res.* **2021**, *29*, 805–822. [\[CrossRef\]](#)
86. Barnabè, F.; Nazir, S. Conceptualizing and enabling circular economy through integrated thinking. *Corp. Soc. Responsib. Environ. Manag.* **2022**, *29*, 448–468. [\[CrossRef\]](#)

87. Pan, X.; Wong, C.W.; Li, C. Circular economy practices in the waste electrical and electronic equipment (WEEE) industry: A systematic review and future research agendas. *J. Clean. Prod.* **2022**, *365*, 132671. [[CrossRef](#)]
88. Datalogic S.p.A. Non-Financial Disclosure 2023, p. 50. Available online: Available online: <https://www.osservatoriodnf.it/production/dashboard/pdf6/81.pdf> (accessed on 1 July 2025).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.