

Shaping the Future of Business Sustainability: LDA Topic Modeling Insights, Definitions, and Research Agenda

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Abstract

This article offers a comprehensive overview of Business Sustainability (BuS), and directly addresses the lack of consensus around this important concept. Through a mixed-methods approach, we conduct the first systematic literature review of BuS employing Latent Dirichlet Allocation (LDA) topic modeling to uncover hidden thematic structures, Narrative Synthesis to refine and extend BuS definitions within different contexts, and the LDA-HSIM method to classify topics and design a new framework. We analyzed an extensive dataset comprising 92,311 articles sourced from 11,579 journal outlets. From this dataset, we identified 9,561 articles suitable for LDA topic modeling by applying funnel criteria, focusing on articles with clear theoretical underpinnings. A text extraction technique enabled us to identify and analyze theories used in BuS studies. This analysis revealed 150 underlying theories that advance the BuS concept across different research topics. The study contributes to BuS theory development with great potential to improve ethical decision-making by establishing meaningful, context-specific definitions and providing clear guidance for future researchers in selecting appropriate theoretical perspectives for their work. We identify research gaps, propose a prioritized research agenda focused on theory development, and formulate key implications for practitioners and policymakers. This study demonstrates the effectiveness of machine learning methods in conducting large-scale literature reviews to accelerate theoretical advancements and generate research agendas.

Keywords: Business Sustainability (BuS), Systematic Literature Review, LDA Topic Modeling

1 Introduction

Business Sustainability (BuS) has gained interest from researchers, leading to significant growth in publications over the past four decades. Early definitions of BuS tended to be broad and high-level (Dyllick and Hockerts, 2002). Beyond its economic and strategic importance, BuS fundamentally encompasses ethical responsibilities toward diverse stakeholders and society at large. Ethical considerations help businesses balance profit-making with caring for the environment and society, making BuS both a strategic and moral commitment that covers norms, values, and ethical standards (Lashley, 2016; Ugoani, 2019; Hockerts and Searcy, 2023; Adaga et al., 2024). Therefore, the BuS concept has evolved from an initial focus on business continuity to progressively incorporating environmental and social goals alongside traditional financial objectives.

Distinct from related concepts such as corporate social responsibility (CSR) and corporate citizenship, BuS emphasizes the interconnection of firms within larger systems and their role in either reinforcing or undermining the stability of these systems (P. Bansal and Song, 2017). It goes beyond CSR by integrating long-term sustainability considerations and temporal aspects directly into core business practices. BuS seeks to balance immediate, short-term financial objectives with the preservation of future resources, ultimately benefiting both the company and its wider stakeholder groups (Heikkurinen and Mäkinen, 2018). However, promoting sustainability faces challenges due to short-term business thinking, which prioritizes immediate gains over long-term consequences (Lavery, 1996). Human tendencies toward instant satisfaction and temporal discounting (Loewenstein and Thaler, 1989) can unconsciously reinforce short-termism within business decision-making. To counteract this inherent bias, companies are encouraged to proactively integrate sustainability into their core business strategies and operational frameworks. This strategic approach involves balancing short-term goals with long-term environmental and social benefits, aiming to ensure intergenerational fairness and firmly positioning sustainability as a core element of strategic and responsible business practices (P. Bansal and DesJardine, 2014).

Two primary schools of thought currently dominate the discourse surrounding the definition of BuS: universal standardization and contextualization. The standardization

approach uses a one-size-fits-all logic and advocates for a uniform definition, whereas the contextualization approach argues for greater flexibility, tailoring definitions to specific circumstances and operational contexts. Both of these extreme positions possess limitations and can potentially lead to confusion and inconsistencies in implementation. Therefore, a middle ground that effectively bridges these two opposing approaches is urgently needed to enable businesses to develop and implement truly effective sustainable strategies. Although its importance has been acknowledged (Crane et al., 2019; Burritt et al., 2020), the multifaceted character of the BuS concept adds complexity, resulting in different interpretations and a fragmented overall understanding. This complexity further translates into significant variations in operationalization, consequently hindering the direct comparison of research findings across different studies (Ashrafi et al., 2018). Discussions about sustainability are dynamic, reflecting the evolving nature of the BuS concept itself.

A range of theories, such as Stakeholder Theory, Triple Bottom Line (TBL), Institutional Theory, and the Resource-Based View (RBV), have strongly influenced the development of the BuS concept. These theories offer specific perspectives on the economic, environmental, social, and temporal dimensions of sustainability, emphasizing long-term thinking and strategic planning (Montiel and Delgado-Ceballos, 2014; Lozano et al., 2015). They help define the BuS concept from a broader, more surface-level perspective, providing a foundational, general understanding of its principles. However, they potentially overlook the deeper contextual appreciation and understanding required for gaining a fully grounded and practically relevant grasp of BuS. To obtain a holistic overview (Meuer et al., 2020; de Oliveira et al., 2024), it becomes necessary to move beyond the surface-level framework and explore the underlying conceptual roots that shape the core of BuS. Moreover, the interdisciplinary nature of the concept has contributed to a lack of consensus on its definition, resulting in variations in operationalization and hindering comparability among research findings (Hopkins, 2009; Tarei et al., 2021). While existing literature reviews are helpful, they often focus on specific aspects of the concept, leaving a gap for a holistic overview that integrates all relevant perspectives and dimensions (Montiel & Delgado-Ceballos, 2014).

This study addresses these challenges in BuS research by developing a novel, detailed framework to improve both theory and practice. In particular, our study employs three interconnected phases: 1) exploring and mapping the evolving research landscape to synthesize diverse perspectives and establish a holistic overview of BuS research topics; 2) examining scholarly interpretations across different research topics to enhance conceptual clarity and refine existing definitions for practical implementation; and 3) discovering the theoretical gaps in current knowledge and developing a conceptual theoretical framework that integrates appropriate theoretical lenses, providing a foundational infrastructure for future research. Through this structured and multi-phase approach, we aim to bridge the current theoretical-practical divide that currently characterizes BuS research, while providing actionable guidance and insights directly applicable to sustainable business practices. This systematic inquiry will not only contribute to the ongoing academic discourse surrounding BuS but will also facilitate more effective implementation of sustainability initiatives across various organizational contexts, thereby directly addressing the need for coherent and practically applicable BuS research. Conducting a comprehensive literature review is a suitable approach to achieving our goals.

While conventional systematic reviews have proven invaluable for advancing conceptual understanding and providing insightful overviews across various topics (J. Thompson et al., 2014; G. Sharma and Bansal, 2020), they often entail labor-intensive and time-consuming manual tasks, such as extensive information extraction, in-depth analysis, and detailed qualitative coding (Gentles et al., 2016). Additionally, researchers may involve external coders to (partially) objectify subjective assessments and interpretations of the literature to mitigate potential bias. Regarding the BuS concept, given its topicality and exceptionally wide-ranging applicability across highly diverse domains, conducting such traditional reviews becomes challenging due to often limited research resources and, in some cases, limited access to published scholarly work. This can result in the (unintentional) exclusion of potentially relevant articles and critical perspectives from the review process (Jordan and Mitchell, 2015; Asmussen and Møller, 2019).

In contrast, machine learning methods offer a promising alternative approach that can mitigate certain forms of human biases and improve research productivity by automating and streamlining the key aspects of the literature review process (Di Vaio et al., 2020; Chauhan and Shah, 2021; Antons et al., 2023). To uncover the dominant research topics in historical BuS studies over an extended timeframe, we employ one machine learning method – Latent Dirichlet Allocation (LDA) topic modeling, a probabilistic method designed to uncover latent semantic structures within large textual datasets. LDA detects these underlying structures by analyzing word co-occurrence patterns and statistical distributions to identify statistically significant topics that emerge from the text. When combined with our domain knowledge, this approach facilitates the identification of dominant thematic patterns through the analysis of word distributions, specifically using the established bag-of-words model for text representation (Y. Zhang et al., 2010). Furthermore, by examining articles across different temporal periods, we can trace the evolutionary trajectory of the concept over time.

While LDA topic modeling has been previously used for literature reviews in related fields, such as the studies by Gladysz et al. (2023) and Melo et al. (2023), and while the BuS literature itself has been analyzed using alternative methods, such as bibliometric analysis (Jan et al., 2023) and multi-criteria decision-making methods (P. Chowdhury and Paul, 2020), our study represents a significant methodological advancement. To the best of our knowledge, this is the first comprehensive investigation that utilizes LDA topic modeling to conduct a systematic review of the complete body of BuS literature. This novel application of LDA methodology allows us to uncover latent topics and underlying theoretical patterns that previous, more traditional methodologies may have potentially overlooked or failed to identify.

Following the identification of key research topics through LDA, Narrative Synthesis is employed as a complementary method to deeply analyze the top 5% of articles with the highest topic-document probability distributions. These articles are deemed to most strongly represent each research topic. This integrated approach enables us to systematically analyze and interpret qualitative findings in a structured manner while maintaining sensitivity to contextual variations in the literature (Popay et al., 2006).

Through this analysis, we develop both context-specific BuS definitions for each topic and a more broadly applicable universal definition that spans across topics, capturing core commonalities.

Furthermore, we have developed and employed a new method – the LDA-Hierarchical Systems Integration Method (LDA-HSIM) – which integrates results generated from LDA topic modeling with hierarchical systems principles. Drawing from systems thinking approaches, this method proceeds through a series of sequential and iterative stages to systematically organize, structure, and visualize the relationships and interconnections existing among the identified BuS research topics. Through this innovative and rigorous methodological integration, we construct a comprehensive and multifaceted conceptual framework of the entire BuS research.

To thoroughly examine the theoretical foundations of BuS research, we used a text extraction technique to explore and analyze a range of established theories commonly used in different research topics. Through this analysis, we highlight areas that have historically received insufficient theoretical attention and require increased scholarly development and investigation. These insights are intended to guide future researchers in making more informed and strategic decisions when selecting appropriate theoretical frameworks for their own BuS research endeavors, while simultaneously demonstrating the effectiveness and added value of mixed methods, particularly the integration of machine learning approaches, in systematic literature reviews. This methodological integration addresses key limitations of traditional review methods, advancing our understanding of the broader and increasingly complex BuS knowledge domain.

This paper is structured as follows: Section 2 introduces the BuS concept by presenting its theoretical foundations, examining both universal and contextual perspectives on its definition and application, and outlining our study's objectives with its unique research approach. Section 3 then details our methodology, including the overall research design, data collection procedures, and the application of four analytical methods: LDA topic modeling, Narrative Synthesis, LDA-HSIM, and Text Extraction. Section 4 subsequently presents our key research findings, covering topic analysis, research

trends, contextual definitions, conceptual model development, and theoretical gap analysis. Section 5 discusses the theoretical, managerial, and policy implications derived from our research findings. This section synthesizes the outcomes, outlines future directions for impactful BuS research, details our contributions, and acknowledges the study's limitations. Section 6 concludes the paper by presenting our final thoughts and summarizing our overall conclusions.

2 BuS Concept: Background and Knowledge Gaps

The BuS concept, frequently referred to as 'Corporate Sustainability' (Dyllick and Muff, 2016), is multifaceted, covering environmental stewardship, social responsibility, economic viability, and ethical governance. The integration of BuS into business practices aims to create long-term value for all stakeholders while also contributing positively to the broader economy, society, and the environment (Elkington, 2013). This concept has captured the attention of both scholars and practitioners across diverse scientific fields such as environmental engineering, environmental economics, and strategic management (Meuer et al., 2020), with scholarly interest steadily growing since the 1980s (Purvis et al., 2019).

2.1 The Initial Theoretical Foundations of the BuS Concept

The BuS concept is derived from the broader idea of sustainability, which was formally defined in the landmark 1987 Brundtland Report as the concept of sustainable development, specifically emphasizing the needs of the present generation without compromising the ability of future generations to effectively meet their own needs (WCED, 1987). From this perspective and foundational principle, the theoretical foundations of the BuS concept were initially constructed upon several well-established and influential theories developed and refined over time. **Stakeholder Theory**, prominently introduced by Freeman in 1984, emphasizes the importance of considering the interests of all stakeholders directly affected by business decisions and operations (Parmar et al., 2010; Freeman et al., 2018; Freeman et al., 2021). In 1994, John Elkington's **Triple Bottom Line (TBL)** framework expanded on this by urging businesses to balance their economic, social, and environmental performance (Elkington, 1998, 2013, 2018). While these theories focus on stakeholder engagement and performance, Institutional Theory, developed earlier in the 1980s by DiMaggio and

Powell, explains how external pressures, such as regulations and societal norms, influence business sustainability practices (DiMaggio and Powell, 1983; Greenwood et al., 2014). Finally, Resource-Based View (RBV), introduced by Barney in 1991, shifts the focus to the internal resources and capabilities that businesses can leverage for sustainable competitive advantage (Barney, 1991; Peteraf and Barney, 2003; Kraaijenbrink et al., 2010). Together, these theories illuminated the interplay between businesses, society, and the environment. Thus, business sustainability is a strategic approach that is shaped by external influences and internal capabilities for balancing economic viability, environmental stewardship, and social responsibility. This initial theoretical foundation is outlined in Fig. 1.

Insert Fig. 1

Stakeholder Theory and BuS

Stakeholder Theory serves as a starting point for understanding BuS. It emphasizes that businesses are not only accountable to their shareholders but to all stakeholders who are affected by their operations – this includes employees, customers, suppliers, communities, and even the environment. In the context of BuS, this theory broadens the company’s focus from mere profit generation to considering the needs and expectations of all stakeholders, which are integral to achieving long-term sustainability. By engaging with various stakeholders, businesses can better align their strategies with societal and environmental goals, ensuring that their operations contribute to sustainable development in a meaningful way (Freeman, 2010b; Freeman et al., 2018). Therefore, from this theory’s perspective, BuS is a business decision that considers the impacts on all stakeholders, not only shareholders. It stresses the importance of ethical conduct and responsibility toward those affected by business activities (Hockerts and Searcy, 2023).

Triple Bottom Line (TBL)

In addition to considering the interests of multiple stakeholders, the TBL reinforces the need for businesses to balance three core dimensions of sustainability and offers a structured way for implementation: People (social responsibility), Planet (environmental stewardship), and Profit (economic viability) (Elkington, 1997). TBL is one of the most well-known approaches to BuS, and it expands traditional performance metrics by encouraging companies to not only focus on profit but also to measure and report their social and environmental impact. It initially played an important role in BuS by helping businesses integrate these three dimensions into their core strategies (Elkington, 2013). In 2018, Elkington recalibrated TBL, arguing that businesses had tended to focus too heavily on profit, often using TBL as a framework for incremental improvements rather than transformative change (Elkington, 2018). He criticized the application of TBL in BuS as being too narrow in scope and failing to address larger systemic challenges. Therefore, system-level changes were called for to challenge traditional business models by shifting from profit-focused, incremental improvements to transformative, regenerative practices that address broader environmental, social, and economic challenges on a global scale. This insight reinforces the principles of Stakeholder Theory, wherein a business must account for the internal and external relationships (i.e., all entities) to ensure sustainability (Freeman, 2010a).

Institutional Theory

Institutional Theory examines the external pressures that drive businesses to adopt sustainable practices. Developed by DiMaggio and Powell (1983), this theory suggests that businesses operate within a broader social and regulatory environment where conformity to societal norms, regulations, and industry standards is crucial for legitimacy and long-term survival. It highlights how businesses are shaped by institutional forces – such as environmental regulations, industry best practices, and public expectations – that push them toward sustainable practices. Businesses often adopt sustainability initiatives not only to satisfy stakeholders but also to comply with external pressures like governmental policies or shifting social values (DiMaggio and Powell, 1983; Powell and Bromley, 2015). By aligning with these institutional demands, companies can enhance their legitimacy, reputation, and overall long-term viability. Institutional Theory, thus, provides an important lens for understanding how businesses,

through their responses to regulatory and societal pressures, can contribute to broader sustainability goals (W. R. Scott, 2008). Compliance with these external influences not only supports long-term resilience but also strengthens a company's ability to operate ethically and responsibly in an increasingly regulated and sustainability-conscious world (Greenwood et al., 2014).

Resource-Based View (RBV)

In addition to external pressures highlighted by Institutional Theory, the Resource-Based View (RBV) shifts the focus to the internal resources and capabilities that contribute to a firm's long-term success. Developed by Barney (1991), the RBV argues that a company's competitive advantage is driven by resources that are valuable, rare, inimitable, and non-substitutable (VRIN). These internal assets provide companies with unique opportunities to embed sustainability into their business models, differentiating them in the market (Peteraf and Barney, 2003). By leveraging sustainable technologies, innovative processes, and skilled human capital, companies can not only respond to external sustainability demands but also advance their core operations by integrating sustainability into their processes. For instance, firms that adopt green technologies or design eco-friendly processes can achieve a strategic advantage while contributing positively to environmental goals (Kraaijenbrink et al., 2010). Furthermore, building on this concept, the Natural Resource-Based View (NRBV), introduced by Hart (1995), extends RBV to emphasize how environmental strategies – such as resource conservation, pollution reduction, and sustainable product development – can generate both sustainability outcomes and competitive advantage. By proactively engaging in environmental sustainability initiatives, companies not only improve efficiency and reduce costs but also enhance their competitive position as leaders in sustainability.

While these foundational theories have been instrumental in shaping early BuS concepts, many organizations still struggle to integrate sustainability into their overall management strategies, leading to inconsistencies and missed opportunities in achieving BuS (Hahn et al., 2015; Ivory and Brooks, 2018; Burritt et al., 2020). For example, although corporations are treated as open systems, the management of internal and external forces (e.g., organizational culture, internal resource allocation, and

institutional pressures) often lacks detailed guidelines for businesses on how to effectively engage with these external factors (Howard-Grenville and Bertels, 2011; Kantabutra, 2022). Furthermore, the rapidly changing global landscape – characterized by interconnected social, environmental, and economic challenges – demands a more comprehensive, interconnected, and adaptive theoretical framework (Armstrong et al., 2023; D. Wang et al., 2024). This highlights the need to revisit these initial foundational theories of BuS. For instance, Stakeholder Theory has been criticized for being overly broad and offering limited guidance on how to prioritize conflicting stakeholder interests in practice. Moreover, it often fails to address the systemic complexity of modern sustainability challenges, where the interconnectedness among stakeholders complicates decision-making (Parmar et al., 2010). Similarly, the Triple Bottom Line (TBL) framework has been criticized for its limited practical application, functioning more as a reporting mechanism than a tool for driving systemic change (Hahn et al., 2015). Its three pillars are often treated in isolation, leading to fragmented sustainability efforts (Slaper and Hall, 2011).

Institutional Theory, while valuable in explaining how businesses conform to external pressures, often lacks insight into how businesses can innovate and proactively lead sustainability efforts rather than merely adhere to established norms. This reactive approach limits its effectiveness in guiding forward-looking sustainability strategies (Greenwood et al., 2014). Finally, the Resource-Based View (RBV) has been critiqued for being too static, focusing primarily on firm-specific resources and neglecting the dynamic external factors that influence sustainability. RBV does not sufficiently account for the need for businesses to continuously adapt and innovate to respond to evolving environmental challenges and stakeholder demands (Ambrosini et al., 2009).

As a result, there is an increasing call for developing a more integrated theoretical framework capable of addressing the complexity of BuS. Contemporary BuS issues demand an approach that integrates systems thinking and multidisciplinary perspectives, adopts regenerative business models, and accounts for sustainability challenges' dynamic and interconnected nature (Geissdoerfer et al., 2018; Lüdeke-Freund et al., 2018; Adams and Abhayawansa, 2022).

2.2 Defining the BuS Concept: Universal and Contextual Perspectives

There are two main viewpoints on how BuS should be defined and implemented. One perspective emphasizes that a universal definition of BuS is necessary for developing a common framework. This facilitates the alignment of business strategies with global objectives, such as the Sustainable Development Goals (SDGs) (Sianes et al., 2022). Many scholars argue that a universal definition can ensure consistency, comparability, and global accountability (Lozano et al., 2015; Mio et al., 2020; Rosen, 2020; de Oliveira et al., 2024). For example, indicators like those from the Global Reporting Initiative (GRI) help firms measure sustainability in a way that resonates across borders, facilitating a shared understanding and collective global action on issues like climate change, social inequality, and resource scarcity (Bice and Coates, 2016; Threlfall et al., 2020). Additionally, a standardized approach promotes consistency in sustainability reporting and benchmarking, enabling comparability across organizations and sectors. This consistency enhances transparency, accountability, and collective progress toward sustainability goals (Brown et al., 2009).

Other scholars advocate for a contextual approach to BuS, suggesting that the BuS concept should be tailored to the specific circumstances and needs of each business and its environment, as this could help businesses develop appropriate sustainability strategies (Gerner, 2019; Sahle et al., 2024). For example, Meuer et al. (2020) identified essential attributes of the BuS concept after summarizing 33 original definitions to help businesses understand how to interpret BuS. They recognize that different industries, regions, and business segments present unique sustainability challenges and opportunities, necessitating customized strategies. By allowing for contextual adaptations, businesses can develop more relevant and effective sustainability solutions, thereby strengthening innovation and resilience (Boons et al., 2013). Moreover, a contextual approach respects cultural and regional differences, which is particularly important for multinational corporations operating in diverse settings (Gerner, 2019; Sahle et al., 2024).

However, despite the advantages of both perspectives, each has its drawbacks. Critics argue that a universal definition without context only offers broad guidance without sufficient meaning and cannot help businesses address different situations (Dyllick and Muff, 2016). It risks promoting a one-size-fits-all approach that may not work in all settings, potentially limiting innovation and flexibility (Hart and Milstein, 1999). On the other hand, a purely contextual approach can lead to fragmentation (see subsection 2.2.1 for details), making it difficult to compare sustainability efforts across organizations and slowing overall progress (Adams and Frost, 2008). Furthermore, scholars and practitioners agree on the importance of context; however, they also identify a disconnect regarding context, leading to inconsistent practices and misalignment in strategy planning within organizations (see subsection 2.2.2 for details). Additionally, they highlight a lack of clarity regarding the impact that different contexts have on understanding and applying the BuS concept (Bebbington and Larrinaga, 2014; Hahn et al., 2015; Lozano, 2015).

2.2.1 Fragmented BuS Studies

The concept of BuS is complex, and the diversity of meanings, as mentioned earlier, can be largely attributed to its evolutionary nature and its application in diverse research topics. This often leads to confusion and different interpretations (Pazienza et al., 2022), posing challenges in developing a single definition that is meaningful and universally applicable (Rațiu and Anderson, 2015; Meuer et al., 2018). Promoting sustainability requires balancing environmental, economic, and social (EES) responsibilities, which can be further complicated by conventional narrow approaches that either prioritize profit alone or neglect stakeholder diversity (Porter and Reischer, 2018; Purvis et al., 2019). In this regard, BuS studies vary significantly in their interpretation of the concept and the theories they consider relevant (e.g., Goyal et al., 2013; Sianes et al., 2022; Benameur et al., 2023). For instance, Engert et al. (2016) integrated BuS into strategic management. This is insightful, but their framework did not capture the complex relationship between strategic decision-making and broader sustainable development objectives. Similarly, studies exploring multi-criteria decision-making methods (M. T. Chowdhury et al., 2020), the convergence of the circular economy and BuS (S. Bansal et al., 2022), the cognitive framing perspectives (Hahn et al., 2014), and work on performance metrics (Rezaee, 2016; Rezaee and Tuo, 2019) have broadened our

understanding of the concept. This diversity gives rise to various subfields, such as family business (e.g., Ferreira et al., 2021; Aparicio and Iturralde, 2023), ecologically sustainable entrepreneurship (e.g., Gast et al., 2017; Kraus et al., 2018; Johnson and Schaltegger, 2020), sustainability-oriented service innovation (e.g., Calabrese et al., 2021), and sustainability in business models (e.g., Schoormann et al., 2016). While these studies have made valuable contributions to specific aspects of BuS, the lack of integration between these perspectives remains a noticeable challenge (Michael S Hopkins, 2009; Michael S. Hopkins et al., 2009; Bertini et al., 2021). Thus, as highlighted by Sambhanthan et al. (2017), there is a call for a more integrated perspective on BuS. The risk is that popular research fields could overshadow lesser-known ones. Given the broader landscape of sustainability research, this poses a genuine dilemma for theoretical advancement.

2.2.2 Disconnected and Inconsistent BuS Practices

A conventional interpretation of the BuS concept centers around the creation of long-term value for shareholders (Dow Jones Sustainability Indexes, 2019). Most emphasis is placed on the economic domain, stressing how sustainable practices can contribute to long-term profitability and the company's capacity to endure and succeed in the market (Rappaport, 1999; Friedman, 2007). However, when businesses focus solely on internal economic gains, they may overlook the significant costs associated with their actions, particularly when operating in a short-term profit-oriented 'business-as-usual' manner. Dyllick and Muff (2016) consider this approach unsustainable. Such a business trend can lead to the underestimation of broader social and environmental impacts, or external costs linked to business operations (Pojasek, 2007; Svensson and Wagner, 2015). For instance, in a sustainability-committed company, departments might pursue diverse and disconnected initiatives; one department may focus on waste reduction while another prioritizes community outreach. The absence of alignment and coordination leads to a disjointed approach to sustainability within the organization (Stoughton and Ludema, 2012; Giovannoni and Fabietti, 2013; Milán-García et al., 2019).

Furthermore, the narrow economic focus often slows the progress of the integration of sustainability initiatives with broader global objectives, making it challenging for

organizations to align their internal practices with global sustainability goals. Consequently, the disconnect between global sustainability goals and local relevance exacerbates inconsistent BuS practices. Current global initiatives, such as the United Nations Sustainable Development Goals (SDGs), often face challenges in adapting to individual communities' unique socio-economic and cultural landscapes (UN, 2023). For instance, while global efforts may prioritize the adoption of renewable energy, local regions might encounter specific barriers, such as inadequate infrastructure, economic constraints, or cultural resistance that impede progress (Gómez-Baggethun and Naredo, 2015). Achieving global sustainability goals requires a nuanced approach that aligns broad objectives with local contexts to ensure effective and equitable implementation.

Thus far, discussions about the BuS concept have tended to take place in isolation. For example, the contemporary interpretation of BuS, which encompasses EES dimensions, may obscure the inherent conflict between human well-being and environmental preservation, as exemplified by the issue of environmental security risks (Lautensach and Lautensach, 2022). Kuhlman and Farrington (2010) advocate for a return to the original essence of sustainability, emphasizing the conservation of irreplaceable natural resources and prioritizing the welfare of future generations over the satisfaction of present needs. Conversely, McKenzie (2004) advocates for a separate categorization of social sustainability from environmental and economic sustainability, and cautions against burdening the term 'sustainability' with multiple meanings, each requiring a clear definition. Current research heavily focuses on empirically examining the relationship between environmental and social performance in business and its financial outcomes (S. Zhang et al., 2022; Naseer et al., 2023; Y. Xu and Zhu, 2024). The focus on empirical analysis alone limits the exploration of interdisciplinary perspectives, hindering the integration of insights from diverse disciplines and potentially isolating the field (Linnenluecke and Griffiths, 2013). Consequently, different levels of management are confused about how to understand and implement sustainability strategies in business. For example, managers often perceive sustainability primarily as an effort focused on efficiency improvements and cost-cutting (Stoughton and Ludema, 2012). This misinterpretation might also lead to practices such as (un)intentional greenwashing, where companies misleadingly present themselves as environmentally friendly without making substantive sustainability efforts (Delmas and Burbano, 2011).

Although BuS is discussed in several research areas, there is a lack of a common or unifying foundation and identification of factors that influence its integration into strategic management.

Enhancing collaboration and integration across various facets of sustainability research within the BuS field is crucial. However, interdisciplinary approaches are often overlooked, leading to a gap in cross-disciplinary engagement. Schoolman et al. (2012) found that environmental sciences have the highest number of published articles but draw the least from other disciplines. Conversely, economics adopts a more integrative approach despite having fewer BuS-related publications. This highlights a clear lack of interdisciplinary collaboration in the BuS field.

Moreover, the diversity and complexity of BuS issues directly impact how companies approach sustainability. Businesses striving to become more sustainable must choose between adopting a universal perspective or a contextualized approach. This decision influences how they shape their strategies, measure their progress and successes, and engage with stakeholders. Without connecting these two approaches, effectively implementing sustainability becomes challenging. Additionally, as more companies prioritize sustainability, integrating these differing viewpoints becomes increasingly difficult (Adams and Frost, 2008; Eccles et al., 2014; Lozano, 2015; Dyllick and Muff, 2016). Therefore, bridging the gap between the universal and contextual perspectives on BuS is necessary. Despite ongoing debates, an integrated approach that combines these viewpoints is lacking in the literature (Nidumolu et al., 2009; Lozano, 2015; Benkert, 2021). Developing a comprehensive framework that leverages the strengths of both perspectives is urgent to make theoretical advancements.

2.3 Research Objectives

Although BuS research has gained increasing attention among academics and practitioners (De Giacomo and Bleischwitz, 2020), much of the literature focuses on well-established aspects while overlooking emerging trends and unexplored areas. Scholars emphasize the need for a broader and updated review that includes various topics and contexts. Specifically, there are calls for a more holistic approach to BuS (Jia

et al., 2019), a deeper exploration of sustainability in business-to-business markets, and further studies on sustainability in small- and medium-sized enterprises (SMEs) (A. Sharma, 2020). In addition, a lack of cohesion in BuS research, particularly in the integration of Stakeholder Theory, TBL, Institutional Theory, and RBV, along with inconsistencies in research methodologies, further complicates theoretical advancements.

To address these issues and advance theory development, it is essential to first trace the historical evolution of BuS research. Therefore, one of our primary objectives is to offer a historical overview of BuS studies, including all relevant research to mitigate potential biases in our analyses. By reviewing existing literature and incorporating diverse perspectives, our research seeks to define the BuS concept in a manner that aligns global sustainability goals with local relevance. A clear and integrative definition is necessary not only to advance academic understanding but also to provide businesses with practical guidance for effective sustainability implementation.

To further advance the BuS concept, this study aims to develop an integrative framework that establishes a universal foundation of core sustainability principles while allowing for contextual adaptations that address specific business and environmental circumstances. This approach is grounded in the aforementioned theoretical foundations by drawing on Stakeholder Theory to ensure comprehensive value creation, TBL to provide a universal performance measurement framework, Institutional Theory to recognize sustainability priorities, and RBV to emphasize the strategic importance of sustainable resource management.

To achieve these objectives, we have designed a three-phase research approach guided by the following research questions:

Phase 1: Mapping Research Topics in BuS Studies

RQ1: Can we develop a holistic overview of the BuS concept that incorporates a diverse range of perspectives?

RQ2: What are the different BuS research topics?

Phase 2: Defining BuS Concepts across Different Research Topics

RQ3: How do scholars interpret the BuS concept within different research topics?

RQ4: How can we advance existing BuS definitions to develop a comprehensive understanding to guide academic research and practical implementation?

Phase 3: Developing a Conceptual Theoretical BuS Framework

R5: How are theories currently being applied in BuS research, and what are the key areas of focus, overlooked areas, and potential improvements for enhancing theory-driven BuS research?

R6: What are the theoretical gaps in BuS research, and how can we apply the appropriate theoretical lenses to advance our understanding of the concept?

R7: What new conceptual theoretical framework can be developed to comprehensively illustrate the overall BuS concept, which may serve as a foundational infrastructure to assist future researchers?

3 Methodology

3.1 Research Design

In this study, we employed four methods to examine BuS literature from 1980 to 2022, helping us understand how the BuS concept evolved over time. While we will explain the methodological details later, we present here a concise overview of our approach. Firstly, we adopted **Latent Dirichlet Allocation** (LDA) topic modeling, a machine learning method that serves as a generative probabilistic model used for uncovering hidden thematic structures (topics) within a large collection of documents (corpus) (Blei, 2012b). To further explore the contextual aspects of these topics, we used the **Narrative Synthesis** method. This qualitative approach enabled us to explore the most representative studies, discovering detailed insights into how BuS is conceptualized, discussed, and evolved within each thematic area. By integrating the quantitative findings from the LDA with qualitative analysis through narrative synthesis, we conducted a study to capture both the overarching topics and the fine details of the BuS literature. This approach enabled us to refine and extend definitions of BuS in different contexts by systematically categorizing and synthesizing the most relevant articles.

Third, we combined the quantitative insights from LDA with qualitative narrative synthesis to develop a new methodological approach – the **LDA-Based Hierarchical Systems Integration Method** (LDA-HSIM). This method systematically transforms topic modeling results into a structured conceptual framework while maintaining the contextual richness revealed through narrative analysis. LDA-HSIM comprises four stages: building upon LDA results for topic identification, organizing topics into hierarchical categories, mapping relationships between categories, and validating the conceptual framework. This new integration of quantitative and qualitative approaches allowed us to visualize the interconnections within the BuS knowledge domain.

Finally, and fourth, we utilized a text extraction technique to understand the theoretical foundations and disciplinary perspectives historically applied in BuS studies. This method systematically explored and identified theories from various disciplines often used in BuS research. By extracting and examining these theories used, we were able to map the interdisciplinary nature of BuS studies and assess the evolution of theoretical approaches over time. Details of this process are provided in subsection 3.6.

3.2 Data Collection

In machine learning, the general principle of “garbage in, garbage out” is particularly critical, because machine learning algorithms heavily rely on high-quality, representative data to learn patterns and make accurate predictions. Any poor input data can degrade model performance and result in misleading outcomes (Kotsiantis et al., 2006; Domingos, 2012). Besides data quality, data volume is crucial for improving machine learning capabilities. This study utilized Scopus, Web of Science (Binagwaho et al., 2021), and Science Direct (Ramage et al., 2004) to create a suitable database of research publications. We excluded Google Scholar due to its inclusion of non-scientific sources such as blogs and websites, as noted by Jacsó (2012). Conducting the initial keyword search, “business” and “sustainability” formed the core database, which we later supplemented with the term ‘theory’ across all BuS research. All articles included in our dataset are in English to ensure consistency and comparability in content analysis, as English is widely regarded as the prevailing medium for international academic communication today.

As recommended by Schofield et al. (2017), we eliminated duplicates and excluded articles missing essential information, such as DOI numbers. While the presence of a DOI number does not necessarily indicate the quality of the research, it does signify its accessibility and traceability, both crucial in academic research. Therefore, our cleanup process ensured that our dataset was reliable and traceable, aiding in accurate citation and retrieval of sources in academic research. This process resulted in a comprehensive final dataset of 92,311 BuS articles from 11,579 journals.

3.3 LDA Topic Modeling

LDA topic modeling assumes that each document is a mixture of a small number of topics and that each topic is a distribution over words (Blei et al., 2003; Blei, 2012b). This method is used to uncover the hidden research topics within the historical corpus of BuS studies (for the theoretical foundation of this method, refer to Appendix A). In this section, we provide a detailed account of how LDA was applied in our study, including the criteria and methodological choices that underpin our analysis.

3.3.1 Overview of LDA Topic Modeling Process

Since only a few studies have previously used LDA topic modeling in literature reviews (Mo et al., 2015; Antons et al., 2023), there is no well-established method specifically tailored for this purpose. We developed our process by referring to the guidelines established by Asmussen and Møller (2019), who created a conceptual framework for applying LDA to explore large collections of documents. Their approach provides a clear guide that aligns well with our goal of efficiently organizing and analyzing the literature. Following their guidelines, we designed and conducted the LDA implementation in this study through a sequence of four main steps: *Pre-processing*, *Model Generation*, *Model Evaluation*, and *Text Categorization*. The following summarizes each step, and for further details, refer to Appendix B.

Step 1: Pre-processing involves dataset preparation, refining the text using the SpaCy Python package, a tool for tasks such as tokenization, part-of-speech tagging, and named entity recognition to advance natural language processing. The output is a

comprehensive dictionary covering 6,533 words in our study, which serves as an essential starting point for further LDA analysis (Cancho and Solé, 2001).

Step 2: Model Generation involves the creation and development of numerous LDA models to classify text into different topics. We generated thousands of models with different parameters to capture diverse topics in the dataset, aiming for non-overlapping topics. By adjusting the parameters and the dictionary, we aimed to achieve an optimal configuration of parameters that effectively captures the underlying structure and topics in the textual data on BuS.

Step 3: Model Evaluation aims to select the optimal LDA model using metrics. For this task, two primary quantitative metrics are used: **Perplexity** and **Topic Coherence**. Perplexity measures predictive performance, with lower values indicating better performance (Asmussen and Møller, 2019). Topic Coherence measures semantic similarity within topics, with higher values favoring more interpretable topics (Newman et al., 2011; O'Callaghan et al., 2015; Syed and Spruit, 2017). This study uses three coherence metrics: normalized pointwise mutual information (**C_{npmi}**), unsupervised mass (**C_{umass}**), and coherence value (**C_v**). Models showing high initial peaks and steep decays in coherence are preferred (Zvornicanin, 2021).

Step 4: Text Categorization involves refining and validating the results with domain knowledge. The best model emerged after a rigorous evaluation that ensured alignment with our dataset. Texts from the best model were classified into topics based on LDA probabilities. We apply domain knowledge of the subject area related to the text data. This includes understanding specific terminology, concepts, and common relationships found in the text data. This domain knowledge is crucial for interpreting and validating the topics generated by the machine. This topic labeling process includes iterative refinement, and we incorporated feedback from other experts to ensure the accuracy and relevance of the topic labels.

Between steps 2 and 3, there is an iterative feedback loop for training, tuning, and evaluation of models. Before we elaborate further on this (subsection 3.3.2.), we outline

Fig. 2, which illustrates how this loop integrates automated handling of hyperparameters ranges. It includes visual inspection and dictionary tuning to ensure optimal topic configuration and substantial dispersion.

Insert Fig. 2

3.3.2 *Model Training, Tuning (Optimization), and Validation*

The Gensim Python library was chosen to train the LDA model, a commonly accepted tool for topic modeling (Saxton, 2018; Owa, 2021). It offers an abstraction layer to the LDA training software and includes two primary inference algorithms: the **Variational Expectation Method** (VEM) and **Gibbs Sampling** (Jonas et al., 2004), validated by prior research findings (Porteous et al., 2008; Jordan and Mitchell, 2015). *VEM* estimates posterior distributions for document-topic assignments and word-topic distributions iteratively, aiming for convergence. *Gibbs Sampling* updates word-topic assignments based on the current model state until convergence, revealing latent topics in the dataset through stable topic distributions. In the optimization process, the *Tuning* step aims to determine critical Dirichlet hyperparameters – such as topic ‘K’, passes, iterations, alpha, and beta – to effectively capture distinct topics. We established criteria to validate each step, ensuring that key components are set up efficiently. The following subsection further elaborates on the selection of key components and their corresponding criteria in our study.

3.3.3 *Key Components and Criteria*

To optimize the model and extract meaningful insights, we introduce the key components identified and the criteria established in this study. Detailed explanations of how these components function across model training, tuning, and validation can be found in Appendix C.

- **Number of Topics (K):** Determining the optimal number of topics, K , is a crucial parameter that must be specified before running LDA to capture the thematic

structure of the corpus without overfitting or underfitting the data. Following the guidelines of Mimno et al. (2011), we set the lower bound of K at 10 to ensure sufficient granularity in topic segmentation. We incrementally increased K by one up to the point where the additional topics did not significantly enhance the model, observing the impact on model performance based on predefined criteria (i.e., Perplexity and Coherence scores). This systematic exploration, guided by our criteria, allowed us to identify an optimal K that balances detail and coherence.

- **Dirichlet Hyperparameters (α and β):** These control the distributions of topics over documents and words over topics, respectively.
 - α (Document-Topic Density): A lower α setting often helps documents to be associated with fewer topics, resulting in a sparser topic distribution. Conversely, a higher α allows documents to incorporate a more even mixture of topics.
 - β (Topic-Word Density): A lower β often promotes topics associated with fewer words, leading to a sparser word distribution. In contrast, a higher β enables topics to have a more uniform distribution over words.

In this study, both parameters were set to ‘symmetric’ distributions, calculated as $1.0/K$ (where K is the number of topics), based on predefined criteria. These criteria assume a uniform prior belief, enhancing topic diversity and preventing any single topic or word from dominating the model. This configuration contributes to more interpretable results by effectively balancing topic and word distributions, improving overall clarity.

- **Inference Method and Parameters:** We employed *Gibbs Sampling* for model inference due to its effectiveness with large datasets and its ability to provide accurate topic-word assignments. To ensure convergence and stability, we optimized the number of iterations and passes based on predefined criteria, setting them to 50 and 1,000 respectively. These parameters affect the granularity and reliability of the topics extracted, and their tuning was essential for extracting meaningful thematic structures. By adhering to these criteria, we ensured that the

inference process balanced computational efficiency with the accuracy and interpretability of the resulting topics.

- **Model Evaluation with Perplexity and Coherence Scores:** The perplexity score measures how well the model predicts new data; lower perplexity indicates a better fit. However, excessively low perplexity beyond the *knee point* may signal overfitting, where the model fails to generalize to unseen data. To address this limitation, we employ three coherence metrics to evaluate topic interpretability: C_v (ranging from 0 to 1), C_{npmi} (from -1 to 1), and C_{umass} (which can be negative or positive). The criteria are that higher values of C_v and C_{npmi} indicate better models, while C_{umass} scores closer to zero are preferred, reflecting more semantically consistent and interpretable topics. Furthermore, we use both quantitative metrics (performance) and qualitative assessments (meaningfulness and interpretability) to establish our evaluation criteria. We chose models that exhibit high initial peaks and steep declines in coherence scores across different metrics. This pattern indicates that the model quickly achieves high coherence, suggesting strong and interpretable topics, and maintains a sharp decline thereafter, which helps in avoiding overfitting. Specifically, models demonstrating high initial coherence scores and rapid stabilization are considered superior, as they balance interpretability with generalization.

3.4 Narrative Synthesis Method

The narrative synthesis method is a systematic approach that uses a narrative framework to understand evidence (e.g., patterns and themes across studies, evaluating the strength and quality of evidence, contextualizing findings within the broader field of research, and synthesizing information to draw meaningful conclusions). This method primarily relies on textual descriptions to summarize and explain findings from multiple studies (Popay et al., 2006; Lisy and Porritt, 2016). Guided by systematic review principles (J. Thompson et al., 2014; Si et al., 2018; Xiao and Watson, 2019), we developed a process specifically tailored to explore the contextual refinement of each topic after determining an optimal model from the results of LDA. The narrative synthesis process in this study involves three steps: *Exploring*, *Interpreting*, and *Integrating* findings from different studies. This iterative process included three rounds of refinement to examine

relationships within and between studies. Furthermore, the findings illustrate the narrative of BuS studies, enabling us to develop new BuS concepts across different contexts.

3.4.1 Data Exploration and Sampling Strategy

After screening the dataset in each topic (i.e., article titles, abstracts, and keywords) to mitigate the risk of a narrow perspective, we developed a sampling strategy. There is a two-stage sampling process: 1) Alternative thresholds, such as the top 10% matching probability or a probability score above a certain cutoff, were considered; 2) We conducted two rounds of refinement to exclude non-relevant articles and verify thematic coherence (details are provided in Appendix D). Eventually, a 5% threshold criterion was established to identify the most representative articles within each LDA-generated topic – an approach aligned with established bibliometric practices that ensure both analytical depth and manageability (Di Vaio et al., 2022). This threshold yielded papers with high topic-word matching probabilities (i.e., within the top 5%, the highest probability is 0.86, and the lowest is 0.60), exemplifying papers that strongly represent and are associated with their respective topics.

3.4.2 Interpretation and Coding Process

To conduct a preliminary synthesis of findings, this study moved beyond simply identifying and counting results to exploring relationships within articles in each topic and across topics. The relationships we focused on fall into two main categories: connections between the characteristics of individual studies and their reported findings, and interrelations among the findings of different studies.

The coding framework evolved through multiple refinement stages:

- **Initial categorization:** In this stage, each article is assigned to the topic with the highest probability of association as determined by LDA topic modeling. This primary topic, or first match, represents the most prominent theme within the article, ensuring that each piece is grouped according to its strongest underlying subject matter. By focusing on the first matched topic, we establish a clear and organized

framework for analyzing the collection of articles (e.g., the coding label ‘resource-driven and competitive advantage’, ‘governance and policy’).

- **Dimensional coding:** Each topic was initially coded according to well-known sustainability dimensions (e.g., ‘economic’, ‘economic and environmental’, ‘economic, social, and environmental’). When new dimensions were identified, additional codes were created to accommodate these emerging themes (e.g., ‘technology’, ‘innovation’, and ‘culture’). We labeled them in a meaningful and relevant way (e.g., ‘multi-tier supplier sustainability’ and ‘governance mechanisms in sustainability’) to verify the internal connections of each selected article.
- **Cross-validation:** Topics were cross-checked manually for relevance to ensure accuracy and consistency across the coding process. This involved multiple reviewers independently assessing each topic to verify its alignment with the study’s objectives and the underlying data. Discrepancies between reviewers were discussed and resolved through consensus, enhancing the reliability of the coding framework. Additionally, this step included re-evaluating article counts to reflect any adjustments made across the validation process, thereby refining the overall dataset for subsequent analysis.

3.4.3 Integration and Synthesis of Findings

The integration stage used an iterative synthesis approach through successive rounds of analysis to comprehensively understand BuS (Popay et al., 2006). Following established narrative synthesis methods (Thomas and Harden, 2008), we synthesized the findings by comparing and contrasting meanings across topics while maintaining the contextual integrity of individual studies.

In the process, a hierarchical categorization scheme was conducted to integrate findings across studies. This involved analyzing semantic categories to capture both primary themes and cross-dimensional relationships within the LDA-generated topics. Through cross-topic thematic analysis, we identified patterns and their relationships to enable different topics to be organized into higher-level categories (e.g., ‘global perspectives’ and ‘innovation and knowledge’), allowing systematic identification of patterns and theoretical connections within the data. Furthermore, the findings of the articles were integrated into coherent theoretical narratives. Ultimately, emerging theoretical insights

were captured, and a new model was developed to describe BuS. We applied each technique systematically across all topics, with equal weighting given to studies of comparable methodological quality (Popay et al., 2006). This approach ensured analytical rigor while enabling theoretical insights to emerge from the data.

Finally, we examined the connections between articles within each topic to develop a comprehensive understanding of the theoretical landscape. Following established principles of narrative synthesis (Lisy and Porritt, 2016), our approach extended beyond aggregating existing knowledge to generate novel theoretical insights about BuS within specific thematic contexts. We continuously refined emerging theoretical constructs through comparison with primary data until reaching theoretical saturation.

3.5 LDA-HSIM

The foundation of this method draws from the systematic integration of LDA topic modeling with hierarchical knowledge organization principles and systems thinking approaches (i.e., we named this method based on these). As shown in Fig. 3, this method comprises four sequential stages.

Insert Fig. 3

The first stage builds on the LDA results from Section 3.3, transforming the statistical findings into structured thematic elements that serve as building blocks for conceptual framework development. The second stage involves structural organization, drawing on hierarchical taxonomy development methods (Nickerson et al., 2013) and conceptual framework-building approaches (Jabareen, 2009). This stage systematically categorizes topics into broader thematic groups, similar to the hierarchical knowledge organization methods employed by Ramos-Rodríguez and Ruíz-Navarro (2004) in their analysis of strategic management research. Through iterative analysis, we identified central themes and developed categorical classifications.

The third stage focuses on relationship mapping, incorporating principles from systems thinking (B. Williams and Hummelbrunner, 2010) and knowledge network analysis

(Börner et al., 2003). It identifies and maps relationships between concepts and builds upon similar methodological frameworks used in systematic literature reviews and bibliometric analyses. We established both vertical (hierarchical) and horizontal (inter-categorical) relationships, creating a network that reflects the interactions within the BuS domain.

The final validation stage draws from established qualitative research validation techniques (Creswell and Miller, 2000) and framework assessment methods (Cornelissen, 2017). Through iterative review and refinement, we verified the topic coverage and the validity of identified relationships (i.e., the nomological space), as well as the logical coherence of the overall framework. The conceptual model of BuS based on the revealed context is established through this validation process. This iterative process ensures both comprehensive coverage and theoretical coherence, similar to the approach used in grounded theory development (Gioia et al., 2013).

3.6 Text Extraction

The text extraction technique is commonly employed in Natural Language Processing (NLP) and information retrieval systems. It facilitates the targeted extraction of specific information or data from textual sources (Hirschberg and Manning, 2015; Jayaram and Sangeeta, 2017; E. Kim et al., 2017). Our process, initiated with the extraction of theories from the corpus, employed Bigrams, Trigrams, and 4-grams. These extracted theory keywords were subsequently aggregated, accommodating lexical variations to ensure a refined and comprehensive compilation (Rastegar-Mojarad et al., 2015; Rajput et al., 2020). In addition, we manually added 'Triple Bottom Line' and its variations to the theory list, given its popularity, which contributed to the initial BuS theoretical framework (see Fig.1).

To measure the prevalence of theories on specific topics, we use a cutoff approach based on the probabilities of topics. We set a 50% threshold to determine if an article is related to a certain topic. Even though an article may have connections to various topics, this threshold ensures a substantial level of certainty about its main focus, making it relevant to our analysis. By applying a text extraction process, we can perform a multidisciplinary examination of theories, allowing us to explore relevant disciplines

guided by the dictionary of theories (Bothamley, 1998) and identify gaps in the final selected model.

4 Findings – Results and Analysis

In this section, we first present the results of our machine learning approach, specifically focusing on LDA topic modeling and the process of selecting the optimal model. Subsequently, we detail our findings, derived from analyses conducted at multiple levels and from diverse perspectives.

When applying the three coherence metric scores, a 17-topic model (M17) emerged as the most promising in explaining BuS (see Fig. 4). The score of C_v is the most used algorithm and shows a clear peak at 17 topics and flattens out to 21 topics with a steep drop afterward. The C_{npmi} metric is considered a more advanced algorithm for assessing coherence in a manner more aligned with human judgment. In this curve, we can see that there is a peak at 17 topics, with a drop in coherence scores after that. The C_{umass} works to some extent differently regarding document-level co-occurrence, asymmetric measure, conditional probability, order sensitivity, and corpus dependency, where lower scores are better. With C_{umass} , we can see that the model is optimal at a number of 18 topics. After inspection of the three coherence curves, there is a consensus that the optimal number of topics is 17. C_v and C_{npmi} have common peaks for 17 topics, and a steep drop can be observed in C_{umass} . Through LDAvis visualization, shortlisted models, particularly M17 (see Fig. 5), demonstrated well-distributed bubbles with human-interpretable word coherence, avoiding excessive overlap into clusters (Sievert and Shirley, 2014). These are semantically relevant (Andrzejewski et al., 2009). Overall, the properties confirm the statistical and qualitative superiority of the model while dividing the corpus into 17 research topics in BuS articles.

Insert Fig. 4 and Fig. 5

4.1 Topic Analysis

The analysis of the LDA result involved examining 17 topics to identify the predominant concepts conveyed by the top keywords. Each topic was then labeled based on its relevance to the domain and subjected to a screening process to ensure consistency within the dataset (see Table 4).

Insert Table 4

Surprisingly, we discovered a significant overlap between the 17 topics identified in our data and the 17 United Nations Sustainable Development Goals (SDGs) (UN, 2015), as shown in Table 5. While the correlation is not directly one-to-one, the connection between them is evident, which could be attributed to the inherent interconnectedness of sustainability issues. Alternatively, it might indicate the influence of the SDGs on the discourse surrounding BuS research. Nevertheless, this alignment underscores the critical areas that require attention to advance toward a more sustainable future. The coincidence of the number 17 in both our results and the SDGs prompts further investigation into *how this alignment underscores the relevance of BuS research to global development goals*.

Insert Table 5

4.2 Overall BuS Research Trend Analysis

From the number of articles published each year (refer to Fig. 6), the data shows a consistent upward trend in research output over the past four decades, indicating a growing interest and activity in BuS research. The overall trend has increased steadily over the years with fluctuations in growth rates. There is a notable increase in the number of articles published from the late 1990s onward, with a particularly sharp rise in the early 2000s. The most substantial growth occurred in recent years (around 2010

onward), indicating a heightened interest or focus on BuS-related research. This trend continues to show significant growth, with the number of articles surpassing 10,000 annually from 2020 onward.

Insert Fig. 6

Trend analysis revealed a salient observation: economic conditions, both local and global (i.e., GDP fluctuations), exert a significant influence on research trends, and policy announcements frequently shape the focus and direction of BuS research. Therefore, a comparative analysis was conducted on the number of published BuS research articles and global GDP fluctuations from 1980 to 2022 (see Fig. 7 and Table 6). The graph provides insights into the dynamic relationship between BuS research, economic variables, and public policy interventions, although with some lag or lead time explained by the typical duration of the publication process (i.e., from defining the research at the beginning and completing it with a published article). It highlights responses to announced policies related to BuS, which align with the conceptual study of Shrivastava et al. (2020), and additionally contextualizes these responses from a financial and economic perspective.

Insert Fig. 7

Insert Table 6

As shown in Fig. 7, BuS research output remained relatively low from 1980 to 1994. The slope of global GDP was much steeper than that of BuS research publications. Both curves remain on a steady trajectory across this period.

From 1995 to 2001, there was a moderate increase in BuS research following the establishment of the UN Agenda 21 action plan for sustainable development, alongside the subsequent Rio Declaration and other policies in 1992 (see Table 6, Policy Announced table, item 5). Economic growth was also steady during this period. Following the 1992 Rio Earth Summit and leading up to the 1997 Kyoto Protocol, there was an observed increase in business sustainability (BuS) research, coinciding with growing international attention to climate change policies and corporate environmental responsibilities. In 2000, the United Nations established the Millennium Development Goals (MDGs), which included eight international development goals covering various sustainability dimensions (Chopra and Mason, 2015). This may have contributed to a delayed exponential growth in BuS research output, where the slopes of both curves appear to be similar. However, the year 2001 marked the culmination of the protracted dot-com bubble crash, indicated as [A] in the figure, which corresponded to a subsequent delayed decrease in published articles after the economic downturn. This raises the question of *whether the economic downturn caused a dip in published BuS studies*. This type of observation will reoccur in subsequent episodes of economic disturbance.

The period from 2002 to 2007 had notable developments. From around 2005, coinciding with the enforcement of the Kyoto Protocol and subsequent climate change and renewable energy policies, the slope of research output started to follow the slope of global GDP. This trend would suggest that significant policy events are likely to stimulate increases in BuS research.

Looking at the years 2008 to 2012, a significant halt in global GDP growth can be observed in 2008 and 2009. The economic downturn that occurred is often referred to as the Great Recession, indicated as [B] and was triggered by a combination of factors that led to a financial crisis. Despite expectations that a crisis of this magnitude would stimulate more research into the economic dimensions of BuS, a notable multi-year decline in BuS publications can be observed starting from 2010, following a roughly two-year lag.

From 2013 to 2018, research on BuS underwent significant shifts. After a period of low interest, the slope of BuS research gradually increased, outpacing that of global GDP growth. However, the momentum may have been disrupted by the global trade slowdown in 2015, indicated as [C], which coincided with a notable flattening of BuS studies. From 2017, BuS research recovered, and the research output showed a steep exponential growth, far outpacing global GDP growth. During this period, significant policy initiatives were implemented, including China's Air Pollution Action Plan (2014), the United States Clean Power Plan (2014), the Paris Agreement (2015), the adoption of the UN Sustainable Development Goals (SDGs) (2015), and the EU Clean Energy Package (2017).

Transitioning to the 2019-2023 period, December 2019 marked the onset of the COVID-19 pandemic, indicated as [D], which caused a one-year decline in global GDP growth, followed by a rapid exponential recovery. The impact of this event on the trajectory of BuS research remains uncertain, although a minor stagnation can be observed during the pandemic. It should be noted that the COVID-19 pandemic was not fundamentally an economic crisis, and it raised questions about sustainability (Nicola et al., 2020). While the exponential growth pattern of research may continue, the extent to which it will be influenced by the pandemic is currently undetermined. Future research can examine the nature of the impact of COVID-19 on BuS.

In summary, our findings show the interplay between BuS research, economic conditions, and policy decisions. We observe that economic growth is a significant factor influencing the output of BuS research. An important question arises: *Is BuS itself a sustainable practice when it appears to be strongly influenced by GDP growth?* Furthermore, policy events act as drivers for increased awareness and research activity in BuS. Shifts in policy focus and research will be examined in the detailed trend analysis that follows.

4.3 Trend Analysis in BuS 17 Topics

Trend analysis was performed for each of the 17 topics, examining their initial appearance and the area under their respective curves (i.e., the mathematical integral of the shape of the curve). This analysis encompasses two primary approaches, visualized in three figures. Figure 8 illustrates the temporal evolution of the total number of articles per topic from 1980 to 2022. Figures 9a and 9b present the evolution of topic mixtures in a detrended and normalized format using a non-lagging Simple Moving Average (SMA). Specifically, Figure 9a depicts the yearly change in topic mixtures from 1980 to 2022 with trend components removed, while Figure 9b focuses on the detrended evolution of topic mixtures from 2000 to 2022. The application of an n -year period SMA aimed to mitigate noise and enhance the identification of underlying topic trends.

Fig. 8, 9a and 9b.

In this analysis, the topics were classified into two groups – *Major* and *Minor* – based on the observed size of the area under the curve. The following is the trend analysis for the two groups. The order of topics in each group reflects their respective levels of importance, as indicated by the surface area under the curve, beginning with topic 13.

4.3.1 Major Topics (Part 1)

Topic 13: Consumer Behavior

This topic shows a significantly higher proportion of publication volume compared to other topics. It first emerged in 1998 but experienced a decline during the 2001 dot-com crash. However, it gained momentum in 2005, aligning with the overall growth of BuS research. From 2012 onward, its growth became increasingly exponential. By 2018, it surpassed all other topics and became the predominant focus of BuS research. In 2022, this topic significantly outpaced other BuS topics, accounting for a 34% share in the mixture of research output topics because of its rapid rise. Unlike most other topics, it appears to have remained largely unaffected by economic events. The less pronounced slope observed during the COVID-19 pandemic may reflect a general decrease in overall BuS research output during that period. It is unclear whether policy events influence the shape of the curve.

The notable increase in publications might be attributed to several factors. For example, in the mid-1990s, a significant increase in global environmental awareness among consumers occurred. This shift toward prioritizing eco-friendly options prompted businesses to develop environmentally conscious marketing strategies. Policymakers were also prompted to enact collaborative policies, promoting sustainable production and consumption (Nyame-Asiamah and Kawalek, 2021). In addition, the emergence of younger generations, such as Millennials and Gen Z as major consumers, likely played a significant role. As these demographics gained purchasing power, businesses had to adapt to their preferences, including sustainability considerations (Reichheld et al., 2023). This multitude of factors has led businesses to realize that integrating sustainability into their practices is essential to remain relevant and competitive in the market (Nyame-Asiamah and Kawalek, 2021). However, it is still unclear *how policy announcements and shifts in focus by businesses influence the trajectory of sustainable consumption, and what the major underlying mechanisms are*. Important questions include: *What factors can contribute to the prominence of BuS research in consumer behavior, and how do these dynamics shape scholarly attention? To what extent does consumer demand serve as a primary driver motivating BuS studies?*

Topic 3: Governance and Policy

This topic first emerged in 1993 with a low number of initial publications but quickly gained significant interest within the research community, surpassing Topic 1 (resource-driven and competitive advantage) in 2002. An examination of its share in the research output initially revealed alignment with general BuS trends. However, its prominence began to diminish after 2013. Notably, this topic demonstrates resilience to economic fluctuations, showing increased interest during periods of economic turbulence. Overall, this topic exhibits signs of decline and underperformance within the research landscape.

Policy events have initially sparked interest in BuS studies; however, the significant increase in sustainability policy events from the mid-2000s does not appear to correspond with the development of this topic. This may be due to the frequency of

policy announcements, which makes implementation challenging in BuS (S. H. Lee and Zhou, 2022; H. Ahmad et al., 2024). For instance, there is an ongoing debate about *how the frequency of sustainability policy announcements impacts the feasibility of BuS implementations*, including considerations regarding top-down governmental or international approaches versus bottom-up initiatives led by local communities and grassroots movements (Sabatier, 1986). Additionally, inquiries persist regarding *the impact of frequent sustainability policy announcements* on enforcement and compliance effectiveness, particularly amid debates between proponents of stringent governmental enforcement and advocates of market-based mechanisms (Monios, 2023). Important questions arise regarding the influence of *the frequency of policy announcements on the effectiveness* of private sector initiatives in driving substantive change, given concerns about greenwashing and arguments for stronger corporate regulation (Ghitti et al., 2023; Puppim de Oliveira and Qian, 2023). Considering the global scope of sustainability issues, it is important to examine how the frequency of policy updates may affect companies' willingness to participate in international governance bodies such as the United Nations. This is particularly relevant in discussions on the subjects of national sovereignty and delegation of authority in the pursuit of common sustainability goals (Puppim de Oliveira and Qian, 2023).

Topic 12: Tourism Service Framework

This topic emerged in 1998, following a steep 10-year increase in global tourism spending, as shown in the International Tourism Receipts (ITR) (Casais, 2012). It also seems to be influenced by significant drops in airfare ticket prices throughout the 2000s (D. Thompson, 2013). Through the mid-1990s, the International Civil Aviation Organization (ICAO) initiated efforts to address environmental concerns such as noise pollution and emissions from aircraft engines (ICAO, 2024). Although not explicitly focused on sustainability, these efforts established the foundation for subsequent initiatives aimed at improving environmental sustainability in aviation. This topic remains popular and aligns with the general trend of BuS, displaying only moderate sensitivity to global economic events.

The increasing emphasis on sustainability in the tourism industry can be attributed to a growing responsiveness to consumer demand. Numerous players in the sector, including hotels, tour operators, and airlines, have initiated environmentally friendly practices such as accelerating the reduction of greenhouse gas emissions, conserving energy, and improving efficiency throughout the tourism supply chain (D. Scott et al., 2016). These efforts aim to reduce environmental impacts (Pratt et al., 2011). Despite advancements in adopting sustainable measures, many businesses have encountered challenges in effectively influencing tourist behavior (Miller et al., 2010). To overcome these challenges, empirical research is needed to *identify key drivers of sustainable tourism development and clarify how they can be leveraged to bring about substantial change in tourist behavior.*

Topic 1: Resource-Driven and Competitive Advantage

Despite surfacing as early as 1989, this topic did not achieve substantial prominence within the BuS research community. Its trajectory seems to have been strongly influenced by economic factors. The decline might further be attributed, in part, to the emergence of new topics, signaling a gradual expansion of research diversity within the field of BuS.

Initially, this topic captured attention for its exploration of leveraging internal resources for competitive advantage. However, its popularity has gradually faded over time due to the rise of new subjects within BuS research that reflect a broader diversification of research interests. For example, recent studies have highlighted the challenges faced by firms and their management teams in effectively allocating resources to address sustainability concerns without compromising business performance (Maniora, 2018; Denuwara et al., 2022). Managers often find it complex to balance sustainability efforts with maintaining competitiveness in their industries (Montiel and Delgado-Ceballos, 2013). This raises questions about *fully understanding the importance of sustainability and how organizations can develop competitive advantage through internal sustainability efforts.*

Topic 11: Environmental Management

This topic emerged through the discussions surrounding the Kyoto Protocol in 1997. It gained significant momentum in 2004, coinciding with the upcoming enforcement of the Kyoto Protocol regulations. By 2016, its growth experienced a remarkable surge, aligning with the implementation of the Paris Agreement, which has since garnered ratification by 196 parties, including 195 countries and the EU (UN, 2016). While exhibiting moderate susceptibility to economic disruptions, a notably sharp decline was evident during the COVID-19 pandemic. There is a noticeable correlation between research output on this topic and policy events, with its expansion surpassing the general trajectory of BuS research.

Despite its perceived importance regarding climate change and the overall management of pollution, this topic accounted for only an average share of 9.5% of BuS research output in 2022. However, this does not diminish the topic's importance; rather, it may be attributed to other research topics capturing more attention. Many businesses grapple with the ongoing challenge of striking a balance between investments in environmental sustainability and the absence of evident financial returns (Denuwara et al., 2022). This prompts the question: *How can businesses address the equilibrium between environmental sustainability investments and financial continuity to ensure sustainable development?*

Topic 6: Decision-Making Method

This topic started to surface in 1995 and exhibited steady growth in 2005, where it outpaced the general trend of BuS research. This topic demonstrated robust performance even during periods of economic turbulence, although its relationship with policy events remains unclear. In 2016, this topic experienced exponential growth, followed by a slowdown in 2019 and a contraction during and after the COVID-19 pandemic. However, this topic shows resilience against external factors, aligning with the overall trend of BuS research.

Several factors may contribute to this resilience. For instance, research on methods within this field typically requires extensive time and empirical support (Kitsios et al., 2020). Additionally, sustainable practices are often intertwined with risk mitigation

strategies. Decision-making methods in this domain anticipate and mitigate various risks, including regulatory changes and economic fluctuations, making them inherently adaptable and resilient (Štilić and Puška, 2023). Decision-making methods can be designed to anticipate and mitigate various risks, including regulatory changes and economic fluctuations, rendering them inherently adaptable and resilient. However, a question still arises regarding the integration of emerging technologies, such as artificial intelligence and big data analytics into decision-making methods within business sustainability research: *How can digital technologies effectively be incorporated to optimize resource allocation, risk assessment, and strategic planning processes?*

Topic 16: Financial Management

This topic surfaced in 1994, coinciding with the dot-com bubble, with some earlier scattered publications. Interest grew during this time but sharply declined after the 2001 dot-com crash. It saw a recovery in 2003 and became no longer influenced by economic events. It has since maintained a stable trajectory, mirroring the overall trend of BuS research output. However, it experienced a significant drop in output during and after the COVID-19 pandemic. This topic shows that it is strongly influenced by fiscal policy, which has a lasting impact on the economic environment, thus substantiating the focus of research in H. Liu et al. (2023). In addition, financial management strategies and evaluations in sustainability aim to create longevity and resilience, which may not directly correlate with economic fluctuations.

As efforts progress toward establishing standardized metrics and measurements within the financial dimension of sustainability, the assessment of BuS performance becomes increasingly pertinent (Edmans and Kacperczyk, 2022; Gleißner et al., 2022). Nevertheless, the findings of Denuwara et al. (2022) present an unexpected result: in the stock exchange listing of companies that are part of sustainability indices, sustainability efforts do not necessarily lead to visible financial benefits for most industries, with only the forest products sector exhibiting positive effects. Such outcomes tentatively raise a question about the fundamental nature of BuS: *Is BuS itself an inherently sustainable practice?*

Topic 4: Stakeholder Engagement

This topic first emerged in 1995 and experienced a period of relative inertia until 2005, after which it underwent exponential growth until 2009. Its trajectory was significantly affected by the economic downturn or Great Recession, but it recovered in 2012. However, it was then again impacted by the 2015 global trade slowdown but rebounded in 2018, only to be again affected by the COVID-19 pandemic. Overall, this topic's trajectory aligns with the general BuS research trend, exhibiting consistent performance during periods of economic stability.

The integration of stakeholder theory as a valuable perspective within this topic began in the late 20th century, gained considerable traction in the 1990s, and continued to evolve thereafter (Valentinov, 2023). Stakeholder theory facilitated an expanded view of business responsibility that went beyond a narrow focus on maximizing shareholder value to encompass broader impacts and obligations to various stakeholders, including employees, customers, and others (Camilleri, 2017). As awareness of the interconnectedness of business operations with social and environmental systems grew, stakeholders beyond shareholders became increasingly important in the field of BuS (Petersen and Lemke, 2015; Valentinov, 2023). However, given the recognition of stakeholders beyond shareholders, *how can businesses effectively balance the diverse needs of stakeholders across economic downturns, and what strategies can be used to identify and prioritize key stakeholders amid difficult economic circumstances?* This remains a challenging and complex issue.

Topic 14: Workplace

This topic emerged in 2004 and initially lagged behind until 2013, when it began to align with the general trend of BuS research. In contrast to many other topics, this topic remained relatively resilient to economic fluctuations but experienced a downturn in publication output during the COVID-19 pandemic. Workplace sustainability is closely linked to the social dimension of BuS, particularly focusing on employee well-being (Vila-Vázquez et al., 2018; H.-J. Choi, 2021; E. Jang and Kim, 2021). The delayed emergence of this topic can be attributed to the predominant focus of early BuS efforts on pressing environmental issues, such as pollution, climate change, and resource

depletion, which attracted more immediate attention (Luchsinger, 2009; Chang et al., 2017; Hoffman, 2017).

Moreover, the slow growth of this topic has been linked to the challenge of defining and measuring the social aspect of BuS initiatives (Colantonio, 2009). Historically, businesses have tended to prioritize financial performance, emphasizing profit maximization and shareholder value, often to the exclusion of social sustainability considerations (Ho, 2010; Lemke and Petersen, 2018). Many organizations initially viewed social initiatives as peripheral to their primary business objectives, resulting in a lack of empirical research and a dominance of conceptual studies in the early stages of research (Missimer and Mesquita, 2022).

However, as methodologies for measuring social impact have become more refined over time, the research landscape has gradually expanded (Mio et al., 2022; Saulick et al., 2023). In particular, the ongoing interest in workplace sustainability research is emphasized by its significant impact on organizational dynamics (Colantonio, 2009; M.-C. Yu et al., 2018). A central focus of research revolves around organizational ethics of care and the central role of leadership in the development of both employee well-being and sustainable behaviors in the workplace (Carmeli et al., 2017; S. Ji and Jan, 2020). This leaves a question regarding the following: *What types of leadership styles can most effectively amplify the impact on employee well-being and cultivate sustainable behaviors?*

In summary, analysis of topic mixtures from 1985 to 2022 reveals a trend toward convergence, indicating a shift toward a more balanced and multifaceted approach to BuS. However, it is noteworthy that Consumer Behavior (topic 13) exhibits exceptional growth, with a rapid publication volume increase and continued development over time. Furthermore, publication output in Governance and Policy (topic 3) has plateaued, signaling that researchers are losing interest in exploring this topic. This development leads to the question of *whether the governance aspect of BuS has become less important for shaping rules and policies over time.*

Moreover, in the overall BuS trend analysis, we have considered whether BuS is a sustainable practice when research output closely aligns with the growth of global GDP. During the analysis of the individual topics, a similar question can be raised. The topic of ‘consumer behaviour’ has experienced a remarkable surge and now constitutes 34.5% of research output in 2022. In contrast, efforts toward long-term sustainability, as seen in the topic of ‘environmental management’, green practices and effects, account for only 9.5% of research output. Topics, such as those that center around ‘policy and decision-making’, are becoming less popular. This development raises the following questions: *Are we observing a preference for competitiveness and economic growth over sustainability in BuS practices? Does BuS cater mainly to an uninformed consumer base that makes choices based on perceived sustainability and is susceptible to greenwashing tactics?* Important insights would potentially also be gained by an investigation into *who is funding BuS research*.

4.3.2 Minor Topics (Part 2)

In contrast, while several topics, namely Global Environmental Challenges (topic 8), Digital Community Network (topic 9), Small and Medium Enterprises (SME) (topic 7), Rural Livelihood (topic 2), and Educational Knowledge and Skill Development (topic 15), exhibit a relatively flat trend in Figure 6 with consistently low annual publication counts, topics 5, 10, and 17 display distinguishable evolution patterns. The following presents the trend analysis with observations for these three minor topics (in order of importance of number of publications and trend development).

Topic 10: Sustainable Supply Chain Management

This topic emerged in 1999 and maintained a relatively steady level of publication activity until 2012 when it experienced a significant increase. This increased activity may be associated with the implementation of trade tariffs in the 2010-2012 period, a time marked by increased global trade policy adjustments and protectionist measures. Additionally, various countries implemented tariffs to protect domestic industries and address global trade imbalances. Further growth may have been fueled by increasing attention to the circular economy, particularly since the mid-2010s. Despite moderate sensitivity to economic influences, the topic appears to be rapidly gaining momentum

as more research is needed on sustainable supply chains (von Berlepsch et al., 2024). We noticed that many managers find it very challenging to make BuS practices operational (e.g., Touboulic et al., 2014; Silvestre et al., 2020; Chand and Tarei, 2021; Lemke et al., 2024). The key questions raised are: *How to effectively integrate the BuS concept into end-to-end supply chain operations, and how to make supply chain processes more efficient through BuS initiatives while avoiding greenwashing?*

Topic 5: Ecosystem Management

This topic first emerged in 2000 and has gained significant momentum since 2005. While it is influenced by economic events, its development is likely driven more by policy requirements. It reached a peak in 2018, coinciding with a surge in electric vehicle (EV) sales (IEA, 2023). Concerns about water management in lithium and rare earth metal mining for EV battery and motor production may have contributed to this peak, in addition to a sharp rise in global water consumption (CDP, 2018). The evolutionary trajectory of this topic exhibits a degree of irregularity, making precise prediction of its future development challenging. It is necessary to consider *how businesses interact with the natural environment to ensure that their operations do not harm ecosystems, and how the EV industry measures and mitigates the long-term environmental impacts of its operations, particularly water usage in the extraction of lithium and rare earth metals.*

Topic 17: Global Economic Development

This topic began to emerge in 1992 but has remained relatively stagnant over time. Initially, it appeared to be influenced by economic events, although it showed resilience during the global trade slowdown of 2015, where its activity increased. Due to the low publication volume, there is no clear relationship to policy events visible. There appears to be a lack of in-depth studies on the factors driving this topic. The following research questions could address this gap: *What factors influence the resilience of global economic development initiatives in BuS across periods of economic slowdown? How can policies be effectively designed to promote sustained global economic growth?*

4.3.3 Major and Minor Topics Overview

In summary, our analysis reveals consistent output growth across most major topics, except for ‘governance and policy’ (topic 3), which exhibits stagnation alongside a diversification of publications into a wider range of perspectives, subtopics, and methodological approaches within this domain. Most topics are influenced by economic events, apart from three topics: ‘decision-making method’ (topic 6), ‘consumer behavior’ (topic 13), and ‘workplace’ (topic 14), which show exponential growth. The topic of ‘resource-driven and competitive advantage’ (topic 1) is strongly influenced by economic events, whereas ‘stakeholder engagement’ (topics 4), ‘environmental management’ (topic 11), and ‘tourism service framework’ (topic 12) exhibit a moderate sensitivity, and ‘governance and policy’ (topics 3) and ‘financial management’ (topic 16) demonstrate variable responses to economic events. In addition, topics of ‘environmental management’ (topic 11), ‘consumer behavior’ (topic 13), and ‘workplace’ (topic 14) display a similar steep exponential trajectory overall. Meanwhile, within the minor topics, ‘sustainable supply chain management’ (topic 10) is gaining momentum, while ‘ecosystem management’ (topic 5) displays irregular behavior, with others remaining relatively stable. We found it challenging to understand the complex relationship between policy announcements and the evolution of most topics. Future researchers are encouraged to *go deeper into the minor topics, as they require further development to provide comprehensive insights into the study of BuS from new perspectives.*

4.4 Defining the BuS Concept in Context

The findings of this research yield significant implications. Central to the BuS concept is the role of time (P. Bansal and DesJardine, 2014), characterized by complexity and encompassing “points, lines, surfaces, and volumes,” as described by Jönsson (2003). This temporal dimension poses a challenge to conventional, uniform definitions of BuS. Therefore, to address the limitations inherent in a singular definition, we synthesized insights from the top 5% (n=477) of articles most strongly associated with each topic, aiming to understand BuS within diverse contexts. Two additional rounds of filtering were conducted to exclude books and irrelevant studies. This iterative approach involved deep topic interpretation, coherence assessment, and the identification of representative documents, resulting in a comprehensive examination of 419 relevant

articles. These representative documents were then analyzed to determine the specific contexts in which each topic emerged, thereby validating their relevance. On this basis, a new definition of BuS was then developed based on the context of each topic after synthesizing narratives from the relevant articles. Table 7 shows the refined BuS definitions across different topics, providing a meaningful understanding within each context.

Insert Table 7

Table 7 demonstrates the contextual nature of the BuS concept, with definitions tailored to each specific topic. This contextual framework enables theory development by allowing for refined theoretical constructs that more accurately reflect real-world observations. Furthermore, our approach expands upon existing theories and integrates multidisciplinary perspectives, thus enriching the theoretical landscape of BuS.

4.5 Topic Grouping – Classification and New Conceptual Model Development

We developed a classification matrix that contains three types of criteria when grouping the topics from the optimal model of LDA results:

- *Primary focus*: policy and governance, resource management, operational management, and market interactions.
- *Scale of impact*: global (macro level), organizational level, and local (community level).
- *Type of sustainability*: environmental sustainability, economic sustainability, and social sustainability.

According to this classification matrix designed in LDA-HSIM, we grouped 17 topics into 7 categories, after analyzing each topic against these three criteria (see Table 8)

Insert Table 8

The table is organized by topic number and reflects the outcome of combining three classification criteria. This approach allowed us to identify relevant categories, which are systematically arranged from macro (starting with ‘Global Policy and Economic Governance’) to micro levels (ending with ‘Rural Sustainable Development’). In the following sections, we will explore these in detail, providing insights into their interconnections and significance with the broader context of our study.

Global Policy and Economic Governance: This category addresses macro-level economic policies, governance structures, and institutional frameworks that shape sustainable business practices. The focus is on how economic systems and policies can be designed and implemented to support sustainability.

T3: Focuses on institutional change, corporate regulation alignment with societal expectations, and democratic policy planning

T16: Addresses government policies, fiscal policies, financial stability, and market sustainability

T17: Covers economic growth, efficiency, industry specialization, labor flow, and family capital

Global Environmental Management: This category focuses on environmental challenges and management at a global scale, including ecosystem preservation, resource conservation, and environmental regulations.

T5: Focuses on ecosystem management, resource conservation, and environmental protection

T8: Addresses environmental impact reduction, transition to renewable energy, and climate change

T11: Covers institutional pressures, environmental regulations, and industry standards

Strategic Resource and Supply Chain Management: This category deals with the management of both internal and external resources, including supply chain optimization and resource-based competitive advantages.

T1: Focuses on leveraging internal resources, and capabilities for competitive advantage

T10: Addresses supply chain resilience, supplier management, and circular economy principles

Organizational Leadership and Development: This category focuses on internal organizational processes, leadership development, and organizational learning for sustainability.

T7: Focuses on SME management, internal audit, and implementation performance

T14: Addresses organizational leadership, workplace culture, and employee engagement

T15: Covers educational knowledge, skills development, and sustainable business practices learning

Market & Community Engagement: This category addresses market interactions, consumer behavior, and community engagement through various channels including digital platforms.

T9: Focuses on digital community building, knowledge sharing, and social interaction

T12: Addresses tourism industry practices, competitive strategies, and sustainable tourism

T13: Covers consumer behavior, environmental attitudes, and sustainable consumption

Stakeholder Governance & Decision-Making: This category focuses on decision-making processes and stakeholder governance systems for sustainability.

T4: Focuses on stakeholder management, value creation, and sustainable objectives

T6: Addresses decision-making methods, evaluation techniques, and sustainability assessment

Rural Sustainable Development: This category addresses sustainable development at the local level, particularly in rural contexts.

T2: Focuses on rural livelihood, organic farming, food waste reduction, and rural entrepreneurship

Based on the above BuS categories, we propose the following BuS Context Model (Fig. 10):

Insert Fig. 10

In the BuS Context Model, we conducted the flow through three main types of integration:

- *Vertical integration:* Connecting global to local scales, ensuring high-level strategies translate into local actions while addressing regional needs.
- *Horizontal integration:* Promoting collaboration across functional areas like marketing, operations, and finance to improve decision-making, efficiency, and resource sharing.
- *Multi-level integration:* Managing interactions across different impact scales to address system complexities, optimize processes, reduce conflicts, and create a resilient framework for strategic initiatives and their cascading effects throughout the organization.

4.6 Theory Used and Gap Analysis

This study identified 150 theories from various disciplines contributing to the understanding of the BuS concept. Table 9 provides an overview in order of popularity, shown in the ‘article count’ column.

Insert Table 9

The theories listed in Table 9 were extracted from the data pool and consolidated. The consolidation process involved identifying and merging theories that, despite having different names, essentially refer to the same underlying principles or ideas. This approach ensures a more concise and coherent presentation of the theoretical landscape. We standardized them into commonly accepted theory names and subjected them to an in-depth examination process. Through this analytical process, we recognized an increasing trend in the use of theories in BuS research over time, as shown in Fig. 11.

Insert Fig. 11

Overall, there are fluctuations in the upward trend in certain periods. These fluctuations are influenced by factors like changing research priorities, emerging trends (such as academic topicality, social trends, and industry trends), and shifts in academic discourse. Certain theories, such as Stakeholder Theory and Resource-based Theory, show a consistent upward trend, indicating their widespread adoption over time. Other theories, such as Institutional Theory, Network Theory, and Agency Theory, experience fluctuations but maintain a stable presence. Additionally, new theories, such as Signaling Theory, Prospect Theory, and Choice Theory have emerged and gained relevance in recent years.

We conducted a thorough analysis of theoretical knowledge gaps in the collection of text documents that are used for machine training and analysis (corpus), regarding the BuS concept within each topic. In addition, the top 20 theories were further analyzed according to their frequency in the corpus, considering how they were applied in BuS research (refer to Table 10).

Insert Table 10

The table presents a heatmap displaying the intersections between theories and topics. It indicates the intensity of theory application for each topic, as well as the discipline where the theories are typically based. Theoretical perspectives shape the understanding of the BuS concept, providing very specific views. This theoretical contribution will assist future researchers in selecting new lenses through which to explore BuS, seeing alternative aspects of the concept, and enabling them to make informed choices for their own investigations.

5 Discussion and Implications

This study develops a framework for exploring Business Sustainability (BuS) using a three-phase research design guided by specific research questions. Our approach generated contextual definitions of BuS that offer insights across various domains, yet our analysis reveals a gap in the existing literature: the absence of a unifying conceptualization that fully encapsulates BuS. This study, therefore, highlights the critical need for a novel theoretical framework in the field. The following discussion section will elaborate on the significant theoretical, managerial, and policy implications arising from this multi-layered research.

5.1 Theoretical Implications

Although existing theories offer valuable insights, and the four foundational theories remain relevant, they prove insufficient in fully addressing contemporary sustainability challenges. Addressing the complexities of modern business environments and sustainability issues requires a more adaptable, dynamic, and inclusive theoretical framework. Recognizing and acknowledging the interplay between contextual circumstances and commonalities in definitions, we propose an integrated framework that bridges the gap between universal and contextual perspectives:

Insert Fig. 12

The proposed unified framework (Fig. 12) establishes a core set of universal sustainability principles that can guide businesses across different contexts while incorporating mechanisms for context-specific adaptation. The BuS Unified Framework is designed to enhance future researchers' appreciation of the complexity inherent in the BuS concept and to guide them in their exploration. This framework explains the increasing adoption of sustainability practices by businesses, often as a response to institutional pressures and evolving societal norms, by reconciling universal and contextual perspectives. On the one hand, it recognizes both broad societal influences and their varied expressions in different institutional settings. On the other, it acknowledges that while overarching social expectations exist, their impact can differ significantly across diverse organizational contexts. This framework is proposed as an open-source model, intended for ongoing development and adaptation by the research community. Consequently, the category names were deliberately broad to encompass the diverse topics within each category, yet sufficiently specific to maintain clear distinctions between different facets of BuS research. On this basis, we offer a foundational definition that is both adaptable to varying business settings and cohesive in its core principles. Our integrated definition of BuS is as follows:

Business Sustainability is a contextual concept that is influenced by external factors and internal capabilities and is shaped by the strategic core of the business, reflected in organizational management that integrates governance systems, global perspectives, innovation drivers, resource management, market dynamics, operational context, and local development. It aims to ensure long-term viability and positive impact by balancing economic prosperity, environmental stewardship, and social responsibility while adapting to changing global and local conditions.

To aid theory development, we propose the following future research agenda, organized around the major and minor BuS topics (see Tables 11,12 and 13).

Insert Tables 11,12 and 13

By identifying gaps and opportunities for future research, our work reveals paths for studying underexplored dimensions of BuS and strengthening interdisciplinary connections. Therefore, we suggest possible theoretical lenses to investigate research questions from alternative perspectives. This forward-thinking perspective may inspire theory builders to thoroughly explore the complexities of BuS. It promotes conceptual clarity and practical applications in both scholarly and practical scenarios. Furthermore, we also propose potential theoretical perspectives for the main and three minor topics. Given the lack of attention devoted to the top three minor BuS topics, we urge future researchers to investigate this area further to address the gaps in the BuS domain.

5.2 Managerial Implications

The findings of this study could help managers better understand BuS and directly guide them in incorporating sustainability into their business strategy and long-term business planning. The proposed framework offers a practical and actionable approach to business sustainability, utilizing clear categories such as Sustainable Supply Chain and SME Innovation to guide different sectors in implementing sustainable practices across multiple areas. This makes it easier for managers in different industries to apply the BuS Unified Framework. This enhanced understanding is crucial for ensuring organizational viability and relevance in a future increasingly prioritizing sustainability. The Unified BuS Framework adopts a hybrid approach, advocating for the utilization of universal standards as a foundational element, while emphasizing their adaptation to specific contextual requirements. The universal standardization approach seeks to prevent unethical behavior through common guidelines, while the contextualization approach focuses on meaningful actions tailored to specific circumstances. For instance, a company might adhere to GRI reporting guidelines while focusing on sustainability issues most pertinent to their industry, such as water resource management in agriculture or supply chain transparency in manufacturing. The framework seeks to incorporate dynamic capabilities, enabling proactive responses to emerging

sustainability challenges and facilitating sustainability performance measurement and reporting in a globally consistent, yet locally relevant manner. Comprehending this duality of universal and contextual perspectives empowers businesses and stakeholders to design and implement sustainability initiatives that are demonstrably relevant, meaningful, and effective.

The alignment of business strategies with sustainability goals, as noted in this article, has the potential to lead to long-term profitability. Prioritizing long-term sustainability goals over short-term gains can even help in defining organizational purpose in their specific setting, which is an area that many businesses are struggling with at present (George et al., 2021). Furthermore, managers can anticipate changes in environmental regulations and societal expectations with this enhanced understanding. This understanding can help anticipate and prepare for future sustainability challenges and regulations embedded in the ‘governance and policy’ research topic. Moreover, it connects directly with the 17 topics generated by LDA topic modeling that relate to the established SDGs of the UN. On the one hand, this positions companies well to comply with evolving sustainability regulations. On the other hand, businesses will be better equipped to mitigate environmental, social, and governance risks, as highlighted in the ‘decision-making method’ research topic. Considering environmental and social risks alongside traditional business risks when making strategic decisions also means reassessing current risk management practices. This is particularly vital in current disruptive business times (e.g., Lemke et al., 2024).

Recognizing the importance and makeup of BuS in ‘consumer behavior’ – one of the rapidly growing research topics – managers should allocate resources to develop sustainable products. Capitalizing on new market opportunities with a sustainable product portfolio is therefore a critical aspect for managers to work on. We recommend conducting a product lifecycle assessment to identify areas for sustainability improvements in the current market offerings. This can lead to innovative solutions that not only address sustainability concerns but also create new revenue streams. By extension, the commitment to sustainability can improve long-term value creation and differentiated market positioning. The improved company reputation may not only attract consumers but also other stakeholders, such as investors, new employees,

suppliers, and business partners. As highlighted in the ‘resource-driven and competitive advantage’ research topic, managers can develop these competitive, sustainable offerings in a purposeful and resource-efficient manner, potentially leading to cost savings while reducing environmental impact, thereby meeting both business and sustainability objectives.

Transparent reporting of the company sustainability initiatives and sustainability metrics will help to establish and maintain an open dialogue with stakeholders. This can lead to improved and strengthened stakeholder relationships, which is further emphasized by the fact that ‘stakeholder engagement’ is one of the major topics identified by machine learning. Stakeholders can also be found in the organization. For instance, the ‘workplace’ research topic shows that BuS may promote a sustainable business culture through leadership efforts and management style, which in turn can positively influence employee morale and retention. Thus, managers should involve employees at all levels in sustainability initiatives so that sustainability principles will be embedded across all business functions. This can include training programs, incentive structures that reward sustainable practices, and creating channels for employees to contribute ideas for improving the company sustainability performance. This leaves vital lessons for corporate leadership teams and human resource departments, as employees are often motivated and committed when their employer is contributing positively to society and the environment.

In summary, the implications of our study can directly lead to greater resilience of a company when reflecting on and improving, for instance, their long-term strategic planning, regulatory compliance, innovation and adaptability, stakeholder trust, risk mitigation, resource efficiency, among other factors. Looking outside the organization, the heightened demand for sustainability offerings has an impact on supply chain management. Although ‘sustainable supply chain management’ currently represents a minor topic in BuS, a sustainability focus may encourage managers to improve their supply chain operations and to select suppliers that adhere to ethical and environmental standards. This point was recently made by Gorton et al. (2024) and will contribute to overall supply chain resilience.

5.3 Policy Implications

A refined understanding of BuS, as presented in this study, also offers implications for policymakers. Insights into the volume of published research pertaining to individual SDGs enables policymakers to identify areas of robust knowledge and critical gaps in scholarly attention. Our proposed research agenda may serve to develop and disseminate a comprehensive national research guideline that outlines specific research priorities for each SDG, updated annually based on our latest BuS analysis. Launching a government-funded initiative that pairs academic institutions with private sector companies and NGOs becomes an option to conduct collaborative research on underrepresented SDGs. In this context, Table 5 can function as a framework for translating SDG priorities into actionable BuS research areas. For instance, while SDG 8 (Decent Work and Economic Growth) has been extensively addressed, as reflected in Topics 1, 7, 9, and 14 (90% coverage), SDG 3 (Good Health and Well-being), explored through Topics 2 and 12 (50%), shows that more work needs to be done. This information can guide policymakers in prioritizing resources, developing informed policies, and tracking progress toward SDGs. Furthermore, this understanding can facilitate the alignment of national policies with global sustainability objectives, strengthen intersectoral collaborations, and stimulate research in underrepresented areas to ensure a more balanced and comprehensive approach to SDGs attainment. For instance, establishing a dedicated research grant program for SDG 3, with a focus on under-researched areas identified by our analyses, would directly advance this sustainability goal. Thus, a deeper comprehension of BuS research trends will also enable policymakers to identify areas necessitating regulatory reform and to optimize the frequency of policy announcements. Although the ‘ecosystem management’ research topic remains a comparatively minor research topic according to our machine learning analysis, updated policy interventions in this area hold considerable potential to lead to more sustainable business practices across diverse industries.

As an outcome of making more informed decisions, policymakers can formulate strategies that promote long-term economic growth while protecting resources and encouraging global collaborations, as emphasized in ‘global economic development’, though a minor topic. Based on this foundation, policymakers may promote

partnerships between businesses and other stakeholders to work together and advance sustainability goals. This commitment could be reflected in updated sustainability principles in public procurement policies, which could encourage businesses to adopt sustainability strategies. The encouragement of innovation in sustainable technologies and practices can help companies stay competitive in a global market that is increasingly focused on sustainability. In turn, policies that encourage sustainable business practices can lead to greater economic stability and resilience, where resources are more efficiently used, contributing to the fulfillment of SDGs, as covered in the ‘global economic development’ research topic. When policymakers drive a shift toward investment in sustainable infrastructure, economic growth is balanced with environmental preservation and social well-being. The wider BuS understanding of this paper may also guide policymakers in creating public awareness and education. This is evident in the ‘governance and policy’ research topic, and here, an increased focus on educational campaigns about the importance of BuS can contribute to a culture of sustainability within the broader society.

5.4 Contributions

This study offers a holistic understanding of the trends, thematic developments, and theoretical underpinnings in the BuS literature over the past four decades by employing four methodological approaches: LDA topic modeling, Narrative Synthesis, LDA-HSIM, and Text Extraction. This mixed-methods research design (quantitative and qualitative) allowed us to triangulate findings, enhancing the validity and reliability of our results, and providing a robust analysis that contributes to both academic discourse and practical applications within the field of BuS. A key methodological contribution is the development of LDA-HSIM, a novel method designed to bridge the gap between statistical topic modeling and conceptual model development. The integration of these established methods into a cohesive framework represents a solid contribution to research methodology, particularly in the context of literature analysis and conceptual framework development. Analogous to the evolution of mixed-methods approaches in bridging quantitative and qualitative research (Creswell, 2009), LDA-HSIM offers a systematic way to transform statistical topic modeling results into meaningful conceptual structures while maintaining methodological rigor. Furthermore, this study particularly demonstrates the efficacy of machine learning methods in systematic

literature reviews, effectively addressing the limitations inherent in traditional literature reviews.

Through the rigorous systematic review using our mixed-methods approach, we provide a comprehensive overview of BuS research over time and refine the understanding of BuS within each research topic. The outcome provides valuable insights that contribute to the understanding of BuS among theorists, practitioners, and policymakers. By employing data-driven techniques, we promote inclusivity in uncovering hidden topics and recognizing the multifaceted nature of academic research in BuS. Moreover, our study contributes to future research by suggesting the potential of interdisciplinary approaches and innovative methodologies in advancing BuS knowledge.

To this end, our study reveals numerous future research avenues. These include a detailed examination of the application of various theories within each topic, as well as a continued exploration of gaps and overlooked areas. Moreover, researchers can adopt new perspectives to gain additional insights that could potentially lead to the development of new paradigms and models in the BuS field.

From the trend analysis across the research topics, there are potential linkages with macro-level factors, such as changes in GDP and public policy related to sustainability. While we advanced the definitions of BuS within varying research topics, the proposed framework can serve as a fundamental tool for achieving sustainable business practices and innovation. It not only encourages thorough analysis but also guides future researchers in their exploration of underdeveloped areas within BuS.

5.5 Limitations

Although this study pioneers the use of big data analytics and machine learning methods to advance BuS research, certain limitations warrant acknowledgement. The quality and quantity of available data can impact the accuracy and reliability of our study. To mitigate this limitation, we followed established practices (Becker and Jaakkola, 2020;

Kranzbühler et al., 2020) by consulting reputable online literature databases. This generated a comprehensive literature pool spanning various knowledge domains. While our analysis focused on peer-reviewed articles to ensure high-quality scholarship that better reflects key dialogues within the field (Delbufalo and Wilding, 2012), we recognize that this criterion may have resulted in the exclusion of potentially valuable, though non-peer reviewed literature. Specifically, we excluded certain non-scientific written works found through Google Scholar, due to their failure to meet our stringent standards of reliability, accessibility, and traceability. This selective approach, while ensuring academic rigor, potentially limits the breadth of perspectives in our study. Similarly, the machine learning method can have difficulties in handling multi-language studies. This could result in the misinterpretation of data. In our research, we exclusively worked with scientific articles published in English because this is the contemporary international medium of academic discourse. We hope that colleagues who are more competent in languages will complement our study by examining the literature on BuS, which exists in other languages and is less represented in English language academic outlets. Such multi-language investigation would require the creation of multilingual LDA dictionaries and exclusion tables in different languages for the machine to work with. It also requires cross-language semantic understanding so that language-specific meaning (e.g., jargon, idiomatic expressions that may not have direct translations) can be understood and reliably processed.

As with all machine learning studies, bias could be introduced by training data, which could misrepresent the literature field, leading to skewed results and conclusions. We addressed this potential bias by carefully compiling our dataset, ensuring the inclusion of diverse and representative sources from different journals and research subfields, and by applying preprocessing steps such as text normalization, stop-word removal, stemming, and removing non-contextual parts of speech to mitigate information bias and reduce noise. With these measures, the model focuses on key, meaningful terms, improving the coherence and validity of the generated topics. In our study, we generated thousands of models, which can be difficult to interpret and making it challenging to understand the reasoning behind the classifications. Despite using various evaluation metrics to ensure quality results, the significance and interpretation of the topics generated remain context-dependent. To counter this potential bias, we chose model

M17 as it best represents the data according to perplexity and topic coherence. This is a standard approach to ensure high-quality data extraction from the corpus. As an outcome, we can explain observations and developments in the data by drawing on historical macro-environmental trends. Moreover, we observed a significant overlap between the identified topics and the United Nations Sustainable Development Goals (SDGs). Still, we recognize this potential limitation: alternative parameter choices and settings exist, which could have led to a different model being selected.

Regarding the models, machine learning models can sometimes fit too closely to the training data. This phenomenon is termed ‘overfitting’, which leads to poor generalization on unseen data. To mitigate this limitation, we refined the dictionary to reduce noise and eliminate words that could distort the model and tuned the LDA model to achieve optimal performance metrics. Some machine learning algorithms may miss nuances or context. For this reason, we applied our domain knowledge (i.e., the authors) and academic experts, which represents the qualitative aspect of our study. The combination of quantitative and qualitative methods ensured the validity of the results, which brings us to the conclusions of this article.

6 Conclusions

This study explores the historical research landscape of BuS, analyzing an extensive database spanning 1960 to 2022. The dataset includes 92,311 articles focused on BuS, sourced from 11,579 journals, which were selected for in-depth analysis across 17 identified research topics. In these topics, we partially highlight the ethical components that will contribute to improved ethical decision-making in business. Moreover, this study traces the evolution of theories used in BuS research since the 1980s, when the concept began to gain popularity.

During our extensive research, we discovered a correlation between BuS research and economic conditions, including GDP fluctuations and policy implementation. These economic factors significantly shape the direction and emphasis of sustainability research within the business community. As a result, we identified several research gaps,

formulated key research questions for future investigations, and highlighted potential avenues to explore the hidden dimensions of BuS. Our approach may encourage the use of different theoretical lenses, facilitating interdisciplinary connections and furthering our understanding of the BuS concept.

While universal definitions of BuS offer a valuable broad framework, they inherently lack contextual specificity. This study presents contextually nuanced BuS definitions, derived through a rigorous analytical process. Given the contextual nature of BuS, these definitions serve as foundational elements within the field, with significant strategic implications for managers and policymakers. Researchers seeking to develop a comprehensive understanding of BuS across diverse contexts are therefore encouraged to utilize these contextualized definitions. Theoretical insights can then be more readily integrated into practical applications. These definitions are tailored to the specific settings (i.e., the 17 research topics) and thus carry the depth of meaning that a universal definition is unable to provide.

The tension between universal and contextual approaches to BuS reflects the complex nature of sustainability challenges in a globalized yet diverse business environment. By proposing an integrative framework grounded in fundamental theories, this study bridges the gap between these perspectives. It contributes to providing a more holistic and actionable framework for BuS, facilitating strategies that are both universally aligned and contextually tailored. Our literature review confirms that BuS is a dynamic construct, continuously evolving in response to shifting societal trends, environmental conditions, and diverse stakeholder expectations. The dynamic nature of this concept necessitates regular reassessment. We strongly recommend that researchers conduct thorough examinations of the BuS construct at consistent intervals, such as every decade. This study, conducted at this juncture, is subject to the inherent limitations of current technological capabilities. We acknowledge the ongoing evolution of machine learning technologies. Thus, we encourage future researchers to leverage advancements in machine learning technologies to develop more sophisticated solutions to the methodological challenges encountered in this study and in future research. This regular systematic literature update will ensure that the theoretical framework remains current and relevant, facilitating ongoing advancements in the field. By maintaining an up-to-

date understanding of BuS, scholars can better address emerging challenges and opportunities in sustainable business practices. To this end, we propose the BuS Unified Framework as an open-source resource, which aims to facilitate ongoing expansion and refinement, guiding future theory development and scholarly exploration within the field of BuS.

Overall, we advocate for businesses, as proposed by Elkington (2018), to strive not only to be ‘the best in the world’ but also to be ‘the best for the world.’ We hope that our paper contributes toward achieving this goal.

7 Appendix

A. Fundamental Mechanism and Applications of LDA (section 3.3)

LDA is a probabilistic topic modeling technique designed to discover latent topics within a corpus, making it well-suited for identifying and extracting implicit topics without relying on predetermined categories (Blei et al., 2003; Blei, 2012a). Employing statistical modeling, LDA separates distinct topics from a large volume of textual data. Through the grouping of texts into discrete categories based on their inherent topics, LDA facilitates the identification of central topics within the data, revealing underlying patterns and trends (Bellaouar et al., 2021), which the researcher then contextualizes.

In statistical natural language processing, a prevalent method for quantifying the contributions of distinct topics within a document involves treating each topic as a probability distribution over words. This approach conceptualizes a document as a probabilistic fusion of these foundational topics. Specifically, if **T topics** are considered, the probability of the i^{th} word in a given document can be calculated from the formula: $P_{(w_i)} = \sum_{j=1}^T (P_{w_i|z_i=j}) \cdot P(z_i = j)$ with the latent variable z_i signifying the topic from which the i^{th} word originates and where the probability of the word w_i under the j^{th} topic is given by $P(w_i|z_i = j)$. The term $P(z_i = j)$ signifies the likelihood of selecting a word from topic j within a given document. Importantly, the probability of a word may differ across documents, reflecting the variability in topic prevalence. $P(z)$ encapsulates the prevalence of these distinct topics within a given document, shaping the overarching theme it embodies. On the other hand, $P(w|z)$ underscores the salient words closely tied to a specific topic, delineating its significance.

B. LDA Topic Modeling Process Overview (section 3.3.1)

Step 1 Pre-processing focuses on dataset preparation. This step includes removing non-contextual parts of speech. Using the **SpaCy** Python package, our text refinement process includes eliminating Parts of Speech (POS) that do not contribute significantly to the context, such as adverbs, pronouns, coordinating conjunctions, particles, determiners, adpositions (i.e., prepositions and postpositions), numerals, symbols, and punctuation. We improved the filtering of standard stop words such as ‘the,’ ‘and,’ ‘is,’

and ‘in,’ which are enhanced by filtering out influential high-frequency terms like ‘author’ and ‘study’ (refer to Table 1). Lemmatization is then performed to ensure consistency and standardization of the vocabulary. Different forms of a word such as ‘studies’, ‘studying’, and ‘studied’ were lemmatized to the stem word ‘study’, which improves the model effectiveness.

To enhance the accuracy of the subsequent analyses, we employ a custom filter to augment the standard stop words dictionary, targeting influential high-frequency terms (e.g., ‘author,’ ‘study,’ ‘analysis,’ ‘finding,’), following the insights of Cancho and Solé (2001). This custom filter aims to mitigate potential adverse effects on topic generation. Following this clean-up, we perform lemmatization to reduce words to their base or root form, ensuring consistency in the dataset and standardizing the vocabulary. We set a dictionary cutoff value for words that occurred only in a highly limited subset of papers (cutoff = 4). The final output of this phase is a comprehensive dictionary (see Table 1), which is essential for the subsequent generation of the LDA models and their validation.

Insert Table 1

Step 2 Model Generation involves the creation of numerous LDA models aimed at classifying text into different topics by exploring different parameters or variations to capture different themes within the dataset. We generated thousands of models classifying the corpus into different topics. Each of the models has different hyperparameters (such as number of passes, iterations, alpha and beta) to find an optimal fit for the document terms across a range of topics. The goal is to ensure that the generated topics do not overlap and maintain a sufficient separation from each other in the topic space. An optimal configuration can be achieved that effectively captures the underlying structure and themes within the textual data by tuning the parameters and dictionary.

Step 3 Model Evaluation aims to select the optimal LDA model from the pool of generated models by employing evaluation metrics tailored to determine the model that best fits the given dataset. In this study, two primary quantitative metrics, **Perplexity** and **Topic Coherence**, were utilized to gain further insights into the sensitivity of the LDA model to parameter changes, and to verify the stability of the results. **Perplexity** serves as a measure of how surprised a model is by new data and assesses the model's predictive performance on held-out data, with lower values indicating superior predictive capabilities (Asmussen and Møller, 2019). **Topic Coherence** serves as a measure for evaluating the usefulness and effectiveness of topic modeling algorithms and measures the semantic similarity between high probability words within topics, with higher coherence values suggesting more interpretable and semantically consistent topics (Newman et al., 2011; O'Callaghan et al., 2015; Syed and Spruit, 2017). Topic coherence evaluation metrics in this study include three coherence metrics: normalized pointwise mutual Information (**C_{npmi}**), unsupervised mass (**C_{umass}**), and coherence value (**C_v**). As a rule, it is best to select a model that exhibits a high initial peak followed by steep drops in the coherence curve as it indicates well-separated and meaningful topics (Zvornicanin, 2021). Using insights from the coherence scores, and perplexity values, a subset of candidate models – such as the models with K numbers of 10, 12, 17, and 21 (M10, M12, M17 and M21) – are selectively shortlisted for further human interpretability analysis and detailed examination of segmentation quality.

Step 4 Text Categorization is the inverse process, where an LDA model is used to classify the corpus texts according to the topic constitution. In this study, M17 emerged as the best model, selected based on rigorous evaluation metrics that include coherence scores and perplexity, ensuring its ideal alignment with our dataset. Using this model, all texts were systematically classified into relevant topics based on the inferred probabilities derived from the LDA framework. Domain expertise played a key role during this process, facilitating the interpretation and validation of the resulting topics in accordance with the subject matter.

C. Model Training, Tuning (optimization), and Validation (details) (section 3.3.3)

We varied the number of topics (K) from 10 to 25, incrementing by one for each iteration to evaluate the impact on model performance. We chose 10 topics as the lower bound for detailed segmentation, following the guideline by Mimno et al. (2011), and 25 as the upper limit, based on observation of the perplexity curve evolution. We found that the perplexity and coherence scores plateaued beyond 24 topics. This exploration helped us determine the optimal number of topic range.

The alpha and beta parameters in LDA control the diversity of topics per document and the density of words per topic, respectively. We found that using a ‘symmetric’ distribution for both gave the best results. After optimizing the Gibbs parameters and refining the dictionary, we determined the optimal number of topics (K) using perplexity, coherence scores, and visual inspection with LDAvis. The choice of alpha and beta values significantly affects topic diversity and word distribution. Validation techniques were used for model evaluation, focusing on coherence, interpretability, and relevance, leading to the final adjustments, which are summarized in Table 2.

Insert Table 2

Table 2 shows the inference parameters used to estimate the underlying structure of the data, particularly in topic modeling. These parameters, such as the number of topics (K), *Gibbs Sampling* iterations (50), and passes (1000), significantly affect the interpretability and granularity of the resulting topics. *Dirichlet Parameters α and β* influence the distribution of topics across documents and the distribution of words across topics, respectively. Both were set to ‘symmetric’, assuming a uniform prior belief, with values typically set to 1.0 divided by the number of topics (K).

This study used two measurements to evaluate the quality of LDA models: **Intra-topic Coherence** and **Interpretability Assessment**. Coherence ensures clear thematic clusters, while interpretability checks for relevance.

D. Narrative Synthesis – Sampling Strategy (embedded in 3.4.1)

The process of narrative synthesis involves exploring, interpreting, and integrating findings from different studies. Following the systematic approach outlined by Popay et al. (2006), this study consists of three steps (Thomas and Harden, 2008; Lisy and Porritt, 2016). Firstly, articles closely aligned with the identified topic were selected, specifically the top 5% of articles with the highest probability scores for each topic (see Table 3). Each article can belong to different topics, so it is essential to choose those with the highest matching scores within each of their respective topics.

Insert Table 3

Selecting the top 5% effectively captures the core themes of each topic, even though the matching scores may vary from topic to topic. To mitigate the risk of a narrow perspective by selecting only 5% instead of a higher percentage, we also screened the entire database to ensure that we did not miss any article that is significant in the relevant topic. The overall significance of each topic was derived from reviewing all data, not just the top 5%. However, the synthesis work focused primarily on this top 5% to ensure a high level of relevance and clarity in representing each topic. This focused selection allowed for a detailed examination of the most relevant contributions in each topic after employing domain knowledge to filter out irrelevant articles. Secondly, chosen articles were analyzed to identify facilitators (i.e., instances of BuS concept application) and barriers (i.e., similar, or unclear applications). Lastly, connections between articles in each topic were examined and synthesized to offer a detailed understanding. This approach ensures that the narrative synthesis not only combines existing knowledge but also provides novel insights, enhancing the overall understanding of BuS within the specified thematic context.

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9 Figures

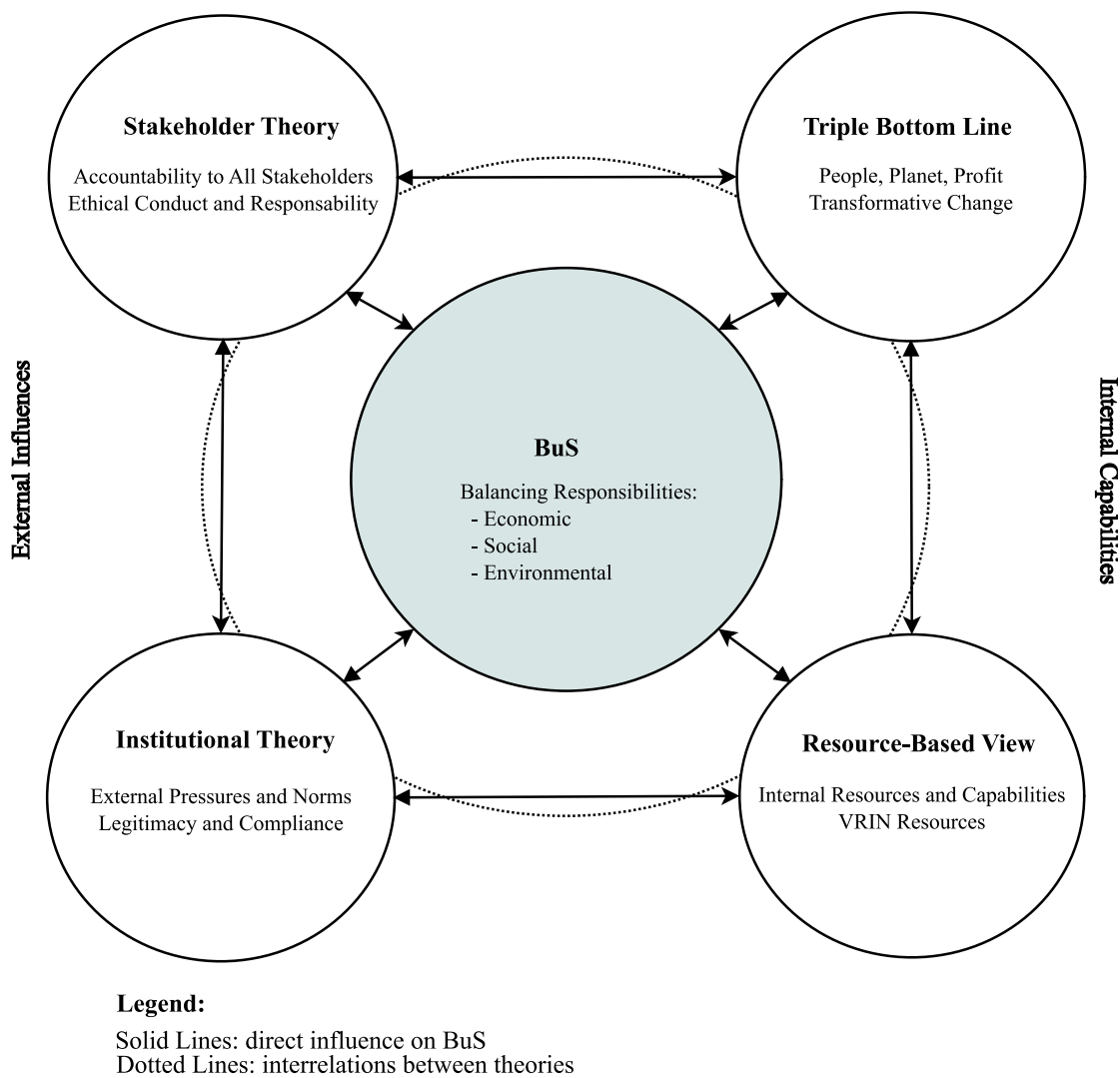


Fig. 1 Initial BuS theoretical framework

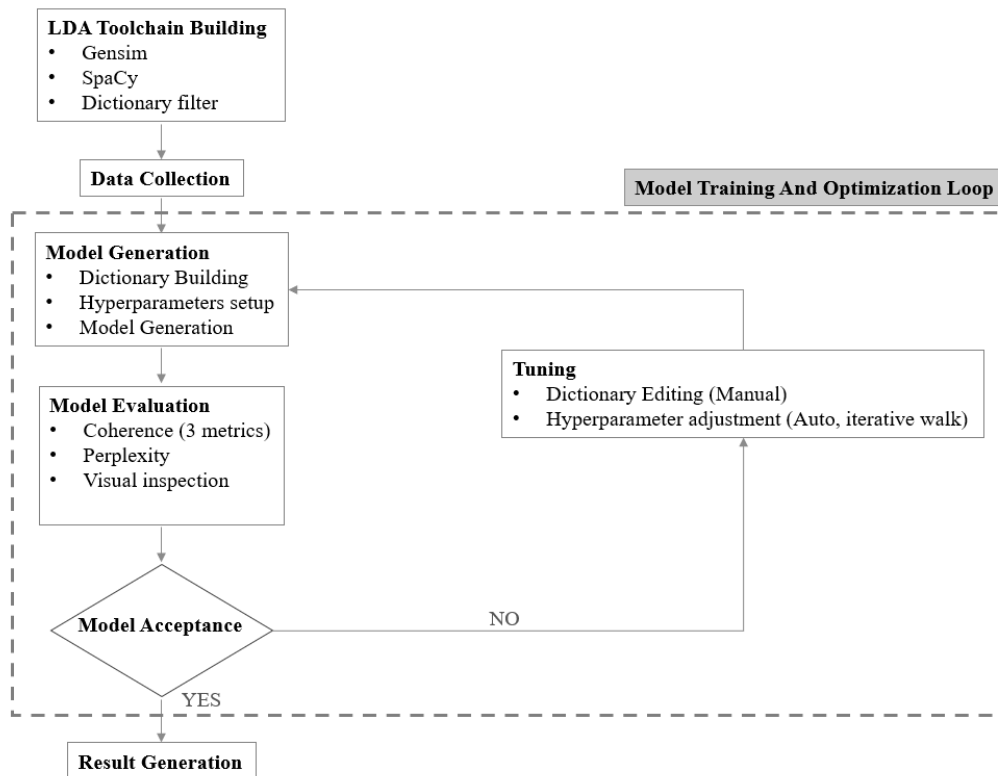


Fig. 2 LDA topic modeling process designed and applied in this study

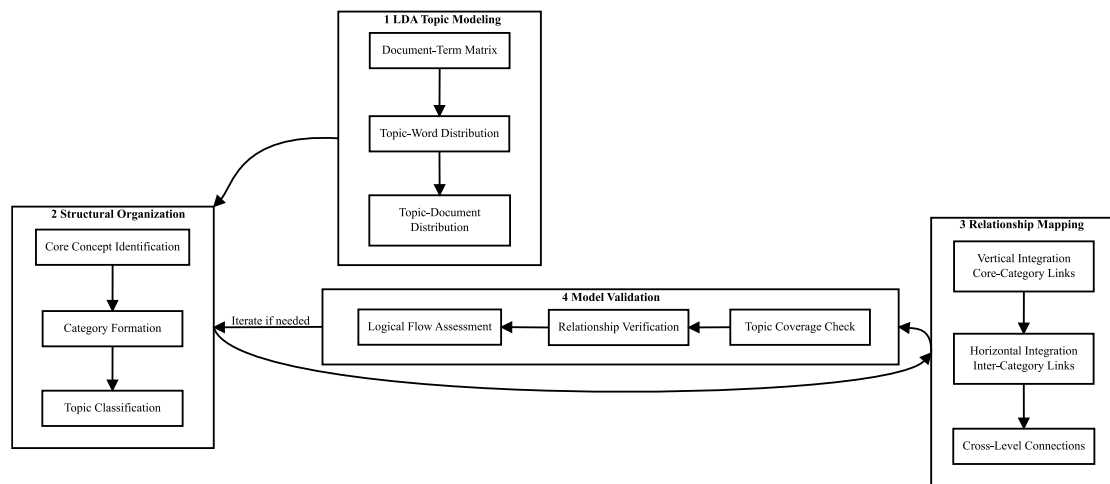


Fig. 3 LDA-HSIM process: Four stages of framework development

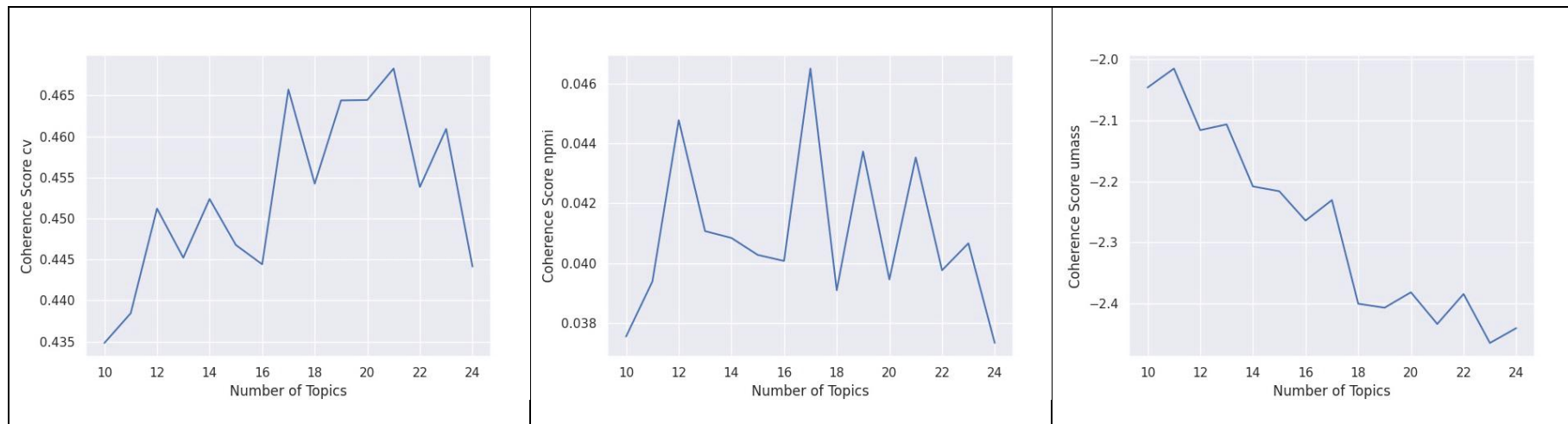


Fig. 4 LDA topic modeling evaluation measurements – three coherence metric scores: C_v , C_{npmi} , C_{umass}

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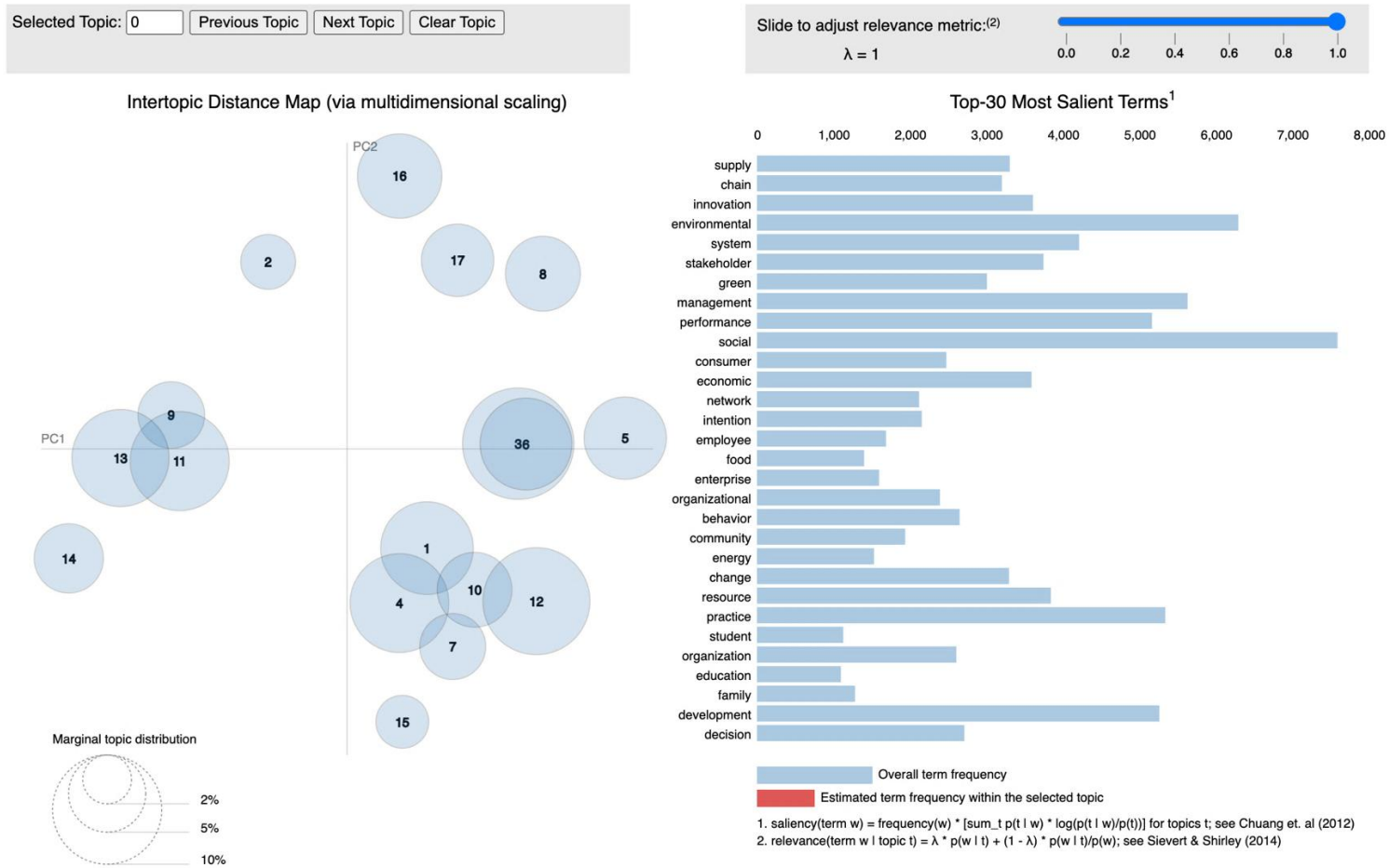


Fig. 5 LDAvis visualization of the 17-topic model (M17)

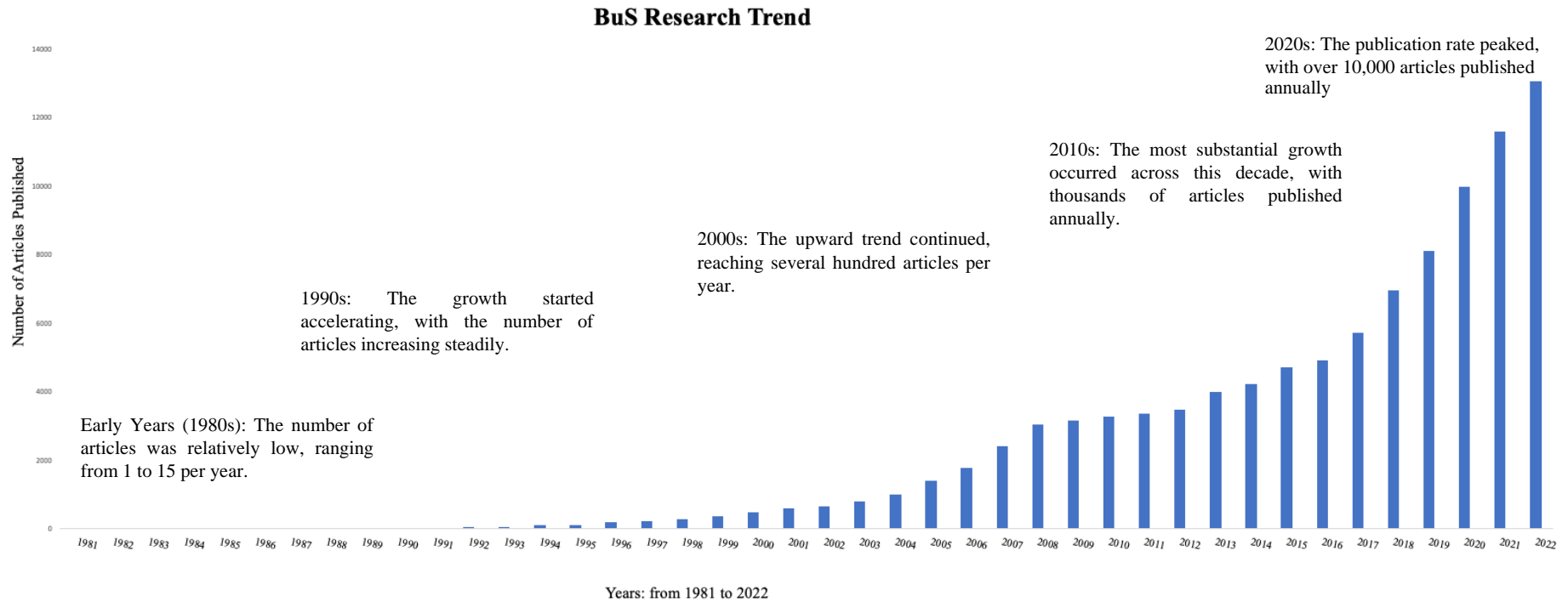


Fig. 6 BuS research trend from 1980 to 2022

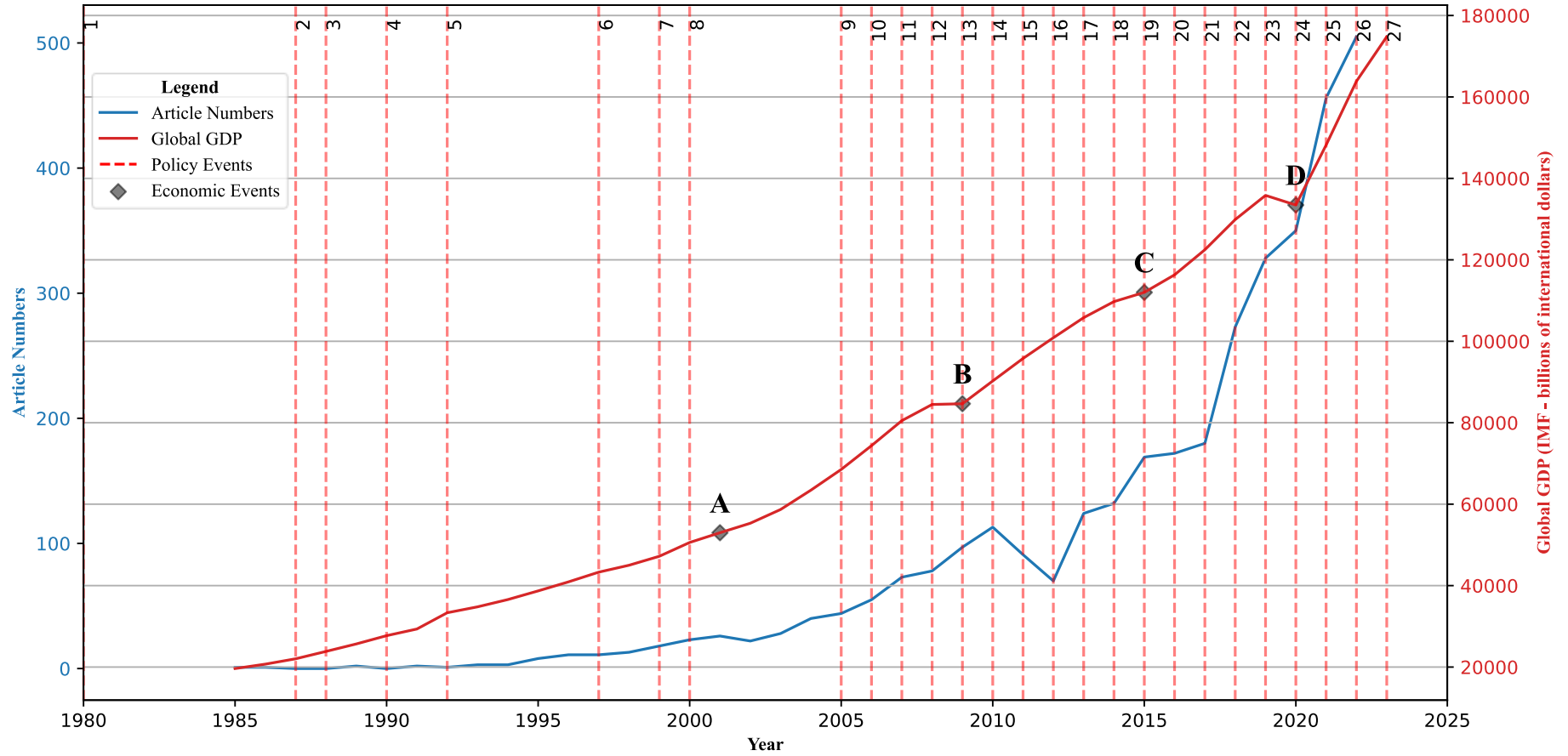


Fig. 7 Comparative analysis of BuS research, GDP fluctuations, and policy announcements (source from: IMF (2023))

Marker and Events			
[A] Dot-com bubble crash, year 2001	[B] Great recession, year 2008	[C] Global trade slowdown, year 2015	[D] COVID-19 pandemic, year 2019

Notes for Fig. 7: The vertical dashed lines indicate major sustainability policy events. The black diamond-shaped markers (A, B, C and D) indicate major global economic events (see table below) having a significant impact on GDP growth. The number of published BuS research articles is represented by the blue curve. The global GDP fluctuation is represented by the red curve.

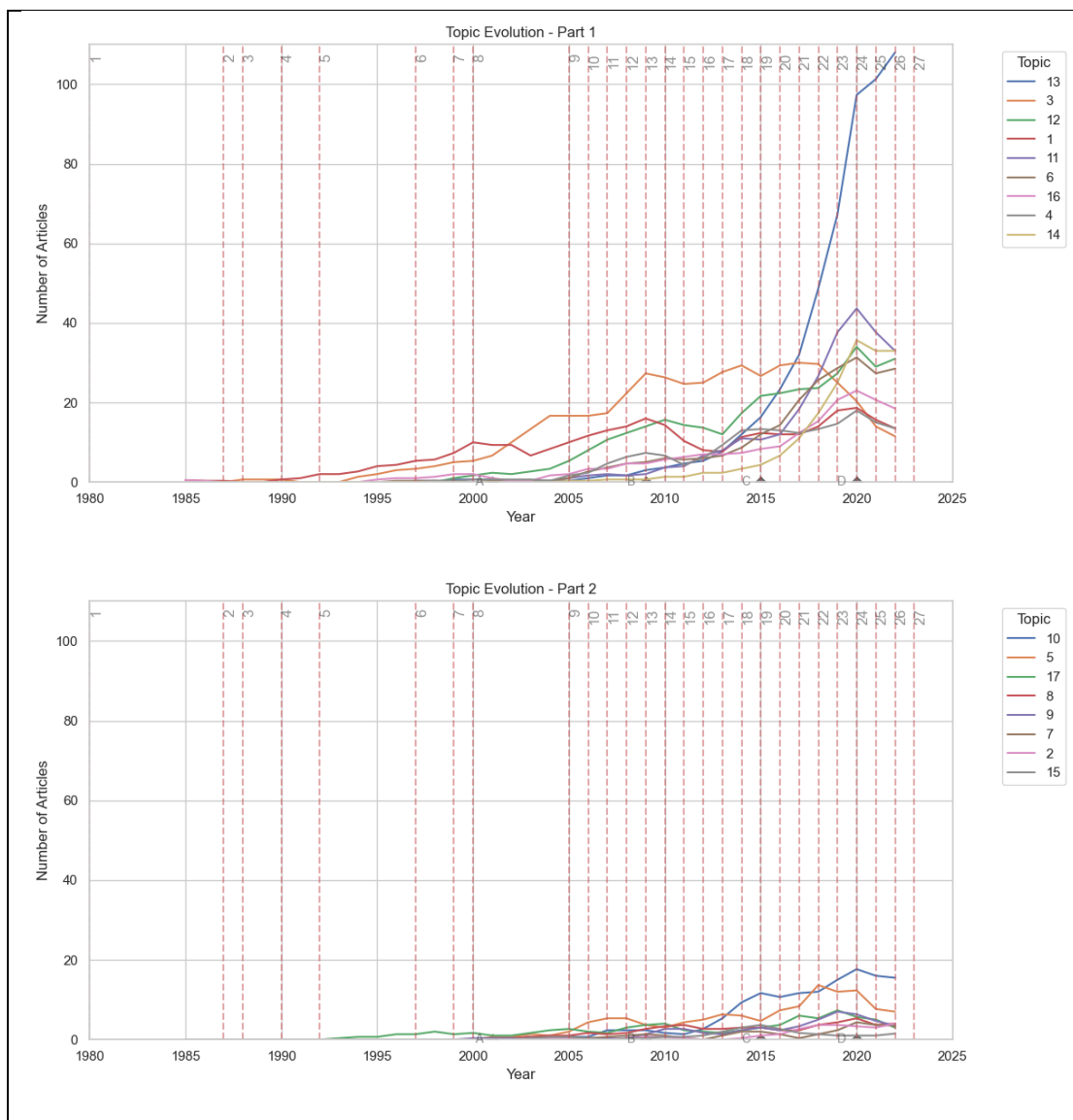


Fig. 8 Trends in BuS research publications for major and minor topics (1980-2022)

Notes for Fig. 8: The evolution of the total number of articles per topic for each year from 1980 to 2022. Each chart is divided into two parts, which not only enhances the visibility of colored curves but also provides a clear segmentation between Major (Part 1) and Minor Topics (Part 2). For the detrended charts, it is important to note that a flat curve means the topic is following the general trend.

To mitigate temporal fluctuations in topic trends, we employed a detrending technique by normalizing article counts for each year within topical categories. Additionally, to denoise the data, particularly during the emergence years of BuS research, a zero-lag 100

smoothing algorithm (SMA) was utilized. This approach facilitated visualization of underlying topic trends.

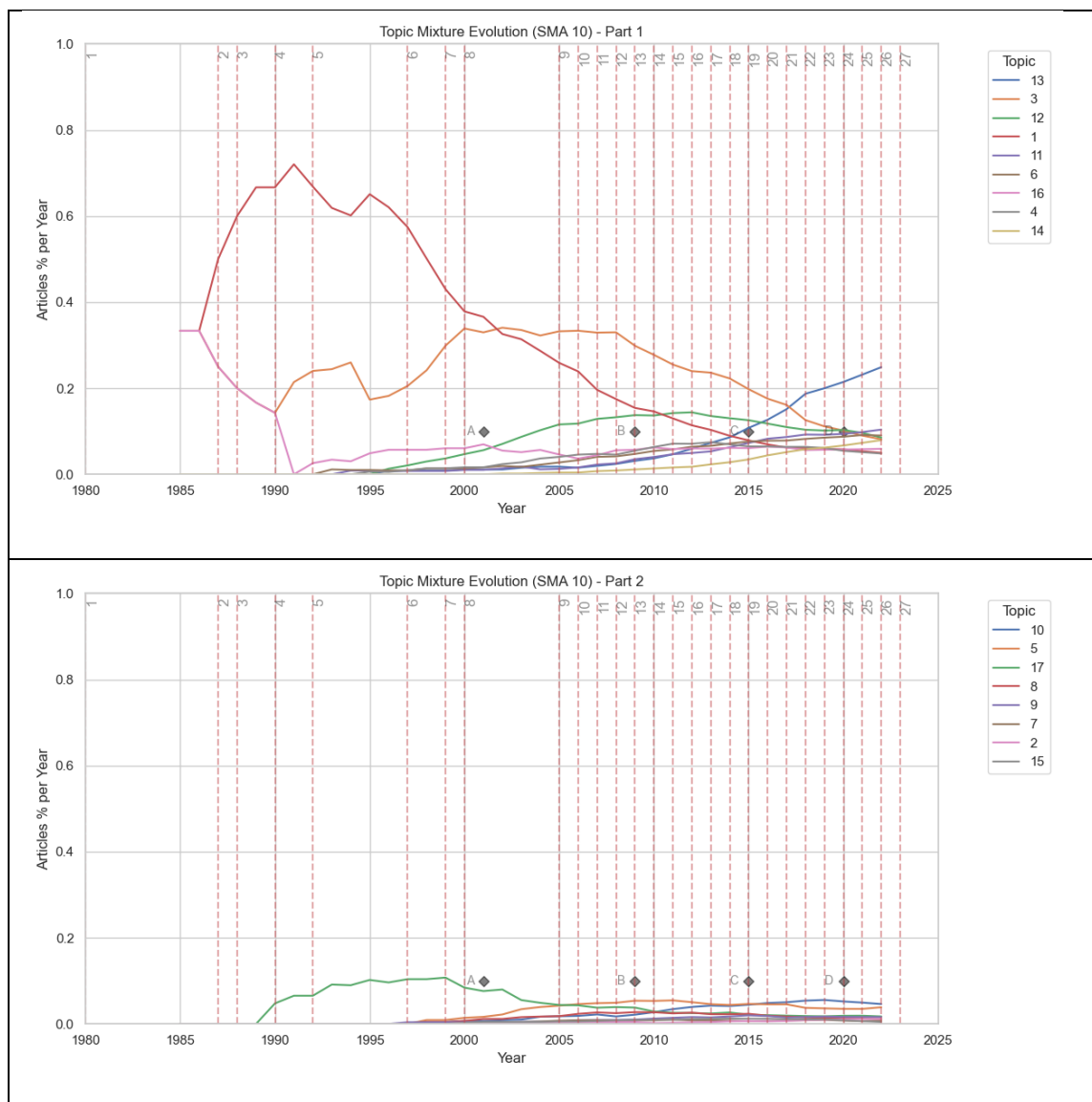


Fig 9a Mixture trends (detrended and normalized) from 1980 to 2022

Notes for Figure 9a: The evolution of the Mixture of Topics per year in a detrended and normalized fashion. In the Topic Mixture charts, a non-lagging Simple Moving Average (SMA) with a period of n-years was used to reduce noise and allow better identification of topic trends. For the detrended charts, it is important to note that a flat curve means the topic is following the general trend. Part 1 presents major topics and Part 2 presents minor topics.

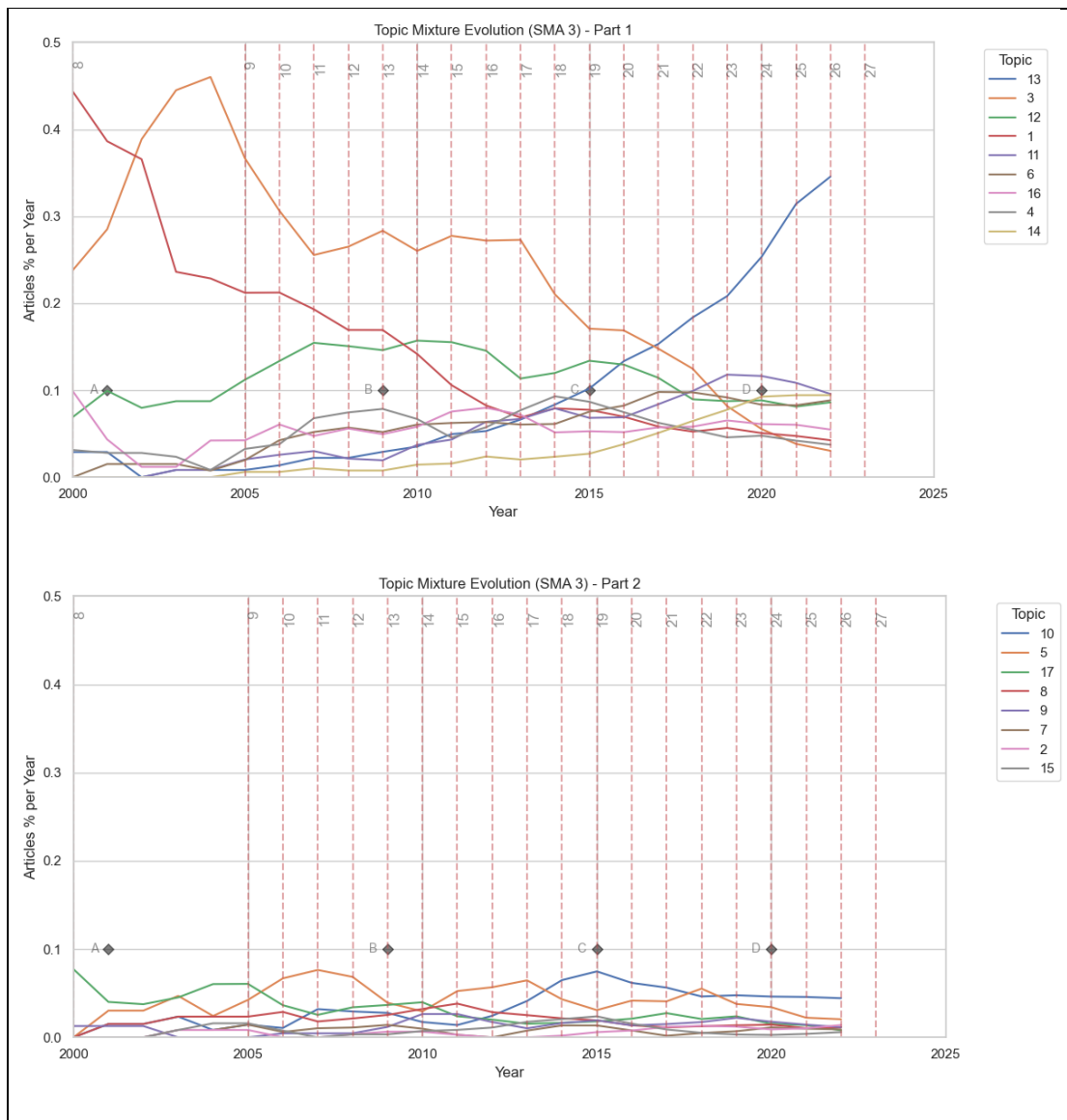


Fig. 9b Mixture trends (detrended and normalized) from 2000 to 2022

Notes for Figure 9b: Similar to Figure 9a, Mixture Trends (detrended and normalized). To increase detail from 2000 to 2022, enabling better scaling of the Y-axis. Part 1 presents major topics and Part 2 presents minor topics.

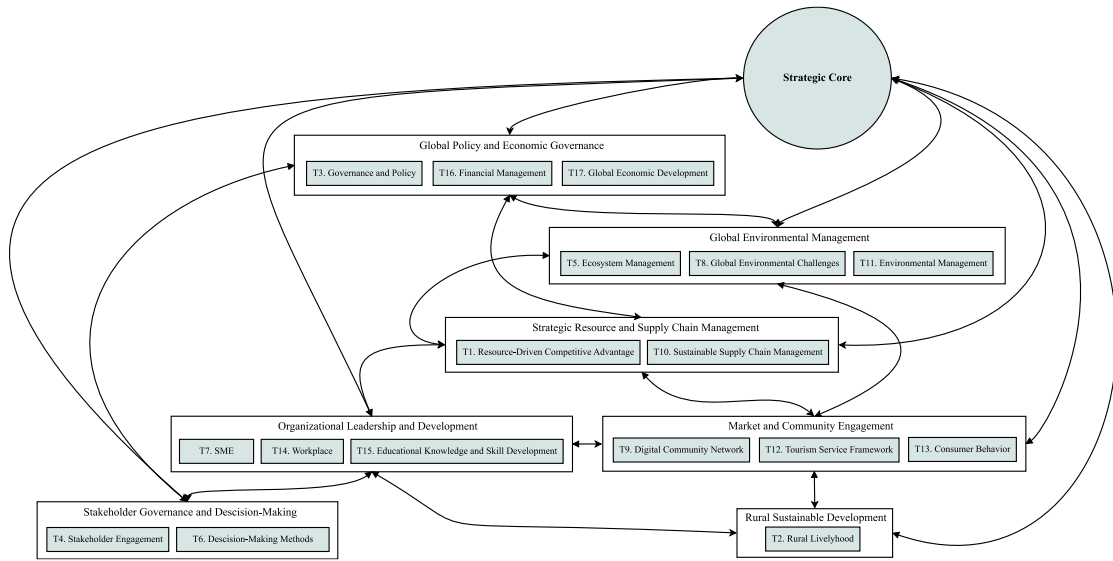


Fig. 10 BuS context model

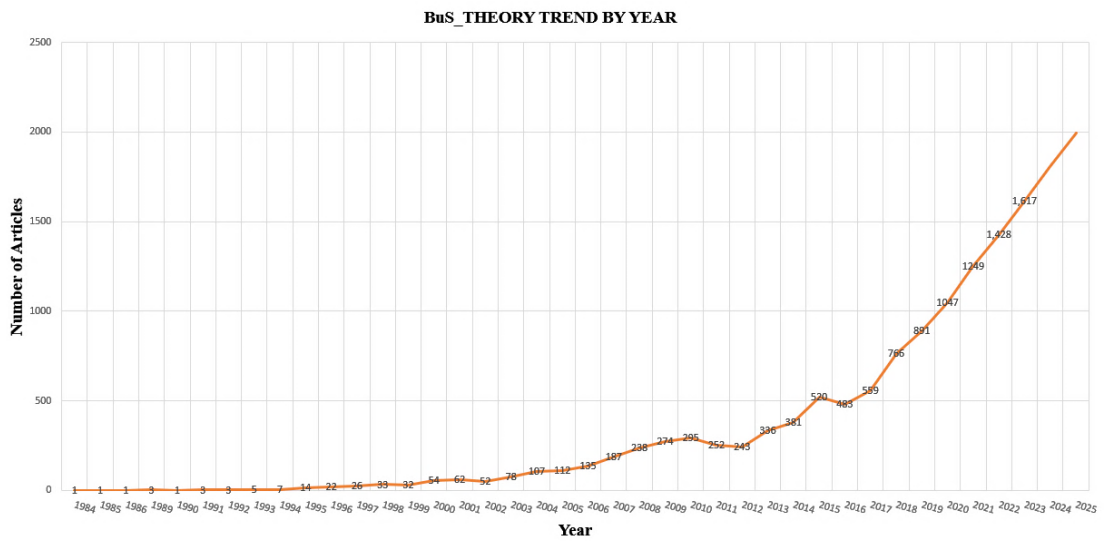


Fig.11 Trend of theories used in BuS research.

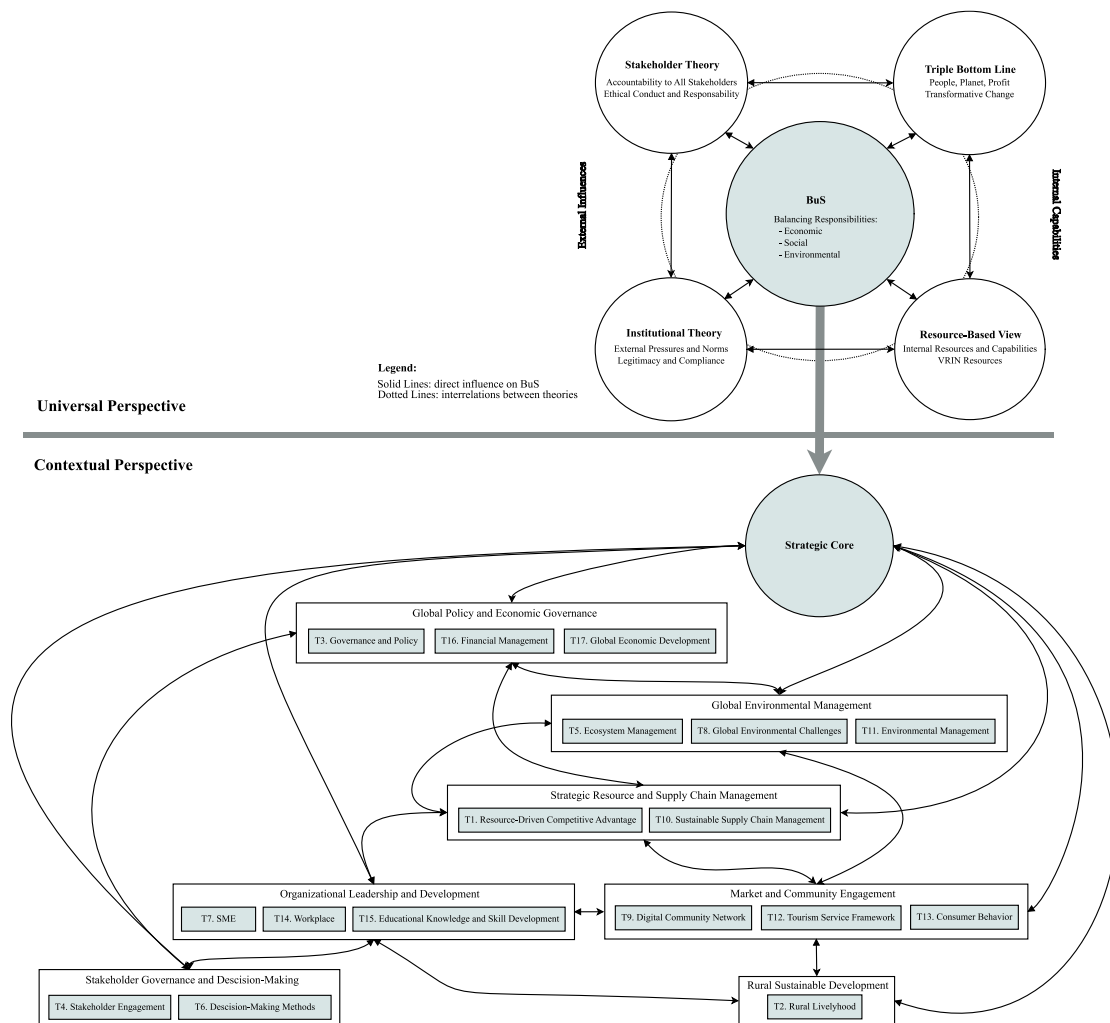


Fig. 12 Unified Conceptual Framework of BuS

10 Tables

Table 1 LDA Dictionary* – removed words

Removed Dictionary Words*
‘business’, ‘businesses’, ‘sustainability’, ‘sustainable’, ‘theory’, ‘theoretical’, ‘study’, ‘studies’, ‘research’, ‘result’, ‘results’, ‘paper’, ‘approach’, ‘model’, ‘finding’, ‘analysis’, ‘examine’, ‘develop’, ‘provide’, ‘article’, ‘book’, ‘literature’, ‘discuss’, ‘address’, ‘addresses’, ‘understand’, ‘understanding’, ‘limitation’, ‘limitations’, ‘propose’, ‘find’, ‘suggest’, ‘important’, ‘high’, ‘significant’, ‘draw’, ‘original’, ‘originality’, ‘base’, ‘model’, ‘datum’, ‘author’, ‘firm’, ‘corporate’, ‘corporation’, ‘company’, ‘future’, ‘work’, ‘implication’, ‘implications’, ‘hypothesis’, ‘methodology’.

*Note: The full dictionary contains 6,533 words.

Table 2 LDA model configuration parameters tested

Elements (Inference Parameters)	Candidates and Settings
The number of topics K	From 10 to 25, increasing by 1 for each iteration
Gibbs sampling iteration	50
Gibbs sampling passes	1000
Dirichlet parameter α	‘symmetric’ (belief over document-topic distribution (1.0/ number of topics (K)))
Dirichlet parameter β	‘symmetric’ (belief over word-topic distribution (1.0/number of topics (K)))

Table 3 Probability threshold for top 5% articles in each topic

Topic	5% Threshold (Probability)
T1	0.78
T2	0.79
T3	0.74
T4	0.66
T5	0.69
T6	0.82
T7	0.66
T8	0.60
T9	0.69
T10	0.70
T11	0.73
T12	0.74
T13	0.85
T14	0.86
T15	0.61
T16	0.73
T17	0.64

Table 4 M17 topics: Top 10 keywords and topic name

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
Topic 1 (818_39): Resource-driven and Competitive Advantage	innovation	5.85%
	resource	3.71%
	capability	2.36%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
	technology	2.09%
	strategy	1.95%
	knowledge	1.83%
	competitive	1.58%
	advantage	1.52%
	strategic	1.48%
	market	1.41%
Topic 2 (145_6): Rural Livelihood	food	6.50%
	entrepreneurial	4.47%
	entrepreneurship	4.26%
	entrepreneur	2.70%
	farmer	2.46%
	rural	2.13%
	organic	1.71%
	agricultural	1.58%
	farm	1.04%
	label	1.00%
Topic 3 (1356_45):	policy	1.80%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
Governance and Policy	social	1.78%
	public	1.50%
	practice	1.13%
	institutional	1.11%
	governance	1.06%
	political	1.01%
	actor	0.79%
	local	0.78%
	change	0.74%
Topic 4 (754_36): Stakeholder Engagement	stakeholder	4.58%
	social	3.25%
	value	3.20%
	project	1.95%
	responsibility	1.19%
	management	1.11%
	organization	1.08%
	framework	0.98%
	manager	0.92%
	design	0.86%
Topic 5 (458_19): Ecosystem Management	system	6.42%
	urban	1.71%
	development	1.67%
	water	1.54%
	city	1.49%
	ecosystem	1.39%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
	ecological	1.18%
	industrial	1.15%
	resilience	1.06%
	management	1.00%
Topic 6 (632_31): Decision-Making Method	decision	2.94%
	method	1.93%
	disclosure	1.89%
	reporting	1.39%
	information	1.27%
	evaluation	1.25%
	report	1.01%
	indicator	1.00%
	criterion	0.98%
	make	0.95%
Topic 7 (202_10): Small Medium Enterprises (SME)	management	5.74%
	enterprise	4.84%
	organization	2.06%
	sme	1.90%
	small	1.88%
	organizational	1.81%
	practice	1.52%
	medium	1.32%
	implementation	1.31%
	strategic	1.26%
Topic 8 (319_14):	change	4.01%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
Global Environmental Challenges	energy	3.79%
	climate	1.95%
	environmental	1.89%
	transition	1.40%
	global	1.09%
	crisis	1.01%
	consumption	0.97%
	policy	0.87%
	natural	0.76%
Topic 9 (218_11): Digital Community Network	network	5.64%
	community	4.06%
	social	3.75%
	board	1.74%
	sharing	1.62%
	information	1.54%
	digital	1.50%
	platform	1.46%
	user	1.44%
	communication	1.33%
Topic 10 (456_23): Sustainable Supply Chain Management	supply	8.23%
	chain	7.98%
	supplier	3.11%
	management	2.53%
	circular	1.45%
	practice	1.19%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
	economy	1.16%
	industry	1.13%
	logistic	1.09%
	product	0.95%
Topic 11 (839_41): Environmental Management	environmental	5.88%
	performance	5.17%
	green	4.26%
	practice	2.14%
	effect	2.04%
	relationship	1.99%
	social	1.75%
	impact	1.40%
	influence	1.37%
	institutional	1.36%
12 Topic 12 (1056_34): Tourism Service Framework	tourism	1.91%
	service	1.66%
	development	1.63%
	practice	1.57%
	framework	1.35%
	design	1.32%
	review	1.18%
	marketing	1.00%
	identify	0.90%
	process	0.86%
Topic 13 (923_42):	consumer	3.64%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
Consumer Behavior	intention	3.18%
	behavior	2.43%
	perceive	2.02%
	attitude	1.78%
	influence	1.55%
	factor	1.50%
	behavior	1.30%
	purchase	1.17%
	value	1.16%
Topic 14 (338_17): Workplace	employee	4.91%
	organizational	3.92%
	leadership	3.12%
	organization	3.06%
	relationship	2.26%
	behavior	2.26%
	role	1.39%
	effect	1.34%
	self	1.24%
	knowledge	1.14%
Topic 15 (150_8): Educational Knowledge and Skill Development	student	5.64%
	education	5.41%
	learning	4.83%
	university	2.90%
	learn	2.47%
	program	2.14%

Topic Number (total article_ reviewed articles): Topic Name	Top 10 Keywords	Probability
	school	1.71%
	experience	1.68%
	skill	1.52%
	educational	1.39%
Topic 16 (557_28): Financial Management	risk	1.99%
	market	1.99%
	investment	1.90%
	cost	1.83%
	financial	1.72%
	carbon	1.24%
	government	1.22%
	policy	1.01%
	effect	0.94%
	price	0.90%
Topic 17 (340_15): Global Economic Development	economic	5.63%
	family	3.40%
	development	3.01%
	growth	2.62%
	capital	2.38%
	economy	2.31%
	country	1.79%
	accounting	1.41%
	region	1.07%
	social	0.95%

Table 5 UN SDGs connected with M17 topics

UN SDGs	M17 Topics
1. No Poverty: End poverty in all its forms everywhere.	T2 Rural Livelihood
	T16 Financial Management
2. Zero Hunger: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	T2 Rural Livelihood
3. Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.	T 2 Rural Livelihood
	T12 Tourism service Framework
4. Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.	T15 Educational Knowledge and Skill development
5. Gender Equality: Achieve gender equality and empower all women and girls.	T7 Small Medium Enterprises (SME)
	T9 Digital community Network
6. Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all.	T5 Ecosystem Management
	T11 Environmental Management
7. Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable, and modern energy for all.	T8 Global Environmental Challenges
8. Decent Work and Economic Growth: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.	T1 Resource-driven and Competitive Advantage
	T7 Small and Medium-sized Enterprises (SME)
	T9 Digital community Network
	T14 Workplace
9. Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.	T1 Resource-driven and Competitive Advantage
	T6 Decision-making Methods

UN SDGs	M17 Topics
10. Reduced Inequality: Reduce inequality within and among countries.	T17 Global Economic Development
11. Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.	T3 Governance and Policy
	T5 Ecosystem Management
12. Responsible Consumption and Production: Ensure sustainable consumption and production patterns.	T10 Sustainable Supply Chain Management
	T11 Environmental Management
	T12 Tourism Service Framework (SGD 12)
	T13 Consumer Behavior
13. Climate Action: Take urgent action to combat climate change and its impacts.	T8 Global Environmental Challenges
	T11 Environmental Management
14. Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.	T2 Rural Livelihood
	T5 Ecosystem Management
15. Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	T5 Ecosystem Management
16. Peace, Justice, and Strong Institutions: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.	T3 Governance and Policy
	T16 Financial Management
	T4 Stakeholder Engagement

UN SDGs	M17 Topics
<p>17. Partnerships for the Goals: Strengthen the means of implementation and revitalize the global partnership for sustainable development.</p>	<p>T17 Global Economic Development</p>

Table 6 Policy events related to sustainability

Item	Year	Policy Announcements
1	1980	Brundtland Report, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Single European Act, Montreal Protocol
2	1987	Intergovernmental Panel on Climate Change (IPCC), First Climate Action Programme
3	1988	The European Community adopts the First Climate Action Programme to address climate change
4	1990	UN Conference on Environment and Development (UNCED), Clean Air Act Amendments
5	1992	UN Agenda 21 action plan for sustainable development, Rio Declaration, Treaty on European Union (Maastricht Treaty), U.S. Energy Policy Act encourages renewable energy development and energy efficiency.
6	1997	Kyoto Protocol
7	1999	EU Water Framework Directive
8	2000	Millennium Development Goals (MDGs)
9	2005	Kyoto Protocol (Enforcement), European Union Emissions Trading Scheme (EU ETS)
10	2006	Renewable Energy Standards (Various Countries), California's Global Warming Solutions Act (AB 32)
11	2007	Renewable Portfolio Standards (United States), Australia's Renewable Energy Target (RET)
12	2008	United Kingdom Climate Change Act, Germany's Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG)
13	2009	American Recovery and Reinvestment Act (ARRA), China's Renewable Energy Law, The EU Renewable Energy Directive
14	2010	Copenhagen Accord, South Korea's Green Growth Strategy
15	2011	Japan's Feed-in Tariff (FIT) Program, United States Fuel Economy Standards (Corporate Average Fuel Economy, CAFE)
16	2012	California's Cap-and-Trade Program, Brazil's National Climate Change Plan
17	2013	EU 2030 Climate and Energy Framework, India's National Solar Mission (Jawaharlal Nehru National Solar Mission, JNNSM)
18	2014	China's Air Pollution Action Plan, United States Clean Power Plan

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Item	Year	Policy Announcements
19	2015	Paris Agreement, UN Sustainable Development Goals (SDGs)
20	2016	Canada's Pan-Canadian Framework on Clean Growth and Climate Change, Morocco's Noor Solar Power Plant
21	2017	United States Withdrawal from the Paris Agreement, European Union Clean Energy Package
22	2018	California's Senate Bill 100, New Zealand's Zero Carbon Act
23	2019	EU Green Deal, Japan's Long-Term Strategy under the Paris Agreement
24	2020	COVID-19 Recovery Plans, United States Rejoining the Paris Agreement
25	2021	U.S. rejoined the Paris agreements, Net Zero Targets, European Union Fit for 55 Package, The United Nations Climate Change Conference (COP26) focusing on increasing ambition to meet the goals of the Paris Agreement
26	2022	United States Infrastructure Investment and Jobs Act, China's 2060 Carbon Neutrality Pledge
27	2023	International Renewable Energy Investments, Climate Resilience Plans

Table 7 BuS definitions in 17 topics

Topic	<i>Definition: 'Business Sustainability is...</i>
Topic 1 Resource-driven and Competitive Advantage	<p data-bbox="539 333 1343 551"><i>... the strategic integration of technology and innovation in the alignment of organizational and individual capabilities, together with the effective allocation and transfer of resources to improve economic efficiency and to meet dynamic environmental conditions to create sustainable competitive advantage in business.'</i></p> <p data-bbox="539 607 671 633">CONTEXT:</p> <p data-bbox="539 647 1343 1104">Business sustainability in the context of 'resource-driven innovation and competitive advantage' leverages internal resources and capabilities to drive progress and navigate dynamic market landscapes (Muffatto, 1998; Olavarrieta and Friedmann, 1999; Hooley and Greenley, 2005). This perspective argues that companies can achieve sustainability by strategically leveraging their resources and capabilities to create sustainable competitive advantage and thereby contribute to economic prosperity (Danneels, 2002; Anand et al., 2010). Such an approach requires a commitment to continuous innovation, aligning competencies with evolving technologies, and optimizing resource portfolios (Mahoney and Qian, 2013). Companies can drive economic sustainability through strategic initiatives such as mergers and acquisitions and sustainable product and service innovation, leveraging their resource-driven strategies to create lasting value in today's competitive business environment (James, 2002; Moliterno and Wiersema, 2007).</p>
Topic 2 Rural Livelihood	<p data-bbox="539 1122 1343 1339"><i>... a pathway to sustainable livelihoods through a sustainable rural business model. It enables individuals, households, and communities to meet their basic needs and improve their well-being requirements through the sustainable use and management of natural resources to promote social, economic, and environmental sustainability.'</i></p> <p data-bbox="539 1395 671 1422">CONTEXT:</p> <p data-bbox="539 1435 1343 2004">Business sustainability in the field of 'rural livelihood' is concerned with reducing food waste through different approaches, such as eating rituals, developing appropriate materials that support global environmental sustainability, promoting organic farming, and fostering entrepreneurship and innovation among young farm entrepreneurs (Bertoni and Cavicchioli, 2016; Issa and Hamm, 2017; Revilla and Salet, 2018; Apostolidis and McLeay, 2019; Elahi et al., 2022). Meanwhile, improving economic sustainability and household nutrition can promote sustainable food consumption by strengthening fish-related livelihoods and the impact of 'harm and care' dietary motivations (Kawarazuka and Béné, 2010; Dixon and Richards, 2016). Marketing strategies and food labeling play a critical role in promoting sustainable food consumption and shaping consumer behavior (Sørensen et al., 2016; Nugraha et al., 2022). Furthermore, ethical entrepreneurial education is essential to foster responsible and sustainable business practices. To encourage rural entrepreneurship and close the economic gap between rural and urban areas, digital inclusive finance is a viable strategy (Lourenço et al., 2015; X. Ji et al., 2021; X. Yu and Du, 2021). Ultimately, economic, social, and environmental sustainability in this area depends on efficient farm management and the maintenance of the</p>

Topic	Definition: ‘Business Sustainability is...
	long-term viability of rural businesses (Issa and Hamm, 2017; Mercado et al., 2018).
Topic 3 Governance and Policy	<p data-bbox="539 338 1343 555"><i>... the way in which governments and other institutional actors influence and are influenced by the activities and views expressed by local communities, political actors, and other relevant stakeholders in promoting societal change and enhancing economic performance to achieve greater sustainability.’</i></p> <p data-bbox="539 607 671 633">CONTEXT:</p> <p data-bbox="539 651 1343 1413">Business sustainability in the field of ‘governance and policy’ aims to achieve sustainable strategic management, which requires significant institutional change that aligns corporate regulation with societal expectations and promotes societal change toward greater sustainability (Lyon and Maxwell, 2004; Dubbink and van Liedekerke, 2009; Shamir, 2010; Curran, 2015; Chiu, 2018). This alignment is essential to meet the demands of society and to ensure socially responsible business practices (Hamann and Acutt, 2003; Dubbink and van Liedekerke, 2009). Meanwhile, the governance structures need to have more productive interfaces with democratic systems to ensure democratic policy planning for sustainability transitions. A democratic re-foundation is needed from a degrowth perspective, which includes environmental, social, and anthropological challenges (Hendriks, 2009; Blühdorn and Deflorian, 2019). The introduction of a new socio-environmental public sphere can introduce different criteria for decision-making, challenging traditional assumptions about markets, knowledge and causality, and transforming social science (Deriu, 2012; Dutta et al., 2012). Meanwhile, the local governance affects environmental and economic policy (Gibbs and Jonas, 2000; Welch, 2002). Social movements operating through grassroots networks can change public sector management, which involves resistance, accommodation, and messy compromises (Weber, 1999). Spatial assemblage practices, urban development strategies and global policy mobility can stimulate sustainable urban development and the building of sustainable communities, and shift governance toward sustainability (Gibbs and Jonas, 2000; Jonas et al., 2004; Brownill et al., 2013) .</p>
Topic 4 Stakeholder Engagement	<p data-bbox="539 1429 1343 1646"><i>... the integration of stakeholder management, social and value considerations into decision-making and project management practices in organizational settings as well as in the design, planning, and execution of projects aiming at creating a positive economic, social and environmental impact.’</i></p> <p data-bbox="539 1711 671 1738">CONTEXT:</p> <p data-bbox="539 1756 1343 2022">Business sustainability in the field of ‘stakeholder engagement’ aims to promote sustainability through effective stakeholder management, education, governance, and sustainable value creation (Steurer, 2006; Hörisch et al., 2014; Jones and Wicks, 2018; Nyuur et al., 2019; ElAlfy et al., 2020). Neglecting or mismanaging wider stakeholders can lead to negative project impacts such as disengagement, loss of resources, and conflicting requirements (Reynolds and Yuthas, 2008; Eskerod et al., 2015; Perrault, 2017; Fischer et al., 2020; García-Sánchez et al., 2022). Therefore, stakeholder value creation is critical to managing business models with</p>

Topic	<i>Definition: 'Business Sustainability is...</i>
	sustainable objectives (Cragg and Greenbaum, 2002; Lankoski et al., 2016; Freudenreich et al., 2020). In addition, to achieve sustainable project outcomes, project owners need to define clear value and customer propositions with the support of project governance bodies (Bryde and Volm, 2009; Hjelmbrække et al., 2014). Furthermore, co-creating the business case with stakeholders is essential to manage the expectations of stakeholders in the collaborations in financial, environmental, social, and economic aspects (Walker and Laplume, 2014; Schaltegger et al., 2019; Lopez, 2020).
Topic 5 Ecosystem Management	<p data-bbox="539 555 1343 954"><i>... a variety of ecosystem management approaches that combine industrial upgrading and spatial optimization measures for economic development with environmental protection objectives. By incorporating ecosystem-based approaches such as spatial analysis, distributed computing, and coordinated water resource development, businesses can achieve economic growth while minimizing negative impacts on the environment. Ultimately, ecosystem management aims to create a more sustainable and resilient business environment that balances economic development with environmental sustainability.'</i></p> <p data-bbox="539 1012 671 1039">CONTEXT:</p> <p data-bbox="539 1055 1343 1632">Business sustainability in the field of 'ecosystem management' aims to prioritize environmental protection and resource conservation through different approaches (S. Ahmad and Simonovic, 2004; C. Zhang et al., 2019). These approaches include ecosystem-oriented distributed evolutionary computing inspired by the self-organization, scalability, and sustainability of natural ecosystems (Briscoe and De Wilde, 2012). In addition, the coordinated development of water resource subsystems and a cooperative negotiation approach to water allocation in transboundary river basins under scarcity support environmentally and socially sustainable development (Degefu et al., 2016; Liang et al., 2018; H. Sun et al., 2020). Meanwhile, effective problem-solving methods for open, complex, large-scale systems that challenge multiple disciplines rely on social-cognitive development and interaction (Cao et al., 2009). Furthermore, spatial analysis can be used to measure the production-living ecological functions essential for promoting sustainable and moderate development and use of land (Redondo et al., 2019; Xie et al., 2021). Finally, greater synergy between mineral exploitation and the water environment is essential to achieve coordinated development, reduce energy consumption, and environmental problems (Fang et al., 2020; H. Sun et al., 2020).</p>
Topic 6 Decision-Making Method	<p data-bbox="539 1650 1343 1973"><i>... the integration of various uncertainty analysis methods to improve the business decision-making process and the evaluation of the accuracy of the weighting methods in uncertain environments to assess the information obtained. Improved disclosure and reporting allow multi-criteria methods to increase business transparency. It highlights effectiveness and practicality of various approaches to decision-making that consider social and ethical concerns and promote responsible business practices.'</i></p>

Topic	Definition: ‘Business Sustainability is...
	<p>CONTEXT:</p> <p>Business sustainability in the field of ‘decision-making’ contains various methods and techniques. Examples include the Weighted Aggregated Sum Product Assessment (WASPAS) method and Decision-Making Trial and Evaluation Laboratory (DEMATEL) method, which are useful for sustainable development decision-making and improving accuracy in complex problems, respectively (Stanujkić and Karabašević, 2018; Du and Zhou, 2019). Moreover, modal interval trapezoidal fuzzy numbers and universal grey number-based Gaussian elimination methods can support decision-making in different sustainability research and overcome the limitations of existing methods (Jorba and Adillon, 2017). Weight calculating techniques can be used to develop more Multi-criteria Decision-Making (MCDM) methods to aid organizational decision-making (Haqbin, 2022). A new hybrid decision support method and test method are also available to evaluate decision alternatives and the suitability of the production frontier function (Pankratova and Nedashkovskaya, 2014; Albogami et al., 2021; Karimi and Hojati, 2022). Finally, when evaluating green logistic providers in multi-criteria decision-making problems, considering the weights of criteria is important (Ghorabae et al., 2016; Liao et al., 2018).</p>
<p>Topic 7</p> <p>Small Medium Enterprises (SME)</p>	<p><i>... the financial achievement of small- and medium-sized enterprises (SMEs) through various factors, such as the impact of internal audit intelligence on decision-making value, the development of agile organizational culture, the integration of operational excellence, and organizational agility culture. Strategic thinking is also crucial as it serves as the foundation of strategic planning and management, enabling organizations to develop strategic thinkers and ensure their survival and success in uncertain times.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘SME’ aims to help the small to medium enterprises improve their long-term survival to achieve financial success and continuity in SME (Nuntamanop et al., 2013; Bure and Tengeh, 2019; Carvalho et al., 2019). It can use internal audit and internal control as important tools and strategies to help SMEs improve their implementation performance and achieve sustainable growth (Mistry et al., 2014; Pararit et al., 2017; Kupec et al., 2021). Meanwhile, the measurement of intellectual capital needs to take into account both intangible assets and liabilities, as this can help SME managers identify and address barriers to knowledge deployment, foster stronger employer-employee relationships, and improve employee retention and overall business sustainability (Garcia - Parra et al., 2009; Longoni and Cagliano, 2015). Ultimately, adopting a management model based on core business values can help SMEs to define their purpose and focus, set their direction, and enhance their long-term competitiveness, all of which are crucial to achieving business sustainability (X. Li, 2008; Longoni and Cagliano, 2015).</p>
<p>Topic 8</p>	<p><i>... the solution to global environmental challenges such as climate change and resource depletion. It enables organizations to operate in a way that balances economic growth with the conservation and restoration of the natural environment. It considers the use of resources and their impact</i></p>

Topic	Definition: ‘Business Sustainability is...
Global Environmental Challenges	<p><i>on the environment. BuS requires a transition to a renewable and sustainable energy paradigm that businesses must embrace to ensure that their use of resources and their impact on the environment is consistent with a sustainable future.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘global environmental challenges’ requires companies to reduce their environmental impact and move toward sustainable practices, while investors in capitalism continue to overwhelmingly support an unsustainable future based on non-renewable energy (Bergman and Eyre, 2011; DiMuzio, 2012; Lima, 2021). Achieving this goal requires rigorous scientific research to facilitate informed decision-making and policy support to incentivize the adoption of sustainable practices, such as micro-generation and the renovation of historic buildings that balance environmental and heritage needs (Neely, 2010; Judson et al., 2014). Increased attention and investment in low-carbon or green energy futures are critical to overcoming barriers to the transition to a renewable and sustainable energy paradigm (Richter, 2013; Kloppenburg et al., 2019). An integrated ‘renew-non-renew’ model is necessary to address sustainable environmental policy and has significant implications for businesses and their sustainability strategies (Bastianoni et al., 2009; Vaca et al., 2012). However, the entrenched power of the fossil fuel industry is a significant obstacle to this transition (DiMuzio, 2012; X. Xu et al., 2019).</p>
Topic 9 Digital Community Network	<p><i>... the competence of companies operating in the digital space to maintain their economic viability and social responsibility over time. This involves implementing strategies that foster online engagement, participation, and loyalty among users while promoting diversity, inclusion, and open communication within the social community, and contributing to long-term social and economic sustainability.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘digital community network’ aims to promote online engagement to build a long-term economic and social sustainability by prioritizing social interaction, knowledge sharing, and community building (Nov et al., 2010; Moses et al., 2018). This involves implementing strategies that cater to the needs of different user groups, such as those with high interdependent self-construal and those who rely on virtual social structures for information and support (Han et al., 2015; Kurian, 2015). To strengthen relationships with customers and communities, companies need to prioritize diversity, inclusion, and decision-making power, such as for female board members (Nov et al., 2010; Hawarden and Marsland, 2011). In doing so, they can foster innovation and sustainable financial performance (Hawarden and Marsland, 2011). Companies can also create value for their users, employees, and communities while ensuring their own long-term success by prioritizing both social and economic sustainability (J. Zhou et al., 2014; J. Liu et al., 2019; El Afi and Oquiddad, 2021).</p>
Topic 10	<p><i>... the ability to build sustainable supply chain operations in an environmentally and socially responsible manner while maintaining economic viability to promote global supply</i></p>

Topic	Definition: ‘Business Sustainability is...
Sustainable Supply Chain Management	<p><i>resilience, minimize disruption, and increase efficiency. Applying circular economy principles to supply chain management promotes sustainable business practices by building supply chain resilience characteristics in companies that optimize supply chain operations, such as manufacturing, procurement, and logistics management.’</i></p> <p>CONTEXT: Business sustainability in the field of ‘sustainable supply chain management’ aims to enable supply chain resilience and promote environmental sustainability while creating economic value, such as promoting global supply resilience, managing suppliers at every level, and implementing green supply chain management practices (T. Williams et al., 2002; Blackhurst et al., 2011; Grimm et al., 2014, 2016; J. Liu et al., 2023). Overcoming barriers to sustainable supply chain management requires collaboration, transparency, and innovative solutions, while the enforcement of government policies and sustainability standards can encourage long-term implementation and sustainable performance (Silvestre et al., 2018; Silvestre et al., 2020; Chand and Tarei, 2021). Crisis resilience, circular economy principles, and Industry 4.0-enabling technologies can also contribute to sustainable supply chain practices (Meherishi et al., 2019; Fatorachian and Kazemi, 2021; Nag et al., 2021). Prioritizing sustainability throughout the supply chain can lead to more efficient and environmentally friendly production processes and contribute to sustainable business practices (Touboulic et al., 2014; Najjar and Yasin, 2023). Ultimately, it reduces waste through circular logistics systems and studies the impact of circular practices in the circular economy (Meherishi et al., 2019; Cui et al., 2024). By adopting a circular approach, companies can reduce their environmental footprint and achieve more sustainable supply chains (Oelze et al., 2020; Cui et al., 2024).</p>
Topic 11 Environmental Management	<p><i>... the assessment of environmental performance and the implementation of socially and environmentally responsible policies. These practices affect financial performance, decisions about tax aggressiveness (or compliance), and environmental strategies for achieving corporate social responsibility.’</i></p> <p>CONTEXT: Business sustainability in the field of ‘environmental management’ is heavily influenced by external pressures, such as pressure from institutional factors that include government regulations, industry standards, and societal demands (del Mar Miras-Rodríguez et al., 2018; S. Wang et al., 2018a); pressure from clan culture, ethical standards, and external actors that include customers, suppliers and competitors (Miao et al., 2012). These external influences play a critical role in shaping a company’s sustainability initiatives and overall performance. For example, S. Wang et al. (2018a) found that the regulatory and normative pressures positively influence a company’s adoption of environmental management practices. In turn, a company’s environmental commitment can positively moderate the relationship between institutional pressures and environmental management practices. However, the role of resource availability depends on the type of pressure (Chaudhry and Amir, 2020). As companies navigate</p>

Topic	<i>Definition: 'Business Sustainability is...</i>
	this complex landscape, they are embarking on a journey that not only fosters economic success but also leads to environmental responsibility and societal benefits (Khan et al., 2021). This harmonious alignment of environmental strategies and financial performance underscores the central role of corporate social responsibility (CSR) (Pranata et al., 2021; Y. Li et al., 2022). Management attention to humanistic principles has been shown to have a positive impact on CSR initiatives (Hu et al., 2018). In addition, under organizational and regulatory stakeholder pressure, companies, including small and medium-sized enterprises in emerging markets, can develop strategies that not only improve the bottom line of green practices, but also improve their environmental performance and make a positive contribution to corporate reputation and environmental performance (Dögl and Behnam, 2015; Sila and Cek, 2017; Baah et al., 2021) .
Topic 12 Tourism Service Framework	<p><i>... a guiding principle for tourism policymakers and destination managers, directing them to prioritize sustainability in their business agenda. It operates as a marketing framework for service operations, facilitating the design and implementation of environmentally responsible and well-structured tourism practices. These practices aim not only to support local communities but also enable effective market positioning to attract sustainability-oriented tourism, thereby fostering long-term viability and resilience in the tourism industry.'</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of 'tourism service framework' offers guidance to industry policymakers by encouraging them to adopt competitive strategies that consider economic factors while prioritizing sustainability concerns (Fadeeva, 2005; Taisch et al., 2013; Weiler, 2016). Stakeholders involved in this endeavor require specific knowledge of tourism products or local expertise, as well as the ability to foster innovation within the context (Cave and Brown, 2012; Åberg, 2014). At the same time, local tourism governance must capture this innovation and integrate it into policies and best practices for sustainable tourism (Hall and Page, 2010). This will ensure that practices are well structured and effectively marketed to appeal to customers who value sustainable tourism experiences (Stumpf et al., 2016). Marketing plays a key role in identifying and targeting these customers by highlighting the sustainable tourism services, and development practices offered by businesses (Coelho et al., 2018; Foltean, 2019). Achieving this requires innovative methodologies, sound theoretical foundations, solutions to sustainability challenges, integrated service design, effective coaching, service delivery, and a deep understanding of tourism experiences and knowledge sharing (Della Corte et al., 2019; Prestes Joly et al., 2019). As businesses seek to attract customers who prioritize sustainable tourism, the role of marketing in showcasing sustainable practices becomes indispensable (Sharpley, 2000; Cave and Brown, 2012).</p>
Topic 13 Consumer Behavior	<p><i>... the consideration of consumers' perceptions, attitudes, and behaviors toward sustainability that influence their consumption intentions and decisions. To promote the adoption of environmentally friendly products or packaging, policymakers and marketers should develop social advertising campaigns that resonate with consumers' moral norms,</i></p>

Topic	Definition: ‘Business Sustainability is...
	<p><i>attitudes, and perceived behavioral control. Moreover, in response to environmental sustainability crises, companies can facilitate consumers’ willingness, such as to actively engage in renewable energy usage and the utilization of eco-friendly products. These efforts directly reflect the company’s commitment to sustainability values and contribute to addressing urgent environmental challenges.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘consumer behavior’ involves recognizing and integrating consumers’ personal norms and perceived behavioral control to promote the consumption of environmentally friendly products and minimize pollution through effective waste management practices, thereby encouraging sustainable consumption behavior (Park and Ha, 2014; S. Wang et al., 2018b). This approach involves developing strategies to mitigate environmental pollution stemming from various sources, such as the use of plastic (T’ing et al., 2020), by collaborating with consumers to establish a sustainability model. This model encompasses factors like corporate values, technology adoption, recycling, and waste management protocols, and ethical considerations (Ekasari and Zaini, 2020; W. Sun, 2020; Ramzan et al., 2021). It influences sustainable purchasing behavior by navigating the dynamic interplay between business influences and consumer perceptions of sustainability (Lu and GURSOY, 2017; Y.-J. Choi and Park, 2020; H.-W. Jang and Lee, 2021). Consequently, it impacts consumers’ intentions to invest in renewable energy, procure and utilize green products, advocate through positive word-of-mouth, endorse recycling initiatives, and reduce plastic usage and pollution (L. Zhang et al., 2020; Wasaya et al., 2022). These decisions are shaped by consumers’ environmental concerns, knowledge, beliefs, comfort with ambiguity, ethics, attitudes, perceived behavioral control, and subjective norms (S. Wang et al., 2018b; Lam et al., 2022).</p>
Topic 14 Workplace	<p><i>... the alignment of leadership practices and employee behavior in the working environment to promote the sustainable development of an organization. It involves promoting a clear, ethical, and authentic leadership style that enables employees to understand the organizational values and build strong engagement with organization. Such alignment cultivates a corporate culture that is imbued with a sustainability mindset and directs organizational activities toward purposeful endeavors that contribute to long-term development and positive impact on the workplace.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘workplace’ aims to empower organizational leaders to cultivate a supportive culture and build trust in the employee-organization relationship that is associated with innovative behavior in the workplace (M. Li et al., 2016; M.-C. Yu et al., 2018). One effective approach is the adoption of transformational, ethical, and authentic leadership, which has a positive impact on employee work engagement (X. Zhang and Yao, 2019; E. Jang and Kim, 2021). This leadership style plays a critical role in fostering an organizational environment that places a premium on employee well-being (Vila-Vázquez</p>

Topic	<i>Definition: ‘Business Sustainability is...</i>
	<p>et al., 2018; H.-J. Choi, 2021; E. Jang and Kim, 2021; Wen et al., 2021). To achieve this objective, organizations can prioritize sustainability concepts and employ strategies such as enhancing employee self-awareness and self-development through job autonomy, effectively communicating organizational ethics and values, and promoting leadership practices that emphasize sustainability principles (Q. Zhou et al., 2019; Y. Liu et al., 2022). Carmeli et al. (2017) assert that an organizational ethic of care is directly linked to employee engagement in sustainability-related behaviors at work. This correlation is influenced by employees’ emotional responses to the organization’s sustainability efforts, both directly and indirectly, through increased organizational identification (Zhao et al., 2021). Through the implementation of these approaches, companies can drive positive change, enhance employee engagement, and instill a sustainability mindset throughout the workplace (Carmeli et al., 2017; Vila-Vázquez et al., 2018).</p>
Topic 15 Educational Knowledge and Skill Development	<p><i>... the educational cultivation of knowledge and skills aimed at fostering sustainable business practices. It involves guiding practitioners, managers, and students through reflective activities following practical engagement, encouraging active participation in academic discourse. It also involves promoting digital literacy through e-learning platforms and facilitating the mastery and application of personal development tools to become leaders in sustainability.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘knowledge and skills development’ seeks to identify tools and methodologies for creating effective strategies that promote sustainable business practices within the learning and skills acquisition process (Berkvens, 2012; Bien and Sassen, 2020; Haney et al., 2020; Hays and Reinders, 2020). By emphasizing digital literacy, academic engagement, and a balanced curriculum in e-learning environments, institutions strive to equip students with the capabilities needed to navigate the digital landscape and contribute to sustainable future practices (H. J. Kim et al., 2019). For instance, evidence has shown that ‘E-learning’ serves as an effective platform for delivering training on product lifecycle management in manufacturing companies. Moreover, incorporating practical training through case studies enriches learners’ understanding of the subject matter (Kakehi et al., 2009; Chua and Bernardo, 2011). Furthermore, recognizing the influence of teacher expectations, local expertise, and constructive learning environments underscores the central role of educators and institutions in shaping sustainable skill development (Spelt et al., 2015; Johnston et al., 2021). The integration of active learning methods and self-evaluation processes enhances students’ cognitive skills and self-awareness, ultimately fostering a new generation of business sustainability leaders committed to knowledge sharing and sustainable behaviors (Uher et al., 2022).</p>
Topic 16 Financial Management	<p><i>... the strategic alignment of government policies, regulatory frameworks, and strategic financial practices to ensure that businesses effectively navigate risks and capitalize on opportunities in the marketplace. It includes integrating fiscal policies, such as taxation and macroeconomic stability considerations, to navigate effectively economic fluctuations and build business resilience. Sustainable financial management optimizes portfolio composition to maximize</i></p>

Topic	Definition: ‘Business Sustainability is...
	<p><i>return relative to risk, thereby fostering longevity of investment strategies. Transparency and fairness in the carbon finance market increase investor confidence and strengthen the economic and environmental sustainability of the financial system.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘financial management’ is strongly involved with government policies and regulations that define the market for sustainability (Hsing, 2005; Hobbs and Schneller, 2012). These fiscal policies exert substantial influence on the economic environment, not only affecting business costs and prices through mechanisms such as carbon pricing, but also providing incentives for companies to adopt sustainable financing and investment approaches (Bajo-Rubio et al., 2009; Chen and Hu, 2018). For example, the role of sustainable debt policies in promoting financial stability within selected eurozone countries. Businesses operating within these nations find their economic prospects closely tied to the sustainability of fiscal policies (Fincke and Greiner, 2012). In addition, the overall goal is to mitigate the impact of fiscal policy, liquidity risk, information disparities, and market dynamics on both corporate sustainability and financial outcomes (C.-C. Lee and Zeng, 2011; Hur et al., 2018; S. Kim et al., 2021). By addressing sustainability deficits, inflation, underperforming investments, current account imbalances, and market inefficiencies, businesses can enhance their long-term viability (Greiner et al., 2007; Yaqiong, 2011; Huang et al., 2021). At the core of this concept lies the crucial task of accurately evaluating risks and opportunities. This assessment not only guides sustainable business practices but also drives progress and innovation within the marketplace (Latief and Lefen, 2018; S. Kim et al., 2021).</p>
Topic 17 Global Economic Development	<p><i>... the balancing of different factors to support economic prosperity in different regions and countries and to promote long-term economic growth and sustainability. The sustainability of business and the economy as a whole considers the role of natural capital in the production process and its impact on the growth process. Meanwhile, by incorporating the flow of energy and materials into the economy, the services provided by nature can be properly valued in the accounting system of neoclassical environmental and resource economics. Moreover, it allows for poverty reduction policies to be tailored in each region based on its specific natural endowments.’</i></p> <p>CONTEXT:</p> <p>Business sustainability in the field of ‘global economic development’ aims to promote economic growth while considering various factors such as the efficiency of spending on business growth, industry specialization, labor flow, access to credit for the poor, family capital, spatial agglomeration, regional integration, and the valuation of natural resources and services in different locations (Ghatak and Guinnane, 1999; Guoyu and Qingli, 2011; Fernandez-Feijoo et al., 2019; Kokocińska et al., 2020). Moreover, the success and sustainability of family businesses are significantly influenced</p>

Topic	<i>Definition: 'Business Sustainability is...</i>
	<p>by economic vulnerability, income, owner experience, and family and business processes (Danes et al., 2009). To ensure sustainability, the role of natural capital in the production process should be considered. A broad vision for the economy and society is necessary to underpin sustainable competitiveness, and economic behavior depends on social context and co-evolves with the biophysical universe (England, 2000; Gowdy and Iorgulescu Polimeni, 2005). The aim of regional integration in developing regions is to improve competitiveness, attract investment, and negotiate better access to new and existing markets (Tian Yuan et al., 2018; Krapohl, 2020).</p>

Table 8 Topic classification matrix based on three criteria

Topic	Classification Criteria		
	<i>Primary Focus</i>	<i>Scale of Impact</i>	<i>Type of Sustainability</i>
T1	resource management	organizational	economic
T2	resource management	local	environmental and social
T3	policy and governance	global	all three types
T4	policy and governance	organizational	social and economic
T5	resource management	global	environmental
T6	policy and governance	organizational	economic
T7	operations	organizational	economic
T8	policy and governance	global	environmental
T9	market interactions	community	social
T10	resource management	global	environmental and economic
T11	operations	global	environmental
T12	market interactions	market	social and economic
T13	market interactions	market	environmental and social
T14	operations	organizational	social
T15	operations	organizational	social
T16	policy and governance	global	economic
T17	policy and governance	global	economic

Table 9 Theories used in BuS studies

No.	Theory Name	By Discipline	Article Count	Percentage (%)
1	grounded theory	methodology	558	10.1
2	stakeholder theory	multidisciplinary (management/business ethics)	516	9.3
3	institutional theory	multidisciplinary (sociology/political science/management)	442	8.0
4	triple bottom line	interdisciplinary (economics/ecology/sociology)	245	4.4
5	systems theory	interdisciplinary (mathematics/sociology/engineering)	237	4.3
6	game theory	multidisciplinary (mathematics/economics)	221	4.0
7	network theory	multidisciplinary (mathematics/sociology/computer science)	176	3.2
8	agency theory	multidisciplinary (economics/management)	158	2.8
9	resource dependence theory	management	157	2.8
10	economic theory	economics	141	2.5
11	legitimacy theory	multidisciplinary (political science/sociology/management)	133	2.4
12	fuzzy set theory	mathematics	127	2.3

No.	Theory Name	By Discipline	Article Count	Percentage (%)
13	theory of planned behavior	psychology	120	2.2
14	social exchange theory	sociology	102	1.8
15	contingency theory	management	80	1.4
16	capital theory	multidisciplinary (sociology/psychology)	71	1.3
17	identity theory	multidisciplinary (economics/sociology)	71	1.3
18	signaling theory	economics	69	1.2
19	complexity theory	interdisciplinary (mathematics/physics/social sciences)	64	1.2
20	practice theory	interdisciplinary (sociology/philosophy)	64	1.2
21	marketing theory	marketing	52	0.9
22	social identity theory	psychology	51	0.9
23	organizational theory	management	49	0.9
24	value theory	philosophy	49	0.9
25	social capital theory	sociology	48	0.9
26	prospect theory	economics/psychology	47	0.8
27	social theory	sociology	46	0.8

No.	Theory Name	By Discipline	Article Count	Percentage (%)
28	complex adaptive system	interdisciplinary (mathematics/physics/biology/ computer science/social sciences)	41	0.7
29	graph theory	mathematics	41	0.7
30	utility theory	economics	39	0.7
31	cognitive theory	psychology	37	0.7
32	critical theory	interdisciplinary (philosophy/sociology/politics)	36	0.6
33	social cognitive theory	psychology	35	0.6
34	social network theory	sociology	33	0.6
35	choice theory	psychology	32	0.6
36	development theory	multidisciplinary (sociology/economics/political science)	32	0.6
37	theory of transaction cost	economics	32	0.6
38	information processing theory	psychology	31	0.6
39	rough set theory	mathematics/computer science	31	0.6
40	dependency theory	sociology	29	0.5

No.	Theory Name	By Discipline	Article Count	Percentage (%)
41	diffusion of innovations theory	communications / sociology	29	0.5
42	control theory	psychology	27	0.5
43	entrepreneurship theory	management	27	0.5
44	dynamic capability theory	management	26	0.5
45	resource based theory	management	26	0.5
46	stewardship theory	management	26	0.5
47	transition theory	interdisciplinary (sociology/psychology/environmental studies)	26	0.5
48	process theory	management	25	0.5
49	social practice theory	sociology	25	0.5
50	evolutionary theory	biology	24	0.5
51	protection motivation theory	psychology	24	0.5
52	structuration theory	sociology	23	0.4
53	attribution theory	psychology	22	0.4
54	ecological systems theory	interdisciplinary (ecology/psychology/sociology)	21	0.4
55	cultural theory	psychology/ sociology/anthropology	20	0.4

No.	Theory Name	By Discipline	Article Count	Percentage (%)
56	grey systems theory	mathematics/engineering	20	0.4
57	resilience theory	ecology/psychology/sociology	20	0.4
58	activity theory	interdisciplinary (management/ psychology/education/human-computer interaction)	19	0.4
59	social movement theory	sociology/politics	19	0.4
60	upper echelon theory	management	19	0.4
61	regime theory	politics	18	0.3
62	actor network theory	sociology	17	0.3
63	construal level theory	Psychology	17	0.3
64	organizational learning theory	interdisciplinary (management/psychology/ sociology/anthropology)	17	0.3
65	role theory	sociology/psychology	17	0.3
66	theory corporate social responsibility	business ethics/management/sociology	17	0.3
67	general systems theory	interdisciplinary (mathematics/biology/engineering/social sciences)	15	0.3

No.	Theory Name	By Discipline	Article Count	Percentage (%)
68	item response theory	mathematics/statistics	15	0.3
69	regulation theory	economics/politics	15	0.3
70	social learning theory	sociology/psychology	15	0.3
71	culture theory	multidisciplinary (anthropology/sociology/cultural studies)	13	0.2
72	strategic management theory	management	13	0.2
73	strategy theory	management	13	0.2
74	chaos theory	mathematics	12	0.2
75	complex network theory	interdisciplinary (mathematics/physics/biology/computer science/social sciences)	12	0.2
76	consumer culture theory	marketing/sociology	12	0.2
77	information theory	mathematics/computer science	12	0.2
78	theory human capital	economics	12	0.2
79	modern portfolio theory	mathematics/finance	11	0.2
80	norm activation theory	psychology	11	0.2

No.	Theory Name	By Discipline	Article Count	Percentage (%)
81	complex systems theory	interdisciplinary (mathematics/physics/computer science/economics/social sciences)	10	0.2
82	regulatory focus theory	psychology	10	0.2
83	theory of real option	multidisciplinary (methodology/economics)	10	0.2
84	rational choice theory	sociology/ economics	9	0.2
85	cumulative prospect theory	economics	8	0.2
86	optimal control theory	mathematics	8	0.2
87	social role theory	multidisciplinary (sociology/psychology)	8	0.2
88	corporate governance theory	management	7	0.1
89	extreme value theory	mathematics/statistics	7	0.1
90	microeconomic theory	economics	7	0.1
91	organizational information processing theory	management	7	0.1
92	strategic choice theory	multidisciplinary (sociology/management)	7	0.1
93	sustainable development theory	interdisciplinary (economics/sociology/political science)	7	0.1
94	endogenous growth theory	economics	6	0.1

No.	Theory Name	By Discipline	Article Count	Percentage (%)
95	interdependence theory	psychology	6	0.1
96	transformative learning theory	education	6	0.1
97	innovation system theory	interdisciplinary (economics/sociology)	5	0.1
98	normalization process theory	sociology	5	0.1
99	path dependence theory	economics/sociology	5	0.1
100	transition management theory	sociology/politics	5	0.1
101	world systems theory	sociology	5	0.1
102	impression management theory	psychology	4	0.1
103	labor process theory	sociology	4	0.1
104	multi attribute value theory	economics/management	4	0.1
105	neoclassical economic theory	economics	4	0.1
106	public value theory	politics/management	4	0.1
107	supply chain management theory	management	4	0.1
108	business management theory	management	3	0.1

No.	Theory Name	By Discipline	Article Count	Percentage (%)
109	business model innovation theory	management	3	0.1
110	cognitive behavior theory	psychology	3	0.1
111	innovation management theory	management	3	0.1
112	Marxist theory	multidisciplinary (politics/economics/sociology)	3	0.1
113	moral development theory	psychology	3	0.1
114	multi attribute utility theory	economics/management	3	0.1
115	organizational identity theory	multidisciplinary (management/psychology)	3	0.1
116	social marketing theory	marketing	3	0.1
117	competitive-advantage theory	management	2	0.0
118	discrete choice theory	multidisciplinary (economics/marketing/mathematics)	2	0.0
119	disruptive innovation theory	management	2	0.0
120	economic growth theory	economics	2	0.0
121	expectancy value theory	psychology	2	0.0

No.	Theory Name	By Discipline	Article Count	Percentage (%)
122	green innovation theory	sociology	2	0.0
123	market process theory	economics	2	0.0
124	natural capital theory	interdisciplinary (ecology/economics)	2	0.0
125	neoclassical growth theory	economics	2	0.0
126	occupational choice theory	economics	2	0.0
127	relationship management theory	management	2	0.0
128	relationship marketing theory	marketing	2	0.0
129	resource-advantage theory	marketing	2	0.0
130	social innovation theory	sociology	2	0.0
131	system innovation theory	interdisciplinary (economics/sociology)	2	0.0
132	theory of sustainability	interdisciplinary (economics/sociology/ ecology/management)	2	0.0
133	change process theory	multidisciplinary (psychology/management)	1	0.0
134	comparative management theory	management	1	0.0
135	consumer choice theory	economics	1	0.0
136	dual process theory	psychology	1	0.0

No.	Theory Name	By Discipline	Article Count	Percentage (%)
137	evolutionary growth theory	economics	1	0.0
138	marketing strategy theory	marketing	1	0.0
139	neo-institutional theory	sociology	1	0.0
140	organizational role theory	interdisciplinary (psychology/sociology/management)	1	0.0
141	political process theory	politics	1	0.0
142	risk management theory	interdisciplinary (economics/psychology/sociology/management)	1	0.0
143	s-curve innovation theory	multidisciplinary (economics/management)	1	0.0
144	self-determination theory	psychology	1	0.0
145	socio- technical system theory	interdisciplinary (sociology/engineering/management)	1	0.0
146	socio-technical transition theory	sociology/economics	1	0.0
147	sociological role theory	sociology	1	0.0
148	sustainability management theory	interdisciplinary (economics/sociology/ecology/management)	1	0.0

No.	Theory Name	By Discipline	Article Count	Percentage (%)
149	sustainability transition theory	interdisciplinary (economics/sociology/ecology/management)	1	0.0
150	transaction cost economics	economics	1	0.0

Table 10 Theory gap analysis in 17 topics

Top 20 Theories		Discipline	Topics*																
			T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17
1	grounded theory	methodology	36	12	76	70	8	10	26	10	18	34	14	182	24	6	16	12	6
2	stakeholder theory	multidisciplinary (management/business ethics)	14	5	26	185	3	26	9	5	13	30	136	23	2	5	2	30	6
3	institutional theory	multidisciplinary (sociology/political science/management)	28	5	80	44	3	11	13	7	3	33	167	17	5	7	2	10	7
4	triple bottom line	interdisciplinary (economics/ecology/sociology)	14	X	7	50	7	38	X	3	X	28	28	31	16	7	2	X	X
5	systems theory	interdisciplinary (mathematics/sociology/engineering)	12	5	46	13	56	20	7	3	X	13	6	33	X	4	4	7	8
6	game theory	multidisciplinary (mathematics/economics)	11	4	12	5	19	23	1	6	4	19	3	8	X	1	X	100	5
7	network theory	multidisciplinary (mathematics/sociology/computer science)	26	5	49	9	16	5	3	X	19	9	4	22	1	4	1	2	1
8	agency theory	multidisciplinary (economics/management)	11	X	13	7	3	7	8	X	16	12	35	4	X	2	X	26	14
9	resource dependence theory	management	30	2	3	7	X	2	3	2	17	39	33	1	X	X	3	12	3
10	economic theory	economics	8	2	28	4	7	8	2	13	X	2	1	8	2	X	1	24	31

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11	legitimacy theory	multidisciplinary (political science/sociology/management)	1	X	19	13	X	24	7	3	4	1	46	3	X	X	X	24	3
12	fuzzy set theory	mathematics	1	1	X	1	5	90	2	5	X	6	2	3	3	X	2	2	4
13	theory of planned behavior	psychology	1	8	2	1	X	1	X	X	1	1	2	X	98	1	1	1	2
14	social exchange theory	sociology	1	1	2	4	1	1	3	1	9	6	10	12	18	31	X	1	X
15	contingency theory	management	17	X	1	3	1	3	7	X	X	13	28	4	X	1	X	1	1
16	capital theory	multidisciplinary (economics/sociology)	10	1	5	3	2	X	1	2	14	1	8	5	4	2	3	2	7
17	identity theory	multidisciplinary (sociology/psychology)	2	X	2	10	X	X	X	X	3	X	7	4	14	27	X	1	1
18	signaling theory	economics	4	1	3	9	X	6	2	1	2	2	19	2	7	2	X	8	1
19	complexity theory	interdisciplinary (mathematics/physics/social sciences)	X	12	12	4	18	X	1	X	2	4	1	10	2	X	X	X	3
20	practice theory	interdisciplinary (sociology/philosophy)	X	2	21	3	X	X	1	12	3	1	X	17	3	X	1	X	X

* Notes: The number in each column represents the total number of articles within each topic that utilize the specified theoretical lens. A 'cross'(X) indicates that the theory was not used in that particular topic.

Table 11: Future research agenda: major topics

Major Topics	Key Research Questions	Possible Theory Lenses
Consumer Behavior	How do policy announcements and shifts in focus influence the trajectory of sustainable consumption, and what are the major underlying mechanisms?	<ul style="list-style-type: none"> • Legitimacy Theory • Theory of Planned Behavior
	What factors contribute to the prominence of BuS research in consumer behavior, and how do these dynamics shape scholarly attention?	<ul style="list-style-type: none"> • Consumer Culture Theory • Institutional Theory • Diffusion of Innovation Theory
	To what extent does consumer demand serve as a primary driver motivating BuS study?	<ul style="list-style-type: none"> • Stakeholder Theory • Social Identity Theory • Market Process Theory • Social Market Theory
Governance and Policy	How does the frequency of sustainability policy announcements affect the feasibility of BuS implementation?	<ul style="list-style-type: none"> • Strategic Management Theory • Signaling Theory
	What impact does the frequency of policy announcements have on the effectiveness of private sector initiatives?	<ul style="list-style-type: none"> • Stakeholder Theory • Agency Theory • Transaction Cost Economics • Risk Management Theory

Major Topics	Key Research Questions	Possible Theory Lenses
	How does the frequency of policy updates affect the willingness of companies to participate in international governance bodies such as the United Nations?	<ul style="list-style-type: none"> • Agency Theory • Transaction Cost Economics • Institutional Theory
Tourism Service Framework	What are the key drivers of sustainable tourism development?	<ul style="list-style-type: none"> • Systems Theory • Sustainable Development Theory • Consumer Culture Theory • Norm Activation Theory
	How can they be leveraged to bring about substantial change in tourist behavior?	<ul style="list-style-type: none"> • Resource-Based Theory • Systems Theory
Resource-Driven and Competitive Advantage	What does sustainability mean to business, and how can companies develop a competitive advantage by becoming sustainable?	<ul style="list-style-type: none"> • Resource Dependence Theory: • Dynamic Capability Theory • Natural Capital Theory
Environmental Management	How can companies balance investing in environmental sustainability with financial continuity to help ensure sustainable development?	<ul style="list-style-type: none"> • Ecological Systems Theory • Legitimacy Theory • Complex Systems Theory
Decision-Making Method	How can digital technologies be effectively integrated to optimize resource allocation,	<ul style="list-style-type: none"> • Information Processing Theory • Decision Theory • Complexity Theory

Major Topics	Key Research Questions	Possible Theory Lenses
	risk assessment, and strategic planning processes?	
Financial Management	Is BuS itself represent an inherently sustainable practice?	<ul style="list-style-type: none"> • Corporate Social Responsibility Theory • Capital Theory • Resource-Based Theory
Stakeholder Engagement	How can companies effectively balance the diverse needs of stakeholder groups during an economic downturn?	<ul style="list-style-type: none"> • Stakeholder Theory • Social Capital Theory • Resource Dependence Theory
	What strategies can be used to identify and prioritize key stakeholders in tough economic times?	<ul style="list-style-type: none"> • Social Exchange Theory • Stakeholder Theory • Network Theory
Workplace	What types of leadership styles can most effectively amplify the impact on employee well-being and cultivate sustainable behaviors?	<ul style="list-style-type: none"> • Leadership Theory • Organizational Theory • Social Identity Theory

Table 12 Future research agenda: minor topics

Minor Topics	Future Research Agenda	Possible Theory Lens
Sustainable Supply Chain Management	What are the most effective ways to integrate the BuS concept into end-to-end supply chain operations?	<ul style="list-style-type: none"> • Supply Chain Management Theory • Resource-Based Theory • Dynamic Capability Theory
	How can supply chain processes be made more efficient through BuS initiatives, rather than through greenwashing?	<ul style="list-style-type: none"> • Legitimacy Theory • Institutional Theory
Ecosystem Management	How do businesses ensure their operations do not harm ecosystems?	<ul style="list-style-type: none"> • Ecological Systems Theory. • Stakeholder Theory • Institutional Theory • Corporate Social Responsibility Theory
	How can the electric vehicle industry measure and mitigate the long-term environmental impacts of its operations, particularly with regard to water usage in the extraction of lithium and rare earth metals?	<ul style="list-style-type: none"> • Natural Capital Theory • Resource-Advantage Theory • Resource Dependence Theory • Legitimacy Theory
Global Economic Development	What factors influence the resilience of global economic development initiatives in BuS across periods of economic slowdown?	<ul style="list-style-type: none"> • Resilience Theory • Complexity Theory • Resource Dependence Theory

Minor Topics	Future Research Agenda	Possible Theory Lens
	How can policies be effectively designed to promote sustained global economic growth?	<ul style="list-style-type: none"> • Institutional Theory • Sustainable Development Theory • Transition Theory

Table 13 Future research agenda: overall topics

Overall Topics	Future Research Agenda	Possible Theory Lens
Following BuS Trends	How will the governance aspect of BuS become less important over time?	<ul style="list-style-type: none"> • Institutional Theory • Legitimacy Theory • Resource Dependence Theory • Stakeholder Theory
	How do the UN 17 SDGs affect research in BuS? How are they relevant?	<ul style="list-style-type: none"> • Legitimacy Theory • Resource Dependence Theory • Dynamic Capability Theory • Stakeholder Theory
	What is causing the decline in BuS studies amidst the economic downturn?	<ul style="list-style-type: none"> • Resource-Based Theory • Institutional Theory • Contingency Theory • Strategic Management Theory
	Why are we observing a prioritization of competitiveness and economic growth over sustainability in BuS practices?	<ul style="list-style-type: none"> • Resource Dependence Theory • Institutional Theory • Competitive-Advantage Theory • Agency Theory

	<p>Why do companies sometimes use BuS concept to target consumers who base lack comprehensive knowledge about sustainability, leading them to make decisions based on superficial perceptions and potentially fall prey to greenwashing tactics?</p>	<ul style="list-style-type: none">• Consumer Culture Theory• Signaling Theory• Theory of Planned Behavior• Legitimacy Theory
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