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Abstract

This study examines editorials from leading journals in sustainability science published between 1993 and 2022. By analyzing 76 editorials from *Environment, Development, and Sustainability*; *International Journal of Sustainable Development & World Ecology*; and *Sustainable Development*, the article investigates the field's historical development, interdisciplinary connections, and interactions with sustainable development policies. Using qualitative content analysis, the editorials are categorized into three distinct periods: foundation (1993–2002), introspection (2003–2012), and diversification (2013–2022). The foundational phase emphasizes key themes, such as systems thinking, participatory research, and indigenous knowledge, along with the interplay between scientific knowledge and environmental policy. The introspection phase is characterized by increasing interdisciplinarity and a problem-oriented approach, focusing on socioecological and economic systems, particularly ecological modernization. The diversification period—marked by global crises like climate change and COVID-19—highlights the importance of transdisciplinarity, with a focus on involving non-academic stakeholders, including policymakers and local communities. Additionally, editorials underscore the need to address global equity while integrating cultural sustainability into sustainability efforts. The study further analyzes the diversity of research contributing to the field, key concepts, the tension between global and local perspectives, and the role of journals as gatekeepers that help establish sustainability science as an autonomous research field. Drawing on Pierre Bourdieu's sociology of science, the article interprets sustainability science as a heterodox science that challenges the boundaries of traditional disciplines; and as a field that competes for legitimacy and recognition, balancing interdisciplinary and transdisciplinarity with its disciplinary identity.

Keywords Sustainability science, Sustainable development, Bourdieu, Editorial, History of science, Field theory

1 Introduction

Sustainability science integrates knowledge across various disciplines to address complex, multifaceted sustainability challenges—often referred to as 'wicked problems'—which require adaptive strategies and engagement with multiple stakeholders [1–3]. Achieving sustainable development requires innovative knowledge and collaboration

across academic, governmental, and societal domains, as underscored by the Brundtland Commission's landmark report [4]. Since the publication of this report, the 'stock of knowledge capital' in sustainability science has expanded significantly, marked by an increasing number of dedicated journals and research output which have effectively mapped the field's intellectual trajectory [5–8].

The evolving nature of sustainability science reflects the complexity of the challenges it addresses. The field has grappled with defining its identity, establishing legitimacy, and integrating diverse disciplinary and non-academic perspectives. While previous studies have relied on traditional academic outputs—such as research articles, literature reviews, and books—these approaches may overlook critical aspects of how the intellectual directions of sustainability science have been shaped over time. In particular, the role of editorials has not been sufficiently explored as a source of insight into the formation of the field and the origin of its debates.

This article addresses this gap by leveraging editorials as a novel lens to explore the historical development of sustainability science. Editorials offer key viewpoints on prevailing thoughts and debates within the scientific community at different times, reflecting both the intellectual climate and emerging trends within the field. Typically authored by permanent members of editorial boards or invited guest editors, editorials reflect the views of leading scholars who evaluate the scientific quality of manuscripts and suggest paths for future research. However, it is important to acknowledge that editorials may represent the perspectives of more established voices within the field, who potentially align with more dominant narratives. This raises the question as to whether the views expressed in editorials may marginalize alternative or emerging perspectives within the scientific community. Despite—or perhaps because of—these characteristics, editorials provide a unique and valuable lens into the mechanisms that set the direction of research in the field, offering insights into the shaping of academic discourse and the consolidation of intellectual trends.

Empirical studies have explored the characteristics of editorials as a genre, revealing their distinct role in shaping academic discourse. Hulme, Obermeister, Randalls and Borie [9] applied content analysis to editorials published in *Nature* and *Science*, finding differences in how these journals frame climate change: *Nature* focused on institutional and governance challenges, while *Science* emphasized technological, energy, and communication issues.

Hellsten and Leydesdorff [10] examined how editorials in the journal *Climatic Change* transitioned from multidisciplinary to transdisciplinary in focus. Initially, the journal employed a multidisciplinary approach, with contributions from various fields remaining largely within their respective boundaries. Over time, the journal adopted a more interdisciplinary profile, integrating knowledge across disciplines. Eventually, it developed a transdisciplinary focus, increasingly incorporating policy-relevant research and addressing broader societal challenges.

Furthermore, bibliometric research, such as the paper authored by Campanario and González [11], has analyzed the role of editorials in Journal Impact Factor calculations, while van Leeuwen, Costas, Calero-Medina and Visser [12] discussed the role of editorials in research evaluation, suggesting that they are increasingly recognized as significant contributions to scientific communication. The subjective tone and rhetorical strategies of editorials, including the use of metaphors and humor, further enhance their ability to

connect with readers and influence the academic conversation [13]. Editorials addressing predatory publishing often employ emotionally charged language, intended to invoke strong reactions from their readers [14]. Despite differences among traditions in various disciplines and individual journals, research on editorials underscores their crucial role in the production of new scientific knowledge.

Plakhotnik [15] highlighted the potential of editorials as leadership tools to influence the development and character of journals, although their actual implementation varies across disciplines. Petersen, Hattke and Vogel [16] defined 'editorial governance' as the framework of practices and policies which influence the integrity, independence, and strategic direction of academic journals. This governance encompasses the composition and characteristics of editorial teams, including their roles as opinion formers, gatekeepers, and arbiters of disciplinary values. Editors shape the mission, scope, and intellectual trajectory of journals by composing editorial boards, assigning reviewers, making final publication decisions—and, notably, by writing editorials.

Accordingly, this article aims to examine the field's historical trajectory and seek answers to the following research question:

How do editorials in a selected set of sustainability science journals reflect the field's historical development from 1993 to 2022?

In addressing this question, a text corpus was identified and analyzed using the methods discussed in the following section. The results are ordered in three distinct periods, followed by further analysis and discussion of these findings. More specifically, for a deeper understanding of the history of sustainability science, the analysis and discussion section of the article utilizes Pierre Bourdieu's [17] sociology of science as its analytical framework. From this standpoint, scientific fields are structured spaces of social relationships where individuals and groups compete for legitimacy and status or, in Bourdieu's lexicon, 'symbolic capital' [18]. Editorials are typically authored by editors or senior scholars and may reflect dominant positions within the field. From a Bourdieusian perspective, they can be seen as vehicles for reproducing symbolic capital and legitimizing specific epistemic standpoints, which may indirectly marginalize alternative or emerging perspectives. Moreover, scholarly journals are not conceptualized here as active gatekeepers in the Mertonian sense of regulating access to publication [19], but rather as repositories of symbolic capital that contribute to the structuring of the scientific field [20–22]. Editorials, in this view, function as instances of objectified cultural capital through which dominant perspectives are both articulated and contested.

The paper concludes by reflecting on the limitations of the chosen approach, offering suggestions for future research, and summarizing the main conclusions.

2 Data sources and methods

2.1 Data sources

The journals *Environment, Development and Sustainability* (EDS), *Sustainable Development* (SD), and the *International Journal of Sustainable Development & World Ecology* (IJSDWE) were selected for their comprehensive representation of sustainability science and their relative longevity compared with other periodicals. The selection of these journals is supported by bibliometric studies, which highlight their roles in shaping sustainability research [23–25]. These periodicals are classified in the database *Web of Science* under the category "Green & Sustainable Science & Technology" [26], analyzed in detail

by Bautista-Puig, Manana-Rodriguez and Serrano-Lopez [23]. Farrukh, Meng, Raza and Tahir [25] focused on SD, while Ellili [24] analyzed EDS, both underscoring the variation in the sustainability topics that these journals address.

The analysis begins in 1993, which marks the launch year of SD, one of the three journals in this study. This year also closely follows the 1992 United Nations Conference on Environment and Development (Earth Summit), a landmark event that catalyzed international interest in sustainable development [27]. IJSDWE was launched in 1994, and EDS in 1999. Therefore, 1993 represents a meaningful and practical starting point for the analysis, capturing the emergence and institutionalization of sustainability science in the scholarly publishing landscape.

While the selected journals publish a broad range of sustainability-related research, including topics that extend beyond the definitional core of sustainability science, this study focuses specifically on how sustainability science is represented and articulated in their editorial discourse.

Among the most prolific contributors, Luc Hens, a founding editor of EDS, authored 12 editorials, while the late David Pimentel, another founding editor of EDS, contributed 7 editorials. The late John Jeffers, founding editor-in-chief of IJSDWE, contributed five editorials, shaping the journal's mission to integrate ecological and socioeconomic perspectives. Sneha Gautam, an air pollution expert, contributed four editorials, and Guofan Shao, editor-in-chief of IJSDWE at the time of writing, authored three.

2.2 Qualitative content analysis

Although the study involves a structured analysis of published editorials, it is not conceptualized as a literature review. As defined by Schreier [28], qualitative content analysis (QCA) is a method for systematically describing the meaning of qualitative material, rather than synthesizing prior research. QCA was selected for its capacity to identify recurring concepts while also uncovering deeper layers of meaning. In line with Sutton, Clowes, Preston and Booth [29], review articles are typically aimed at summarizing and integrating findings from empirical studies, whereas the present study treats editorials as primary discourse material and applies qualitative content analysis to interpret their thematic and epistemic development over time.

In this context, the present work aligns with interpretive and reflexive strands of sustainability science that emphasize epistemological openness and theoretical framing [30]. It draws on the author's disciplinary background in information studies, and the analytical approach is informed by Bourdieu's sociology of science, particularly his concepts of field, capital, and struggle, which shape how editorial discourse is understood in relation to the institutional development of sustainability science [18]. Recognizing that qualitative content analysis is inherently interpretive, the analysis does not claim neutrality. Instead, it acknowledges that all meaning-making is shaped by the researcher's theoretical lens and positionality. Within this framework, the editorial texts are approached not simply as descriptive reflections of the field, but as discursive interventions that contribute to its ongoing formation.

This study applied Krippendorff's [31] approach to QCA, which conceptualizes a text corpus as a system composed of subsystems. In this context, the journal served as the system, with each editorial functioning as a subsystem. These subsystems operate independently in content and focus but are interconnected through shared themes that align

with the journal's broader mission, reflecting Krippendorff's view of systems as composed of interdependent parts. According to Krippendorff's approach, the relationships within and between these subsystems can be analyzed based on explicit content, such as the syntactic structure of the texts, and latent content, which requires contextual interpretation, often mediated through theoretical frameworks. Both explicit content, such as key terms like 'economic growth,' and latent content, requiring interpretation through sustainability science concepts, were examined. Bourdieu's [32] framework was also used to explore how editorials have contributed to shaping the field of sustainability science by discussing concepts and methods.

The full texts of the editorials were imported into the software NVivo for qualitative content analysis; this software was selected because of its ability to manage large text-based datasets and its advanced features, such as matrix coding queries, which allow for nuanced comparisons across documents and codes [33]. The texts were coded by the author, with individual paragraphs serving as the units of analysis. Regular cross-checking to discuss the coding of the texts and ensure consistency was conducted with two experts in scholarly communication.

The coding scheme was developed using an abductive approach, combining deductive reasoning—drawing from existing theoretical frameworks and concepts—and inductive reasoning, which allows new concepts to emerge from the data themselves [31]. The deductive part of the coding scheme uses concepts highly related to sustainability science, such as 'sustainable development,' which were expected to be mentioned in the editorials. The inductive part of the coding scheme was developed from the words identified in the texts. A pilot version of the coding scheme was tested on a subset of the corpus, leading to refinements before the final application. The final coding scheme included 111 codes.

To assess intracoder reliability, Cohen's kappa was calculated on a random sample (5.26% of the dataset, or 4 editorials) selected using the R function *set.seed* [34, 35]. After a seven-month interval, the author re-coded this subset, resulting in a kappa value of 0.70. A value of 0.70 corresponds to substantial agreement, suggesting that the coding process was reliable enough to support the analysis [34]. Using NVivo's matrix coding query functionality, documents and codes were iteratively compared and contrasted, providing a robust means of identifying key patterns across the dataset [36]. Subsequently, heatmaps for Periods I–III were generated from a matrix that matched editorials (rows) with frequencies of coded paragraphs (columns). The heatmaps show the frequency and distribution of key concepts over the three periods, highlighting trends in sustainability science through these editorials.

The coding scheme and heatmaps are available in the Supplementary Material, while Appendix A contains the complete list of the editorials that were analyzed.

3 Results

The findings are organized into subsections representing three distinct periods within the 30 years under examination. The temporal division was established for analytical convenience, aiming to create three periods of approximately equal length. The names assigned to each period ("Foundation," "Introspection," and "Diversification") were developed inductively based on the key themes, concepts, and patterns identified through the QCA approach. These patterns characterize each period, highlighting distinct phases in

the development of sustainability science. Each subsection examines how sustainability science is portrayed by the editorials, particularly in relation to other research fields and sustainable development policies.

3.1 Period I (1993–2002): the foundational phase

The initial phase of sustainability science is primarily characterized by the integration of systems thinking as a core approach. During this period, systems thinking serves as the theoretical bedrock, as illustrated by editorials that explicitly address system analysis [37, 38]. Complexity also emerges as a central concept, particularly in discussions related to land-use systems [38]. In addition to systems thinking, this phase places significant emphasis on the relevance of indigenous knowledge, particularly in the preservation of tropical ecosystems. The integration of knowledge from various scientific disciplines is linked to the field of human ecology [39]. At this early stage, sustainability science emerges as an interdisciplinary field centered on human ecology, aimed at fostering sustainable economic growth within a sustainable development framework [40]. However, some editorials from this period express growing concerns about the limitations and potential misuse of the term 'sustainable development', criticizing its adoption as an empty term unaccompanied by actual policy changes [41]. Nath, Hens and Pimentel [40] explore the gap between the growing awareness of sustainable development's necessity and the disinterest in implementing systems that meet sustainability's core requirements. Three critical factors contribute to this misalignment: the absence of an appropriate economic framework, the absence of a precise definition of sustainable development, and the lack of a "strong political will to promote or implement sustainable development" [40]. Other editorials criticize the misuse of sustainable development as a symbolic means for promoting laissez-faire economics, calling it the "development catchphrase in the 1990s" [41] and a "contradiction in terms and an illusion" [42].

Some editorials from this period also delve into the broader cultural and philosophical underpinnings of sustainability, referencing "cultures, belief systems, and faiths such as Buddhism, Sufism, and Gandhism," which are viewed as counterbalances to excessive consumption and materialism [43]. These cultural perspectives play an integral role in the emerging discourse on sustainability, offering alternative frameworks for understanding and addressing ecological challenges. The editorial by Ip [41] also connects sustainability science to human ecology and global eco-politics, tracing its historical roots back to the early 19th-century works of Thomas Robert Malthus and David Ricardo in political economy. Throughout the foundational phase, there is a strong emphasis on the importance of supportive policies, institutional frameworks, and global governance mechanisms that enable sustainable development. A recurring theme is the call for a reevaluation of global economic systems, prioritizing ecological sustainability, social justice, and long-term well-being over short-term profit and growth objectives. In this regard, Nath, Hens and Pimentel [40] lament.

In this regard, Nath, Hens and Pimentel lament that "the prevailing laissez-faire system of economics, which emphasizes and relies on continually growing production and consumption over time, is at odds with the core requirements of sustainable development—reduced production and consumption and accepting a more modest and less polluting lifestyle" (40, italics in the original).

Traditional disciplines and environmental policies are critiqued for their limitations in addressing biodiversity challenges from a planetary perspective [38]. In response, editorials during this period advocate for participatory research as a necessary alternative to monodisciplinary approaches, emphasizing the need for equal partnerships with developing countries in scientific research [44].

In conclusion, the foundational period is marked by the establishment of key concepts such as systems thinking, human ecology, and a critical perspective on global economic and governance systems. This phase underscores the importance of integrating ecological principles, participatory research, and supportive policies to prioritize sustainable development in both science and policy. However, given the limited sample of only 11 documents, the perspective offered by the editorials from this period is not comprehensive.

3.2 Period II (2003–2012): the introspective phase

In this second period, sustainability science enters an introspective phase, focusing on specific theoretical and methodological approaches rather than foundational initiatives, such as the work of the Brundtland Commission [4]. An example of this introspection is the debate on applying coevolutionary theory—originally a concept from evolutionary biology that examines how interacting species influence each other's evolution—beyond biology to social systems [45, 46]. This discussion begins in *IJSDWE* with McIntosh and Jeffrey [46] commenting on an earlier article by Rammel and Staudinger [45], which led in turn to a special issue on the topic in 2007 [47]. McIntosh and Jeffrey [46] highlight the potential of applying biological coevolutionary theories to the social sciences and argue that while these theories offer valuable descriptive tools, their practical application in guiding sustainability policy remains uncertain. In response, an editorial by Rammel and Staudinger [48] defends the use of evolutionary perspectives to understand socio-ecological systems. This debate exemplifies the broader trend during this period, where sustainability science moves beyond foundational critiques towards a more nuanced exploration of theoretical and methodological approaches.

The second period therefore shifts from broad narratives, such as those seen in Period I, regarding Western culture's negative ecological impact, to a concrete focus on actionable interventions. Editorials in Period II emphasize the more defined, applied, and problem-oriented characteristics of this emerging field. These characteristics are seen as central to interpreting sustainability science as an 'interdisciplinary' field. The complex, real-world problems that sustainability science seeks to address—such as environmental degradation, social inequality, and economic instability—are deemed challenges that cannot be effectively tackled within the confines of a single discipline. Instead, they require the integration of diverse perspectives, methods, and knowledge from multiple disciplines, ranging from the natural and social sciences to the humanities.

The focus on practical, actionable solutions further reinforces the interdisciplinary nature of the field, as it necessitates collaboration across traditional disciplinary boundaries. For example, addressing urban sustainability involves not only ecological and environmental expertise but also insights from sociology, urban planning, economics, and political science. The applied and problem-oriented approach drives the need for interdisciplinary collaboration, making it a defining characteristic of sustainability science during this period. However, one editorial notes that research at the intersection

of sustainable development and cultural heritage followed more "multidisciplinary lines than fully interdisciplinary, integrated research" [49].

In their editorial, Shao, Li and Tang [50] introduce a pyramid metaphor to depict sustainability science's four-dimensional and three-level structure: economy, society, environment, and institutions at the base, with principles, approaches, and applications as the three levels. Moreover, the editorial by Keitsch [51] emphasizes several characteristics of this new science: contributions derived from a wide range of disciplines, including political science and design; the evolution in the field from primarily eco-technical interests to multidimensional issues requiring collaborative efforts; the cultural dimension of sustainable development; and the need for the humanities to balance out positivist approaches more typical of fields such as ecology and physics.

In the interaction between science and policy during Period II, sustainability science is often seen as challenging existing economic and policy frameworks. Young and Utting [52] emphasize the role of sustainability science in influencing fair-trade policies. Baumgartner and Korhonen [53] suggest a holistic and strategic approach to connect scientific research with policy action. Springett [54] criticizes "the narrative of sustainable development as an extension of corporate business as usual," where the sustainable development label is co-opted for commercial interests. In their editorials, Roberts and Hills [55] view sustainability science as an empirical field that must scrutinize the consequences of policymaking, while Pimentel and Burgess [56] take a critical stance regarding the implementation of questionable environmental solutions, such as pesticide use (for further discussion on Pimentel's contributions to the study of sustainable agriculture, see also [57].

A central concept for understanding the interactions between science and policy in Period II is ecological modernization [55, 58–61]. Developed within environmental sociology, ecological modernization argues that economies can grow through industrial ecological innovations and environmental standards while reducing environmental impacts (see [62]). Burger, Daub and Scherrer [58] criticize, in their editorial, the limitations of standards alone in transforming society towards a sustainable Earth, framing ecological modernization as an example of neoliberal governance. Hildén and Rosenström [63] advocate for evidence-based and quantitative assessments of sustainability and the use of more complex standards than only environmental ones.

In sum, this period reflects an introspective phase in which the identity and purpose of the field are pondered. These years are characterized by a stronger focus on theoretical and methodological approaches and a shift toward interdisciplinarity, assessment indicators, and evidence-based policies within—and beyond—the framework of ecological modernization.

3.3 Period III (2013–2022): the diversification phase

Editorials in the last period reflect growing confidence in the field's ability to address diverse and complex global issues, emphasizing a shift towards transdisciplinarity—an approach that involves integrating knowledge across disciplines and engaging non-academic stakeholders, such as policymakers and communities, to co-produce solutions to sustainability challenges. This period marks a diversification of approaches, with the field's applications becoming more varied and integrated into a cohesive transdisciplinary framework.

Global challenges, such as economic crises [64] and the COVID-19 pandemic [65–68], serve as litmus tests for this framework. Several editorials highlight the urgent need for systemic changes to corporate practices [69], the legal system [70], the energy sector [71, 72], architecture and urban planning [73–75], and the food system [76], underscoring the connection between ecological integrity, social equity, cultural values, and lifestyles.

While the transdisciplinary approach is frequently highlighted for its potential to address complex global issues, several editorials from Period III emphasize the associated epistemological and ethical dilemmas. These dilemmas often arise from the complexities inherent in integrating diverse disciplinary perspectives and involving non-academic stakeholders, such as policymakers and local communities, in the co-production of knowledge [73, 77, 78]. In Period III, discussions increasingly focus on the challenges of balancing scientific rigor with the practical demands of policy goals, particularly in areas such as cultural sustainability, education for sustainable development, consumption patterns, and legal frameworks. This heightened attention to the ethical and epistemological implications of transdisciplinary research reflects the field's growing maturity and the recognition of the nuanced trade-offs involved in applying sustainability science to real-world contexts.

Several editorials reflect a continuation of the shift from the dominance of the epistemological paradigm of the biological sciences to that of human ecology and sciences related to the "formation of people's behavioral norms" [74]. These editorials emphasize perspectives on cultural sustainability, which involves maintaining cultural heritage while promoting sustainable practices [79]; education for sustainable development, aiming to equip individuals with the knowledge and skills necessary for sustainable living [78]; consumption patterns that advocate for reduced resource use and sustainable consumer behavior [69, 80]; and legal frameworks that support sustainable policies and regulations [70].

The adoption of the Sustainable Development Goals (SDGs) in 2015 is key to understanding the interactions between science and policy in this diversification phase. Hossain, Gain and Rogers [81] understand the SDGs as conceptual tools to frame sustainability research. An *IJSDWE* editorial states that the SDGs' topics had been discussed in the journal long before the 2030 Agenda for Sustainable Development set these goals [82]. This editorial emphasizes the journal's mission to facilitate communication between stakeholders, and encourages contributions from government agencies, the private sector, and civil society. Ramos, Caeiro, Moreno Pires and Videira [83] highlight both the SDGs' strengths (e.g., growing environmental awareness) and weaknesses (e.g., the gap between objectives and the actual capacity to achieve them).

In summary, the editorials from the last period emphasize the increasing importance of transdisciplinarity and diversification in sustainability science, reflecting broader confidence in the field's capacity to address complex global issues. While promising, the transdisciplinary approach introduces epistemological and ethical dilemmas; particularly relevant when balancing scientific objectives with policy goals, including the SDGs. Issues such as cultural sustainability, education for sustainable development, consumption patterns, and legal frameworks are receiving more attention than had previously been the case.

Table 1 Summary of the findings according to periods I–III

	Period I (1993–2002) Foundation	Period II (2003–2012) Introspection	Period III (2013–2022) Diversification
Sustainability science as a field of study	• Systems thinking and system analysis • Integration of indigenous knowledge • Human ecology and critiques of global economic systems • Emphasis on participatory research and supportive policies • Critique of Western consumer culture and global governance mechanisms	• Critical reassessment of interdisciplinary approaches • Focus on coevolutionary theory and sustainability indicators • Applied, problem-oriented research • Emphasis on ecological modernization • Urban sustainability and collaboration across sectors • Development perspectives of the Global South	• Addressing global challenges (climate change, COVID-19) • Emphasis on transdisciplinarity • Integration of ecological integrity, social equity, cultural values • Systemic changes in various sectors (corporate practices, legal systems, energy, urban planning, food systems) • Ethical dilemmas in sustainability science • Importance of SDGs and their implementation
Selected key Editorials	Jeffers (1999), Ip (1993), Begossi (2000), Nath (1999), Jeffers (1997), Khan (1993).	Rammel (2002), McIntosh (2004), Opschoor (2011), Shao (2011), Springett (2013), Young (2005), Baumgartner (2010), Roberts (2002), Pimentel (2011).	Gautam (2020a, 2020b, 2022), Witjes (2021), Springett (2013), Ramos (2018), Hossain (2020), Álvarez Etxeberria (2017), Mauerhofer (2020), Ferreira (2016), Skjerven (2019), Kell (2022).
Total number of editorials analyzed for each period	11	33	32

Based on the text patterns and frequency of codes found in the editorials from QCA, Table 1 provides a comparative overview of the thematic shifts in the three phases and showcases a selection of key editorials.

4 Analysis and discussion

By conceptualizing scientific fields as structured social spaces where individuals and groups compete for recognition and power, Bourdieu's [17] sociological framework provides a lens for understanding the historical and contemporary knowledge dynamics within sustainability science. A key concept in Bourdieu's framework is 'symbolic capital,' which refers to the prestige, recognition, and authority that individuals, groups, or institutions accumulate within a field [84]. Symbolic capital is not only material or financial resources but includes elements such as reputational power, academic standing, and the ability to influence the field's direction. Scientific journals play a crucial role in the accumulation and distribution of symbolic capital within academic fields [21, 85, 86]. By serving as gatekeepers of knowledge, journals determine which research is deemed legitimate, influential, and worthy of publication, thereby shaping the field's intellectual landscape. Publishing in high-prestige journals grants researchers symbolic capital, as it enhances their visibility, reputation, and authority among peers. Editors and reviewers, in turn, hold significant symbolic capital, as they possess the power to influence the direction of research and validate what is considered valuable knowledge. Consequently, symbolic capital circulates within the academic hierarchy through these publications, reinforcing the status of individuals and institutions that successfully navigate this system. In sustainability science, symbolic capital can take the form of recognition by policymakers, the ability to shape interdisciplinary research agendas, or leadership in defining key sustainability concepts.

In sustainability science, heterodoxy—defined by Bourdieu [32] as the set of approaches and positions that challenge established norms and traditional methodologies—manifests as an interdisciplinary and transdisciplinary endeavor that bridges diverse scientific perspectives to address complex challenges. This heterodox science positions itself against the orthodoxy of conventional, siloed disciplines. Externally, sustainability science competes for symbolic capital with more established disciplines such as economics, ecology, and engineering, as it seeks to legitimize itself as a distinct field capable of addressing complex sustainability challenges. These external struggles position sustainability science within the broader academic hierarchy, where traditional disciplines often enjoy greater prestige due to their longer histories and more established methodologies. Sustainability science, in contrast, must justify its interdisciplinary and transdisciplinary approaches, particularly when it comes to addressing socio-environmental problems that transcend conventional disciplinary boundaries and address 'wicked problems' [3]. Internally, sustainability science experiences competition over symbolic capital as different approaches vie for dominance. These internal struggles center on debates about the field's disciplinary status, autonomy, and varying interpretations of sustainability.

This study's findings reveal that sustainability science emerged primarily out of the necessity to address complex social–ecological problems that transcend disciplinary boundaries. While positioning itself in contrast to traditional monodisciplinary sciences—deemed ill-suited to such challenges—it also drew from interdisciplinary epistemological foundations, including fields such as human ecology and systems analysis. These interdisciplinary fields served as 'bridge sciences', facilitating collaboration between hard and soft sciences to address complex sustainability issues (see [87]). Although Bourdieu's sociology is not only about struggle, also emphasizing "networks of mutual knowledge and alliances" [88], his framework grants significant attention to struggles for control over "competency" [18]; both within scientific fields and between fields. In sustainability science, however, it is possible to observe alliances between fields, such as those between sustainability science and these 'bridge sciences' discussed in the editorials. Other knowledge production alliances mentioned in the corpus of the editorials regard those between the scientific field and civil society, not-for-profit organizations, and other stakeholders.

The analytical categories of struggle used in this study were developed through an abductive coding process, combining theoretical input from Bourdieu's sociology of science with patterns that emerged inductively from the editorials. The distinction between internal and external struggles is not meant to represent mutually exclusive categories, but rather to highlight whether the tension described in a given editorial primarily concerns dynamics *within* the scientific field (e.g., disciplinary boundaries, methodological disputes) or *beyond* it (e.g., its public legitimacy, policy relevance, or funding conditions). In some cases, these boundaries are blurred, and struggles may intersect both domains.

4.1 External field struggles: heterodoxy versus orthodoxy

Sustainability science, as it has developed, represents a heterodox field, contesting the dominant norms and practices of established disciplines like economics, ecology, and engineering. The editorials analyzed from the early foundational phase (1993–2002) illustrate this heterodoxy, as systems thinking and participatory research were

emphasized as central innovations. These approaches challenged more traditional, monodisciplinary heuristics [38, 39]. This marked a deliberate move away from siloed research toward a more integrated understanding of sustainability challenges, positioning the field against the orthodoxy of monodisciplinary science.

The early struggles over the term 'sustainable development' during the foundational phase also reflect a heterodox stance vis-à-vis the orthodoxy of economic growth as an underlying need. Several authors emphasized the potential for the term to be co-opted as a catchphrase, with little substantive impact on policy and practice [40, 41]. These critiques represent the broader struggle within sustainability science to establish a coherent theoretical framework distinct from mainstream economic models that strive for growth without sufficient regard for ecological limits.

As the field matured, the tension between orthodoxy and heterodoxy continued to shape its development. In the introspective phase (2003–2012), sustainability science refined its intellectual tools and expanded its influence in policy debates. Editorials from this period reflect the field's growing symbolic capital, particularly in its ambition to influence policy areas like sustainability assessment, as in the debate on ecological modernization, and fair-trade commerce [49, 58]. During the diversification phase (2013–2022), sustainability science broadened its scope to encompass a variety of topics, including corporate sustainability, urban planning, and cultural sustainability. These expansions, however, brought new challenges, especially regarding the field's relevance for policymaking and the need to apply sustainability principles across diverse contexts. This phase highlights how sustainability science, as a heterodox field, continues to negotiate its identity in relation to more established fields, while accumulating symbolic capital through its closeness to global sustainability agendas and the SDGs, as mentioned in the editorials [82, 83].

It is noteworthy that climate change, while undeniably central to the broader sustainability agenda today, was not a prominent theme in the editorials published during the Foundation and Introspection periods. Editorials in those earlier phases tended to focus more broadly on systems thinking, participatory approaches, and the institutionalization of sustainability as a research concern. The emergence of climate change as a central editorial topic in the Diversification period coincides with the increasing alignment of sustainability science with global policy frameworks, such as the SDGs and the Planetary Boundaries framework [89]. This shift suggests that editorial discourse has tracked, and possibly responded to, the rising prominence of climate issues in both scientific and policy domains.

4.2 Internal field struggles: hard versus soft sciences

A significant internal struggle within sustainability science involves the integration of natural (hard) and social (soft) sciences [90]. In the context of sustainability, the hard sciences, typically associated with disciplines like ecology and environmental science, focus on empirical and quantitative methods. In contrast, the soft sciences, including fields such as environmental economics, sociology, and human ecology, emphasize qualitative approaches which investigate the sociocultural, ethical, and human dimensions of sustainability challenges. Hard sciences are often perceived as more prestigious compared to soft sciences, not just in general—as emphasized by Bourdieu [91] and others [19]—but in the context of interdisciplinary research [92], including sustainability science [93].

It is important to note, however, that the distinction between hard and soft sciences should not be conflated with a simple opposition between quantitative and qualitative methods. Many disciplines within the social sciences—such as economics, political science, and certain areas of sociology—employ highly quantitative and empirically grounded approaches. Similarly, natural sciences often incorporate interpretive and model-based reasoning. In this context, the distinction refers less to methodological orientation and more to the symbolic hierarchy and epistemological framing of disciplines within the field, as represented in editorial discourse.

Despite the increasing role of soft sciences across all three periods, the knowledge produced by hard sciences remains essential to sustainability science's identity. Hard sciences provide foundational understandings of ecological processes, biodiversity, climate systems, and other natural phenomena underpinning sustainability challenges. Integrating quantitative research with qualitative contextual analyses reflects the complex nature of sustainability issues, as evidenced by editorials of the introspective phase that discuss whether—and how—to bridge hard and soft sciences by applying biological models to social systems [45, 46].

The concept of ethnosciences—involving the study of indigenous and local knowledge systems and their interactions with the natural environment—also plays a crucial role in discussions on how to integrate soft and hard sciences into interdisciplinary approaches. Ethnosciences, such as ethnobotany and ethnoecology, bridge natural and social sciences by combining empirical environmental research with the cultural and societal practices of local communities [94, 95]. This integration highlights the need to respect and include local knowledge alongside scientific data to create sustainable and context-sensitive solutions [38, 39].

During the diversification phase, the debate over balancing hard and soft sciences continued to evolve. Editorials from this period reflect an increasing reliance on transdisciplinary approaches and a further shift towards transdisciplinarity—not only bridging various academic disciplines but also involving non-academic stakeholders such as policymakers and local communities. This engagement with diverse knowledge systems highlights sustainability science's ongoing effort to integrate scientific rigor with practical relevance, fostering holistic approaches to global challenges. Notably, an editorial from the corpus [77] highlights challenges such as balancing knowledge creation with practical application, navigating ethical and political considerations, managing power dynamics in co-production, and addressing the difficulties of collaborative settings. Researchers' diverse roles—facilitators, introspective scientists, change agents, and knowledge brokers—each require specific competencies and attitudes, or in Bourdieu's [96] terminology, a different 'habitus.' These transdisciplinary methods emphasize sustainability as not just a technical issue but also a sociocultural and ethical concern, underscoring the field's broader scope in the last period [73, 78].

4.3 Internal field struggles: weak versus strong sustainability

Another key internal struggle within sustainability science is the tension between weak and strong sustainability [97]. This debate centers on the substitutability of natural capital and reflects broader ideological and ethical tensions within the field. Weak sustainability posits that natural capital (e.g., ecosystems, biodiversity) can be replaced by human-made capital (e.g., technology, infrastructure), as long as the total stock of capital

is maintained or increased. This view is closely aligned with neoclassical economic principles, which emphasize economic growth and technological solutions to environmental problems. Proponents of weak sustainability advocate for market-based mechanisms, such as carbon trading and green technology, as ways of balancing environmental protection with continued economic development. Conversely, strong sustainability argues that certain forms of natural capital are irreplaceable. Resources like biodiversity, clean air, and intact ecosystems are considered critical to the planet's ecological integrity and cannot be substituted by human-made alternatives. Strong sustainability emphasizes the need to preserve natural systems and advocates for policies that prioritize ecological limits over economic growth. This perspective challenges the market-based solutions promoted by weak sustainability advocates, asserting that technological or economic fixes alone cannot solve environmental problems.

The editorials from the foundational phase of sustainability science are largely aligned with strong sustainability principles. Editorials from this period critiqued mainstream economic models for failing to account for the environmental costs of unchecked growth [40, 42]. These early debates reflected a heterodox challenge to the dominant economic orthodoxy of the time, as sustainability science sought to redefine the concept of development through an ecological lens.

As the field moved into the introspective phase, the weak versus strong sustainability debate became more nuanced, with several editorials supporting strong sustainability. However, some texts investigated technological innovation and market mechanisms as weak sustainability strategies [49]. During the diversification phase, this tension appeared in editorials discussing corporate sustainability and urban planning [70, 80]. These texts highlighted the debate on how best to balance ecological objectives with economic growth and poverty alleviation targets.

4.4 Internal field struggles: global versus local perspectives

The balance between global sustainability frameworks such as the SDGs and local sustainability challenges represents another significant internal struggle within sustainability science. On the one hand, attention is paid to the planetary scale of the SDGs [83] and large-scale phenomena like world overpopulation [98, 99] and global health, especially in the wake of the COVID-19 pandemic [65]. The editorial by Ramos, Caeiro, Moreno Pires and Videira [83] refers in particular to the Planetary Boundary Framework, which identifies nine key Earth system processes with boundaries which, if crossed, could lead to catastrophic environmental changes [89]. This perspective's persistent significance for the sustainability science field is showed by recent research contributions [100].

On the other hand, even at the early stage of the foundational phase, editorials emphasized the importance of incorporating local knowledge—particularly from Indigenous communities—into global sustainability discussions. This heterodox approach challenged the dominance of Western environmental policies, which often imposed top-down solutions without adequately considering local contexts [39, 43]. Local perspectives were seen as essential for creating more equitable and context-sensitive sustainability strategies. Editorials from the introspective phase reflected growing concerns about how to reconcile broad global frameworks, such as the SDGs, with the specific cultural, environmental, and political realities of different localities. While global frameworks accumulate symbolic capital by aligning with international institutions and policy

agendas, local movements often challenge these frameworks by emphasizing context-specific solutions that involve local stakeholders in the co-production of knowledge [98, 101]. In the diversification phase, editorials reflect an increasing emphasis on transdisciplinary approaches that seek to bridge global frameworks with local sustainability efforts [73, 83].

4.5 Internal field struggles: thematic breadth versus autonomy and identity

Sustainability science, much like climate change research [10], has evolved from interdisciplinary to transdisciplinary approaches. While interdisciplinary work integrates knowledge from various fields [102], sustainability's complex challenges require engagement outside academia, involving policymakers, local communities, and other stakeholders. Transdisciplinarity facilitates the co-creation of actionable knowledge that is both scientifically rigorous and socially relevant [103]. This thematic breadth, while a strength in addressing global challenges, also presents a challenge to the field's efforts to establish a distinct and cohesive identity.

The editorials have shown that sustainability science faces a complex dynamic in its pursuit of autonomy as a field. In Bourdieu's terms, autonomy implies developing an internal logic and symbolic capital separate from other fields [32]. However, sustainability science depends heavily on systems thinking—an approach which emphasizes interdependencies and integration across fields—rather than isolation. Systems thinking is crucial for addressing the complex interdependencies within socio-ecological systems where traditional linear models fall short [87]. These editorials illustrate how this interdependence, rather than undermining autonomy, actually serves as the foundation for sustainability science's distinctiveness. Its autonomy emerges not from isolation but from its ability to integrate diverse knowledge and co-create solutions across academic, policy, and community boundaries, thereby establishing its own symbolic capital and legitimacy.

The broad scope of sustainability science reflects its ability to engage with diverse issues, but this multiplicity complicates its efforts to form a unified disciplinary identity within a transdisciplinary framework. Journals play a critical role in shaping the field's identity by acting as gatekeepers and accumulating symbolic capital [21]. The editorials have shown how periodicals help establish the legitimacy and autonomy of sustainability science within the academic hierarchy [18]. For instance, *IJSDWE's* founding editor-in-chief emphasized the need for sustainability science to distinguish itself as a unique discipline, positioning his journal as a platform to address gaps left by established fields and justifying its focus on sustainable development [38, 44].

These editorials show how the tension between thematic breadth and identity formation is ongoing, as they highlight both the field's diversity and the challenges of defining its core focus [75, 104, 105]. Bibliometric studies corroborate these editorial insights [24, 106], revealing a shift from early general awareness of environmental issues to more specialized topics such as urban sustainability and sustainability assessments after 2004 [24]. This diversification trend is seen in both editorials and broader research, as the field is expanding while continuing to grapple with its identity.

The editorials have also shown that conferences and research programs of centers like IIASA [37] contribute significantly to the identity-building process of sustainability science, as these initiatives help shape the field within academic hierarchies [91]. As

Clark and Harley [5] highlight, such programs have played and continue to play a crucial role in the development and establishment of sustainability science as a legitimate field and an autonomous "room of its own" [1]. Foundational conceptual contributions, such as those by Kates, Clark, Corell, Hall, Jaeger, Loweet al. [107] and Rockström, Steffen, Noone, Persson, Chapin, Lambinet al. [89], have further reinforced this identity-building process by articulating core research questions for the field and proposing integrative frameworks like planetary boundaries, which have broadened the scientific and societal relevance of sustainability science.

Moreover, editorials from the Diversification period increasingly reflect a shift toward transdisciplinary research approaches that aim not only to integrate academic disciplines, but also to foster collaboration with societal actors such as policymakers, NGOs, and community organizations. This trend aligns with calls in the literature for solution-oriented and transformation-oriented sustainability science, where the goal is to co-produce knowledge capable of supporting societal transformations toward sustainability [108]. Rather than focusing solely on interdisciplinary integration within academia, editorials from this period emphasize the need for research processes that are participatory, practice-oriented, and explicitly designed to address complex socio-ecological problems. This evolution in editorial discourse mirrors the broader maturation of sustainability science into a field that actively engages with societal actors in shaping pathways toward sustainable futures.

A second salient trend in Period III is the growing visibility of equity and social justice concerns. Editorials began to highlight not only environmental challenges but also the need for fair and inclusive sustainability transitions, reflecting stronger engagement with the social pillar of sustainability. Topics such as gender, poverty, and cultural sustainability appear more frequently, often framed in connection with SDG implementation and urban development. These themes signal a broadening of the field's normative orientation and a heightened sensitivity to the societal implications of sustainability science.

5 Limitations and future research

This study is limited by its focus on editorial material from three leading sustainability science journals with relatively long publication histories. These journals were selected based on their longevity and documented influence in the field, providing a coherent dataset for analyzing how sustainability science has evolved over time. However, the study does not aim to offer a comprehensive overview of all editorial discourse in the field. Rather, it provides a focused, longitudinal perspective based on a purposive sample of editorial content. Future research could expand this scope by including a broader range of journals, particularly those from different regions—including the Global South—to better capture a diversity of perspectives and editorial voices.

While the selected journals offer insight into how sustainability science has been framed in editorials, they may not fully capture the contributions of all relevant research communities. For instance, perspectives from ecological resilience and resource economics may be underrepresented in this dataset. Future studies could explore these and other research strands more fully by incorporating additional journals or other forms of scholarly communication.

Moreover, this study reflects how sustainability science is framed within a subset of sustainability-focused journals, and specifically from the perspective of editorial

discourse. As such, it does not provide a comprehensive analysis of sustainability science as a distinct academic field, as defined in foundational works by Rockström, Steffen, Noone, Persson, Chapin, Lambinet al. [89], Kates, Clark, Corell, Hall, Jaeger, Loweet al. [107], Lang, Wiek, Bergmann, Stauffacher, Martens, Mollet al. [108].

In addition to limitations in journal selection, the use of qualitative content analysis introduces interpretive challenges. Although coding reliability was assessed, the interpretation of editorial content is inevitably shaped by the researcher's perspective and theoretical orientation—in this case, Bourdieu's sociology of science [28].

An important area for future research lies in investigating whose voices are amplified through editorials. Often authored by a select group of individuals, editorials may reflect dominant viewpoints and potentially reinforce existing power structures within the scientific community. It would be valuable to explore whether these perspectives represent a diverse range of voices or predominantly those of established scholars. By analyzing the thematic and conceptual connections between the content discussed in editorials and research output, future studies could shed light on whether editorials serve as channels for diverse ideas or primarily reflect entrenched academic perspectives.

Moreover, although this study suggests that editorials reflect the field's intellectual development, the extent to which the broader field engages with the ideas presented in editorials remains uncertain. Future research could examine whether editorials effectively guide research and consolidate the field, or if they fail to leave a lasting impact on its development.

Expanding the range of journals analyzed in this article and applying alternative methodologies such as text mining of full texts or interviews with journal editors could further clarify the evolution of sustainability science. Large-scale analyses of the citation impact of editorials and their mentions in social media and policy documents could provide quantitative insights into their symbolic capital [109]. Such studies would help determine whether editorials shape not only academic discourse but also influence public and policy debates.

6 Conclusions

This study contributes to the growing application of sociological theory in sustainability science. While several of the editorials analyzed call for deeper integration of social science perspectives, these appeals are primarily directed at enhancing the field's capacity to address complex sustainability problems, rather than at reflexively analyzing the field itself. By drawing on Bourdieu's [32] sociology of science—particularly his concepts of heterodoxy and symbolic capital—this study offers a complementary perspective on how the identity and boundaries of sustainability science are constructed in editorial discourse. Through an analysis of 76 editorials from three leading journals, key trends were identified across three historical periods: Foundational (1993–2002), Introspective (2003–2012), and Diversification (2013–2022).

The findings suggest that sustainability science has evolved as a heterodox field, consistently challenging the established orthodoxies of traditional disciplines. The foundational phase emphasized systems thinking, participatory research, and indigenous knowledge. During the introspective phase, the field became more self-reflective, critiquing its methods and theoretical foundations, particularly in relation to interdisciplinarity and ecological modernization. By the diversification phase, the field had

broadened its scope, addressing pressing global challenges such as climate change and the COVID-19 pandemic, while incorporating transdisciplinary approaches that engage a wider range of contributors, including policymakers, private sector entities, and local communities.

A key contribution of this study is its focus on editorials—a publication type less-frequently studied compared to research articles—demonstrating their role as channels of legitimized knowledge and sources of authority in sustainability science. By linking these editorials to Bourdieu's concepts and situating them within the broader sustainability science literature, this study offers a novel perspective on how journals shape the field's development. Despite the growing trend toward individualized research consumption highlighted by Desrochers, Paul-Hus, Haustein, Costas, Mongeon, Quan-Haaseet al. [110]—where articles are often read in isolation—journals continue to confer symbolic capital through their prestige, editorial boards, and thematic foci [21]. Editorials, in particular, provide moments of reflection on emerging trends, intellectual developments, and the evolving identity of sustainability science, reinforcing the central role of journals in shaping the intellectual trajectory of the field. While this study demonstrates how editorials capture key trends and underscore the influential role of journals in sustainability science, further research is needed to assess their direct impact on subsequent research and public discourse.

The study of journals as sources of both knowledge and authority is especially relevant for sustainability science, where the community of contributors extends beyond traditional academic boundaries. In this transdisciplinary field, knowledge is co-created with non-academic stakeholders, such as policymakers and local communities. This expanded network of knowledge producers makes the processes of legitimization through scholarly outlets even more crucial, as these channels help establish the credibility of the diverse perspectives integrated into the field.

7 Appendix A: List of Editorials by Year of Publication

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Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s43621-025-01519-9.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Acknowledgements
The author would like to express sincere gratitude to Prof. Björn Hammarfelt and Assoc. Prof. Gustaf Nelhans for the invaluable guidance and support throughout the development of this research. The author also extends thanks to the editor and the five anonymous reviewers for their constructive comments and thoughtful suggestions, which significantly improved the clarity and quality of the manuscript. Last, the author gratefully acknowledges the University of Borås for funding the article processing charge.

Author contributions
M.S. conceptualized the study, conducted the research, performed the analysis, wrote the manuscript, and reviewed and approved the final version.

Funding
Open access funding provided by University of Boras.

Availability of data and materials
All data generated or analyzed during this study are included in this published article or its supplementary materials. The analyzed editorials are accessible through the journal platforms of *Environment, Development and Sustainability, Sustainable Development,* and *The International Journal of Sustainable Development & World Ecology.* A full list of these editorials is provided in Appendix A. The qualitative codes and heatmaps generated from the content analysis are included in the supplementary materials.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent to publish
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 20 February 2025 / Accepted: 25 June 2025
Published online: 24 July 2025

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