

Charting Architecture of Green Venture Capital Research: Insights from Bibliometric Analysis, Systematic Literature Review through TCM Model

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Abstract

Purpose

Green Venture Capital has recently received increasing attention as a way of financing environmentally sustainable entrepreneurs, especially after the Paris Agreement 2015 and this led to greater global commitments regarding climate action. The objective of the study is to map intellectual and thematic evolution of Green Venture Capital research and investigate the theoretical, contextual and methodological development.

Methodology

The current study carries a focused bibliometric assessment of the existing literature on Green Venture Capital, examining the intellectual structure of the field by analyzing the research trends, knowledge and thematic development and systematic review through Theory–Context–Method (TCM) framework.

Findings

The research is specifically concentrated around Institutional Theory and Resource Based View theory leaving behavioural and cognitive related theories less represented. Contextual perspectives indicate higher dominance in developing economies. Methodological approach shows statistical and qualitative methods are widely adopted leaving longitudinal and other approaches marginally represented.

Research Implications.

The GVC literature is methodically tilted towards the developed economies and high-growth and technology-intensive areas. As a result, the largest majority of the most environmentally exposed populations in the world are left without an adequate financial structure and investment paradigm.

Practical Implications

The results provides practical implications for Investors, GVC fund managers, Entrepreneurs and Green startup founders by informing them to implement ESG due diligence procedures for long-term market positioning and supply chain robustness, especially in underrepresented and marginal sectors.

Value

The study incorporates combined review techniques giving a holistic understanding of the research field. The insights generated will guide future research endeavours.

Keywords- Green Venture Capital; Sustainability; Bibliometric Analysis; Systematic Review; TCM Model

1. Introduction

Governments, industries, and civil society struggling with weather extremes, declines in biodiversity, increases in sea level, and food chain instability caused by ecological degradation. The question of how to utilise the use of capital towards environmental purposes has shifted from the margins of the economic discourse to the centre. Green Venture Capital (GVC) is an important tool of sustainability transition because it directs high-risk, high-reward private funding into ventures that bring environmental value and financial returns. The magnitude of this change is hard to articulate. One of the highest sector investments in the global VC ecosystem is 35% of venture financing placed in green technology (Business Research Insights, 2026). Venture funds with climate focus have become increasingly ambitious and more numerous: 27 funds founded in the first nine months of 2024 have raised a total of \$7.1 billion, in contrast to 26 funds raising money in 2023 (Venture Capital Journal, 2024), which shows a growing institutional belief in the commercial viability of green technology. Banks and other financial institutions are putting in record investments: JPMorgan is investing up to \$10 billion in direct equity and venture capital investment as part of a \$1.5 trillion program to invest in batteries, nuclear, and solar technology, and Brookfield Asset Management is raising 20 billion dollars to invest in the clean-energy transition (Bloomberg, 2025). Although the market is slowing down, the enterprise value of global climate tech companies was at an all-time high of 3.4 trillion in 2024, indicating that investors are confident in the long-term prospects of the sector (Quillao, 2025). The climate tech finance dropped by 29 percent in the fourth quarter of 2022 to the third quarter of 2023, as compared to the previous 79 billion to 56 billion, respectively (PwC, 2024). According to Carbon Credits (2025), the amount of global climate tech venture capital investment has reduced by 34% between 2022 and 2023 and 2022 and 2024, to \$19.7 billion and \$17 billion, respectively. This retrenchment was caused by increasing interest rates, macroeconomic uncertainty, and AI-related investment competition. AI accounted for 25% of worldwide VC funding in 2025, up from 15% in 2024 and 7% in 2023 (Bain & Company, 2025), putting huge competitive pressure on climate-oriented transaction flow. Nevertheless, in the first nine months of 2025, the investment in clean energy, storage, and electric vehicle businesses totalled to \$56 billion by both private and public investors around

the globe, compared to the entire year of 2024 (Energy Connects, 2025), a signal of a newfound enthusiasm due to energy security needs, AI-linked power demand, and long-term policy commitments in leading economies. Never the GVC policy architecture been this crucial. The first three quarters of 2024 saw US AI-based climate businesses raise more than they did in 2023 due to the Inflation Reduction Act and other policies, hitting a total of over \$1 billion (PwC, 2024). The ESG and sustainability-oriented companies in the EU are sponsored by government-supported programs and startup accelerators (Business Research Insights, 2026). In spite of the swift growth and strategic significance of GVC, the theoretical background of the concept, as well as its geographical and academic range, is surprisingly fragmented. Such disconnect between practice and academic research jeopardises academic integrity and the standard of policy frameworks, investment policies, and institutional designs based on rigorous research. The research on the topic of venture capital via bibliometrics is vast, yet the literature review regarding GVC has not been conducted in depth (Dayal et al., 2023). The studies on green finance, sustainable entrepreneurship, and ESG investing have constantly highlighted the absence of an integrated approach towards the consideration of GVC as a distinct research topic. The sources of private capital to green startups are increasingly becoming more diverse, although limited data exists and is biased to well-established North American and European ecosystems (Mukherjee et al., 2024). The current literature has identified some interrelated gaps. First, there is the mechanism gap with regard to the insufficient consideration of the integration of GVC investments with venture capabilities, innovation processes, and sustainability performance. Second, there is the context gap in relation to the imbalanced representation geographically and by industry of research on GVCs, as well as the insufficient consideration of how the heterogeneous nature of the institutional environment impacts investment effectiveness. Third, there is the dynamic gap in relation to how little research has been done into how GVCs affect ventures in terms of development, scaling up, and future financing. The existence of such gaps highlights the need for a review that goes further than a mere description of the publication trend in order to cover the intellectual, theoretical, contextual, and methodological advancement of the GVC body of literature. The SLR and bibliometric approach can be quite helpful in uncovering the evolution, intellectual structure, thematic relations, and new topics of a fragmented field of research (Sabando-Vera et al., 2025).

This study answers the following research questions:

RQ1: How has the green venture capital field shown intellectual evolution, knowledge and thematic development ?

RQ2: What dominant theoretical underpinnings, contextual orientations, and methodological approaches convey about green venture capital research through TCM structure analysis ?

RQ3: What structural gaps and research imbalances are conveyed by the Theory-Context-Method framework in the field and develop future research frontiers based on the emerging evidence ?

2. Research Methodology

2.1 Research Design

The research study uses a hybrid approach to methodology, which involves a Systematic Literature Review (SLR) and focused bibliometric analysis to map, synthesis, and critically

analyse the academic literature on GVC. Collectively, these approaches offer a stringent evidence foundation as well as an analytically densely populated description of GVC as a growing research area (Sudan et al., 2023). The SLR process has been carried out in compliance with the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) guidelines, a standardised and internationally recognised methodology of systematic evidence synthesis. PRISMA was chosen due to its ability to cover the systematic coverage, reduce selection bias, and mandate the explicit reporting of inclusion and exclusion decisions at each phase of the review process standards, which is especially significant in an interdisciplinary area of study such as GVC, where pertinent research is disseminated in heterogeneous journals and disciplines.

2.2 Database Selection and Search Strategy

The SCOPUS database was the only source of literature retrieval chosen. SCOPUS is the largest abstract and citation database of peer-reviewed publications in the world, with full and uniform metadata such as author affiliation, number of citations, keywords, and subject category in the entire spectrum of disciplines of interest in GVC research, such as business, economics, environmental science, energy, and sociology. The search query was well designed to ensure that it reached the maximum depth of GVC studies and was specific enough not to include irrelevant literature. The search was conceptualised in terms of three layers of terms: (i) GVC-specific terminology that can describe the spectrum of labels used to describe sustainability-oriented venture investment; (ii) core venture finance constructs; and (iii) sustainability qualifiers. The final search query used in SCOPUS was as follows:

TITLE-ABS-KEY ((“Green Venture Capital” OR “Sustainable Venture Capital” OR “Climate Venture Capital” OR “Eco Venture Capital” OR “Impact Venture Capital”) AND (“Venture Capital” OR “VC investment” OR “Start up financing” OR “Entrepreneurial finance”) AND (“sustainability” OR “Eco friendly”))

The search was limited to studies from 2015 to make certain that the review is covering the period of significant scholarly activity in the area of GVC research, as the bibliometric evidence indicates that the area was still in its infancy prior to 2015. The topic area narrows down restricted access to the six most directly relevant SCOPUS categories: Business, Management and Accounting (BUSI); Economics, Econometrics, and Finance (ECON); Social Sciences (SOCI); Environmental Science (ENVI); Agricultural and Biological Sciences (AGRI); and Energy (ENER). The types of documents were restricted to peer-reviewed articles (ar), review articles (re), book chapters (ch), conference papers (cp), and books (bk) to provide scholarly quality and avoid non-peer-reviewed commentaries. The language filter was used to filter the results to include only English-language publications, which is part and parcel of the conventions of global bibliometric analysis. An open-access filter (OA: all) was used to guarantee that the full text is available to go through the stage of eligibility screening of the full text. The initial corpus of 142 documents was retrieved through this search strategy that was implemented in Feb 2026.

2.3 Inclusion and Exclusion Criteria

A set of inclusion and exclusion criteria was carefully employed in sequential steps of the screening process to guarantee that the final corpus was well representative of the GVC literature and that the corpus met the goals of the study. Articles were selected based on the following criteria: (i) they had to capture a core phenomenon of green, sustainable, climate-

oriented, eco-oriented, or impact-focused venture capital; (ii) they had to engage substantially with the themes of venture finance, entrepreneurial investment, or sustainability-oriented capital allocation; (iii) they were supposed to be published in or since 2015. The documents which were not eligible where (i) only discussed venture capital in a generic sense, without any sustainability or environmental aspect; or (ii) were a green finance instrument other than an equity-based venture investment (e.g., green bonds, sustainability loans) and not related to the GVC nexus. (iii) were duplicate, editorial, correction, or retraction; or (iv) lacked the required level of methodological details.

2.4 PRISMA Screening Process

The process of document selection followed four consecutive steps as per the PRISMA 2020 framework: identification, screening, eligibility evaluation, and final inclusion (Selçuk, 2019; Sarkis-Onofre et al., 2021). The SCOPUS search query (identification stage) identified 142 documents. Additional searches of databases were not performed at this level, but backward citation searching was performed later as an auxiliary. During the screening phase, all 142 retrieved documents were screened against the inclusion and exclusion criteria by reading their titles and abstracts. This initial screening led to the exclusion of 52 documents that were evidently not aligned with the focus of the study—principally those studies where venture capital was mentioned only incidentally in the context of sustainability themes or articles that were found to be duplicates or were automatically filtered as inappropriate types of documents. The 90 papers went through the eligibility process, where complete texts were received and read through to the end. This more granular assessment disclosed 20 further documents that failed to pass the inclusion criteria on close reading—mainly studies that dealt with related concepts (like green bonds, corporate sustainability reporting, or general ESG frameworks) without substantively engaging with the phenomenon of venture capital, or studies whose empirical focus was too distant to be of relevance to this review. These 20 documents were omitted, and the corpus was narrowed down to 70 documents. To reduce the probability of overlooking studies that are influential but not included in the database search—a well-known limitation of any single-string, single-database search strategy—backward citation searching was performed on reference lists of the 70 documents included. This process led to the identification of 3 more studies that fulfilled all inclusion criteria but did not show up in the initial SCOPUS results, presumably owing to indexing errors or terminological differences. These 3 documents were added following full-text verification, bringing the final corpus to 73 documents included in the bibliometric analysis.

2.5 Analytical Framework

The 73 included documents were exported from SCOPUS in BibTeX format and imported into the Bibliometrix package in R for quantitative analysis. The analytical framework applied across these documents encompassed descriptive performance analysis (publication trends, life cycle); scientometric law testing (Lotka's Law for author productivity and Bradford's Law for journal concentration); logistic growth modelling of cumulative publication trajectories; keyword co-occurrence network analysis using the Louvain clustering algorithm; strategic thematic mapping using centrality and density metrics and the TCM framework for structured assessment of theoretical underpinnings, contextual orientations, and methodological approaches. Network visualisations were produced in VOSviewer (Aromataris et al., 2015), with Louvain-based community detection applied to identify research clusters and thematic communities within the co-occurrence network.

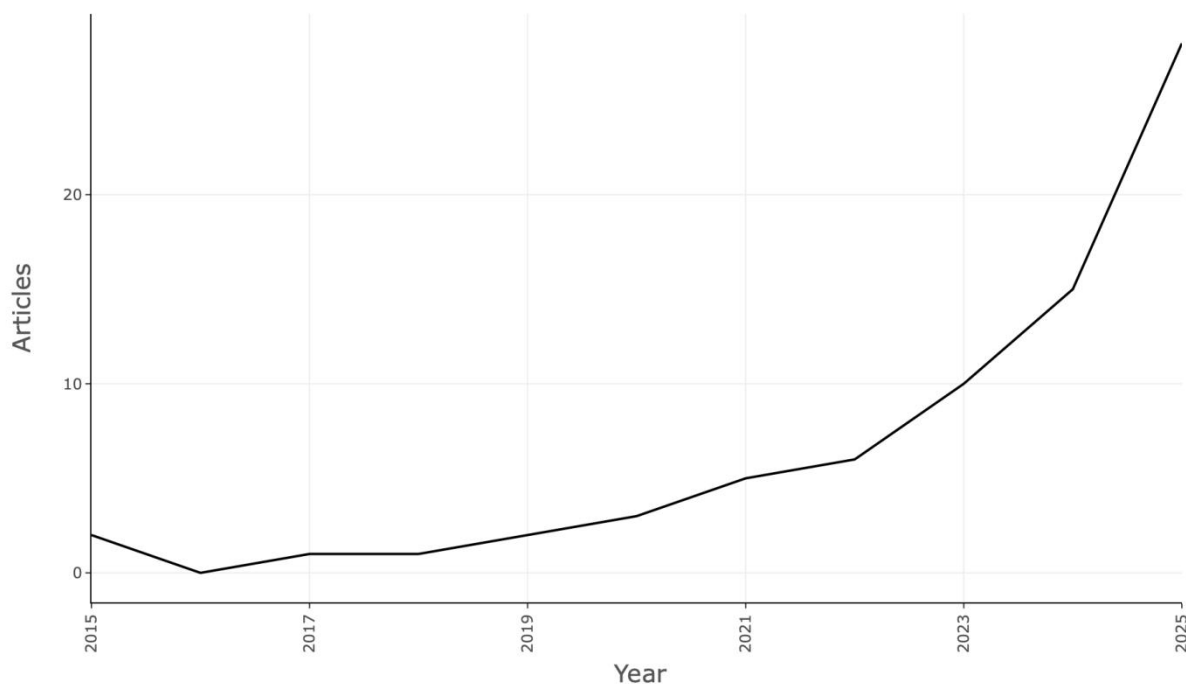
3. Descriptive Analysis

3.1 Intellectual Evolution in GVC research

3.1.1 Temporal distribution of publications

The time series of the publications presents an evident and speeding up increasing trend in the field of GVC and sustainability-focused entrepreneurial finance (see Figure 1). The data reveals that the level of scholarly production was still immature and incomplete in the period between 2015 and 2018, and the number of publications was 0-2 articles per year. This initial stage indicates the conceptual vagueness and a lack of academic coherence of GVC as a research stream. An inflection point appears after 2019, as the number of publications starts to increase, but at a slower pace (2019: 2; 2020: 3) indicating the first mainstreaming of sustainability in the context of venture financing. This shift is consistent with the increasing focus of climate finance, ESG investing, and policy-based sustainability agendas globally. In addition, this exponential increase (especially the almost doubling between 2024 and 2025) is an indication of a paradigm shift to the idea of sustainability-oriented capital allocation, as GVC has shifted to the core of research agendas in business, economics and environmental studies.

Figure 1. Temporal distribution of publications



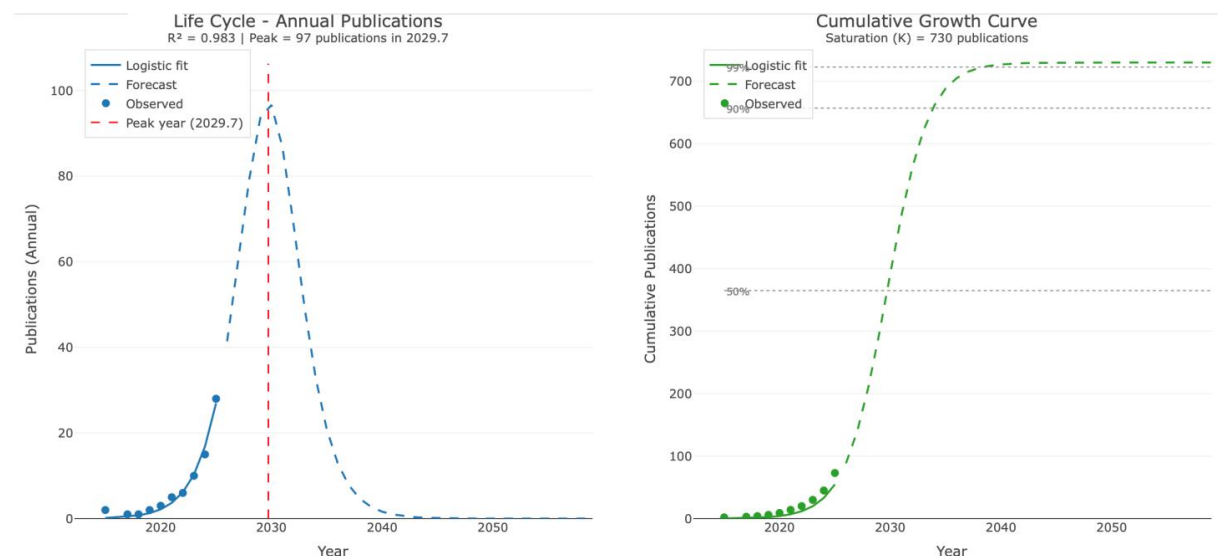
Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

3.1.2 Life Cycle

The scientific discipline has a typical logistic growth curve. An S-shaped pattern is evident in the Cumulative Growth Curve plot. First, the growth was slow (lag phase) between the years 2015 and around 2020-2021 (refer Figure 2). This was then succeeded by a phase of high growth

rate between 2021 and the current time, which signifies accelerating growth. The model projects that this rapid growth will be maintained up until about 2030 when it will begin to slow down slowly, approaching the plateau or saturation phase. The Life Cycle- Annual Publications plot that illustrates the growth rate (new publications per year) illustrates that there was a low annual output initially, and then it began to rapidly increase in terms of publications up to the present data point (approximately 2024-2025). The bell-shaped curve is predicted by the logistic fit, and the annual publications are expected to peak and then decrease. The inflection point (maximal growth rate on the cumulative curve, and annual publications peak) of this model is 2029.7. This is clearly seen visually with the steepest part of the cumulative S-curve and the peak point of the predicted annual publication curve. The logistic growth model explains about 98.3 percent of the variance in the cumulative data on publications. This shows that there is a very high level of correlation between the model predictions and the real observed number of publications.

Figure 2. Life Cycle



Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

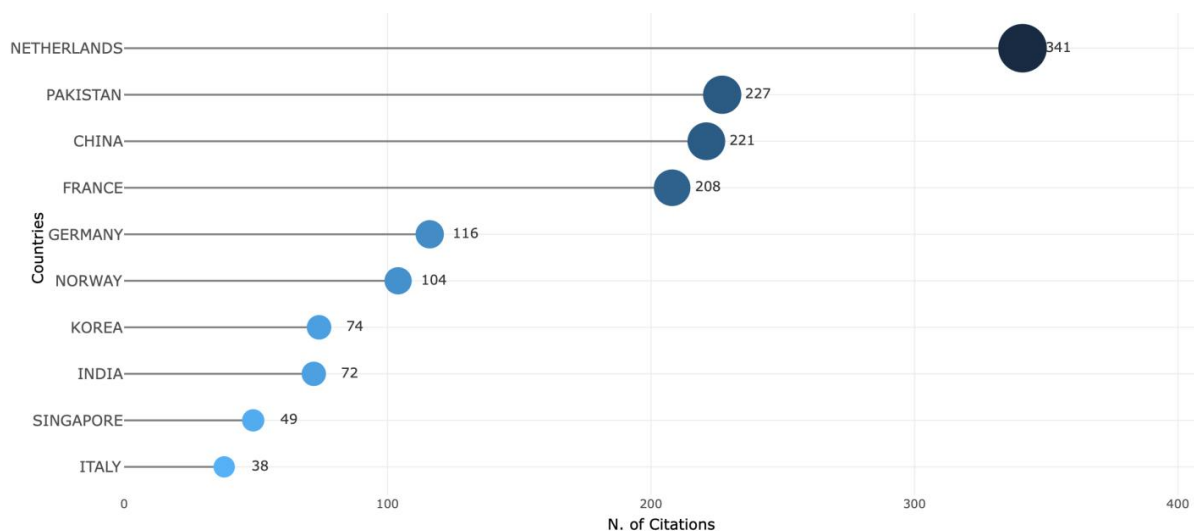
GVC is in its dynamic stage of growth and, therefore, it can be said that the field has recently become relatively young yet with an active scholarly interest. The model of logistic growth forecasts the peak of the scientific production in the years 2029-2030, after which it is expected to gradually shift to the stage of maturity and saturation by the middle of the 2030s to the early 2040s. This is an indication that the field is in the process of consolidation and not at its early exploratory phase. The increased pace of growth can be explained by several positive feedback mechanisms, such as technological progress, availability of more specific funding, changing interdisciplinary structures, and the growing societal and policy interest in sustainability and climate finance. All these drivers have collectively placed GVC as an important research frontier. Nevertheless, the estimated slowing down of the post-peak suggests that the discipline might slowly run out of the research questions it has always based on, and the focus of the scholarship will change. This move is bound to involve increased specialisation, division

into niche sub-domains, and a drift towards related fields like climate finance, sustainable innovation, and ESG investing. Although the field itself is likely to keep expanding in the near future, to maintain its flow, new theoretical extensions, cross-disciplinary integration, and methodological innovation will be needed in future research. It is important to note that unexpected changes, like emergent technologies or change in policy, can change this curve and perhaps initiate another growth cycle.

3.1.3 Most Influential Country

Citation analysis on a country level indicates a geographically heterogeneous but skewed structure of scholarly influence in GVC research see (Figure 3). The Netherlands is the most influential country with 341 citations, which is considerably higher than in other countries. This is preceded by Pakistan (227 citations) and China (221 citations), showing the significant contribution of developed and developing economies. France (208 citations) too shows significant influence, and Germany (116) and Norway (104) are a second group of influential contributors.

Figure 3. Most Influential Country



Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

Moderate citation impact is observed in countries like Korea (74), India (72), Singapore (49), and Italy (38), indicating increased but a relatively less significant presence in the field. The Netherlands' hegemony brings to light its position as a worldwide intellectual center in GVC study, possibly owing to robust sustainability strategies, efficient financial ecosystems, and involvement in climate finance activities. More importantly, the significant citation impact of Pakistan and China can be interpreted as the increasing role of emerging economies in influencing the academic discussion, which signals the end of the traditional Western-dominated research hegemony, but with the assistance of progressive environment-related policies and funding systems (e.g., EU Green Deal). The possibility to increase cross-country cooperation, in particular, between high-impact countries (Netherlands, France) and emerging contributors (India, Korea) is obvious.

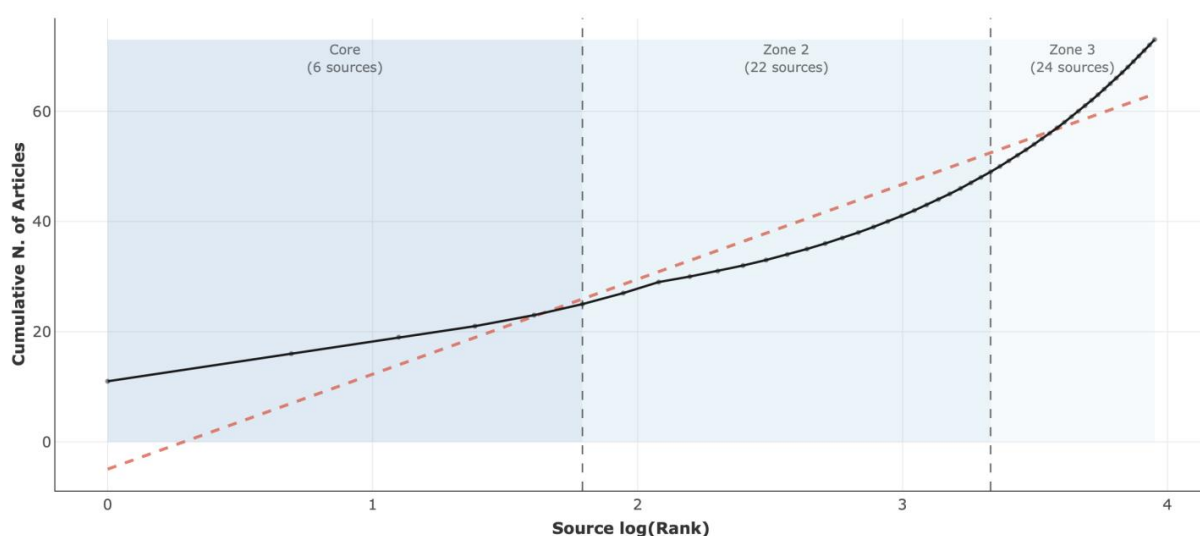
3.2 Knowledge Development through Scientometric Analysis

3.2.1 Bradford's law

In this analysis, the Law of Scattering proposed by Bradford is used, and the distribution of articles in various sources (journals) is studied. Bradford's Law aids in determining the central journals within a given field and the distribution of literature. The distribution of articles closely follows Bradford distribution empirically. The fitted model is $C(r) = -4.95 + 17.23 \log(r)$, where $C(r)$ is the cumulative number of articles and r is the rank of a source. The R-squared of 0.8928** indicates a good fit, which implies that the logarithm of the rank of the source can explain about 89.3 percent of the variability in the cumulative number of articles. Additionally, the Kolmogorov-Smirnov (KS) test gave a p-value of 0.291. As this p-value exceeds the standard significance level of 0.05, we do not reject the null hypothesis that the empirical distribution is that of a Bradford distribution. This is statistically proven to be accurate in the observation of the publication pattern in this dataset in that they follow the Law of Bradford.

The form of the empirical curve (solid black line) gives some information about the publication landscape of the field (see Figure 4). Initial Steep Rise (Zone 1): The curve exhibits a relatively steep initial growth in cumulative number of articles from a few sources (low $\log(\text{Rank})$). This indicates a high level of concentration in the discipline, with some highly productive journals undertaking a large share of the literature. Gradual Flattening (Zones 2 & 3): The slope of the curve decreases gradually as more sources are added ($\log(\text{Rank})$ increases), especially in Zone 2, but then increases towards the end in Zone 3. This implies that an increasing number of journals are needed to obtain the same number of articles as one travels further away. This tailing effect shows how the articles are scattered to a greater number of less specialised or less productive sources. What is being seen generally is a pattern of the field having a high concentration of knowledge in a set of core journals, with the rest of the related research being scattered over a wider periphery.

Figure 4. Bradford's law



Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

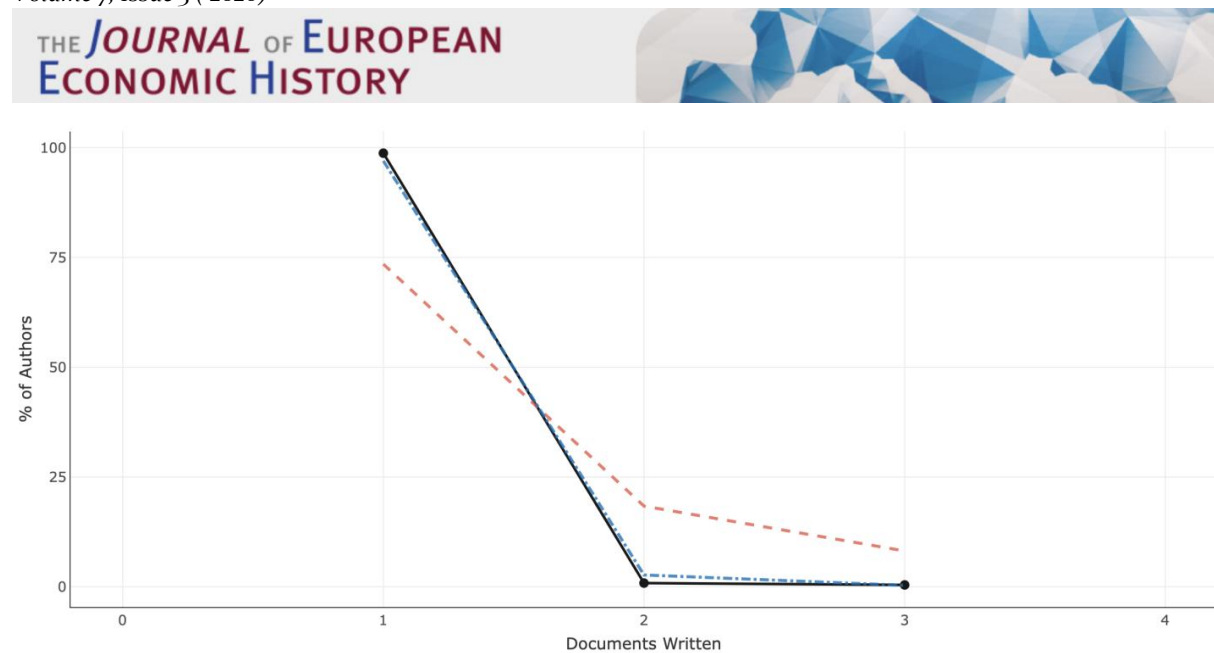
Zone 1, which includes 6 sources, is the most important journal of this research topic. All of the six journals publish a total of about 1/3 of the total articles found in the SCOPUS database to

do this analysis (about 23-24 articles of about 70 total articles). These essential journals are essential to the researchers working in the field: Key Information Sources: These journals are most influential and central to the research area. They will tend to publish basic research, advancements, and quality research. Keep up to date: To keep up with the most significant developments and trends in the field, researchers should focus on keeping up with the most fundamental journals. Publication Strategy: To authors, publication in these core journals can be the most effective to achieve visibility, reach, and impact in the specialized research community. Field Definition: The content that is published in these 6 core journals has a significant influence on defining the main topics and methodologies of the explored field. This Bradford analysis shows a clear center of productive journals and a wider spread of articles of an intermediate and peripheral range of sources. This characteristic distribution is proven by the strong statistical fit to the Law of Bradford, which highlights the importance of recognizing and targeting these fundamental resources in order to gain in-depth knowledge about the research landscape.

3.2.2 Lotka's Law

The Law of Lotka assumes a negative power law relation, i.e., the fraction of authors who publish n articles, $f(n)$, is $f(n) = C / n^{\text{Beta}}$. The study showed a estimated beta value of 5.1708. This is a very high beta value. The greater the Beta, the steeper the fall in the proportion of authors as the number of publications in the Law of Lotka. This means that there is a very high concentration of productivity: a huge majority of authors produce very few papers, and a very small fraction of authors produce more than one paper. It is a highly skewed or Matthew-effect distribution in the field, with a small group of people being overly productive. The R-squared is 0.9356, which means that the fitted Lotka's Law model explains more than 93 percent of the variance in author productivity, meaning that it is an excellent statistical fit. Kolmogorov-Smirnov (KS) p-value of the fitted beta model = 0.996. Because this p-value is much larger than the typical levels of significance (e.g., 0.05), we do not reject the null hypothesis that the empirical data is distributed following the fitted Lotka. This once again proves a very good fit. However, the theoretical Lotka Law with Beta=2 (dashed red line) fits the empirical data much worse. Its KS p-value of 0.518, although exceeding 0.05, is significantly lower than the fitted model, and visually, the red dashed line is significantly different than the black empirical line, in particular to authors with 1 document. The Beta=2 model also underestimates the share of single-paper authors and overestimates the share of authors of 2 or more papers as compared to empirical data.

Figure 5. Lotka's Law



Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

The Lotka-Volterra law observed has a number of implications for the field (see Figure 5). **Extreme Concentration:** A large majority of contributions are made by authors with only one publication. This implies that a barrier to entry with one-off contributions may be low or that there are a large number of researchers who work on the topic but do not focus on it. **Limited Core of Experts:** The almost negligible percentage of two or more publications suggests a very small, or possibly even non-existent, core of highly prolific researchers who, over time, would be motivating the collective production of cumulative knowledge in the field. This might imply that the area is highly disaggregated with regard to authorship. **Niche or Nascent Field:** The high beta value gives a strong indication that it is either a highly professional sub-discipline, in which contributions are specific and not maintained by a large group of people, or that it is a very new field, in which a long history of cumulative authorship has not yet been built. **Specificity in Data Collection:** The query used to extract the SCOPUS data could have also been very narrow in the scope of a large field, thus resulting in such a narrow focus. In case the dataset covers a very limited time, it might also be one of the reasons why the number of publications by the authors can be reduced. The author productivity in this collection is skewed to an extreme of single-paper authors and has no prolific contributors. This trend, confirmed by the beta value of estimation (5.1708) being high and the goodness of fit being strong, is a sign of a very concentrated, perhaps a niche or new, research domain. Further discussion might explore the issues of these individual articles to determine whether they all revolve around one thing or they are independent, isolated works.

3.3 Thematic Evolution

3.3.1 Co-occurrence of Keywords

The co-occurrence network word was created with the help of the Louvain clustering algorithm and normalised with the help of the association, which exposes topography of research topics in a structured manner. The network is made of a large number of interconnected keywords, and the size of nodes is formed by the frequency or centrality of the terms, and the thickness of the edges is determined by the strength of co-occurrence. As presented in (Figure 6), there are four easily identifiable groups (clusters) that are colour-coded: Cluster 1 (Green), Cluster 2 (Purple), Cluster 3 (Blue), and Cluster 4 (Red).

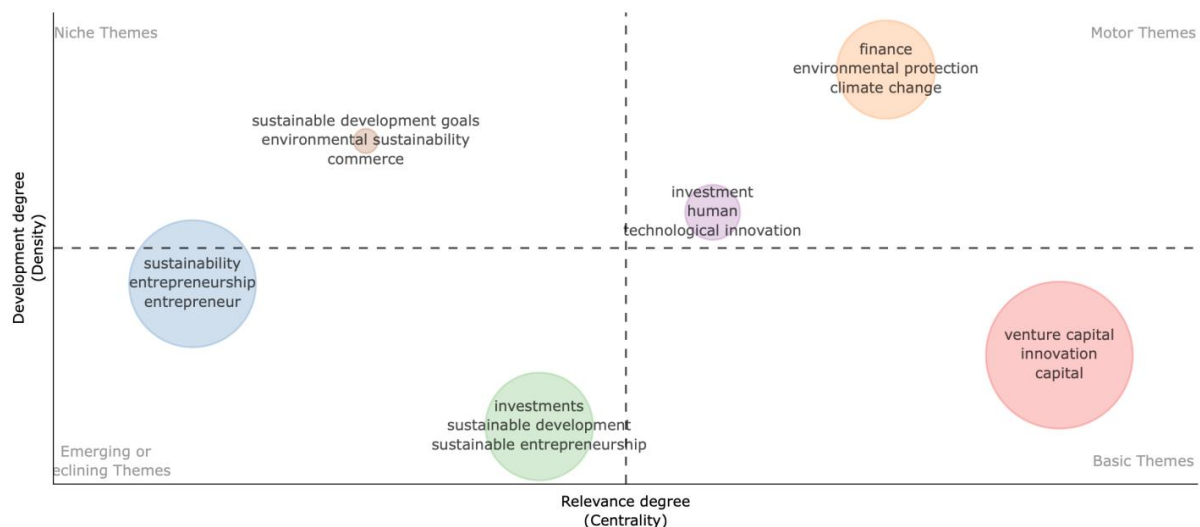
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especially to power green innovations. The close connection with environmental economy, corporate social responsibility (CSR), and ESG (Environmental, Social, and Governance) implies that this venture capital is not only profit-oriented but also has a profound integration of ethical, environmental, and social aspects. The existence of private equity and corporate venture capital further narrows down the nature of capital. According to this community, the importance of privately funded technological and business development that leads to positive environmental changes cannot be overstated.

3.3.2 Thematic Map

The strategic map, created out of a SCOPUS collection based on keyword co-occurrence (KW_Merged) and Louvain clustering, allows a thematic view of the academic landscape. The map (refer Figure 7) is designed in two dimensions: the degree of relevance (centrality) in the x-axis, which shows the extent of a theme being a connection among other themes in the network, and the degree of development (density) in the y-axis, which indicates how well a theme is internally connected and developed.

Figure 7. Thematic Map



Source: Author's Compilation based on Bibliometric Analysis (VOSviewer)

Innovation/ Capital/ Venture Capital is a basic theme. It is important to note that these ideas are core and central to the larger study field; however, their internal elaboration or particular interrelation may not be so thick. These terms tend to be broad categories or assumptions used by researchers instead of delving deeply into the inner mechanics or specificities of these terms in a particular setting. This understanding of a broadly applicable concept is supported by the diverse uses of its core articles (e.g., energy economics, food policy).

Two clusters are defined as niche themes: Sustainable Development Goals / Environmental Sustainability/ Commerce and Sustainability/ Entrepreneurship/ Entrepreneurs. Both are characterised by high internal density, which implies strong and consistent lines of inquiry in

their respective boundaries. Nevertheless, their less centrality implies that they are not yet strongly ingrained within the wider research space or the prevailing themes of motors Finance/ Environmental Protection/ Climate Change and Investment/ Human/ Technological Innovation linking them will increase the visibility.

In the Emerging or Declining Themes quadrant, the Investments/ Sustainable Development/ Sustainable Entrepreneurship cluster is a more undeveloped and less interconnected region. It may mean a few things: it may be an idea that is still in its infancy as a study subject, or it may be an idea that has not caught on yet, or a reassessment of older concepts that is yet to establish itself, or even a repackaged older idea. Additional time analysis (e.g., trend topics) would be necessary to differentiate between rising and falling. The crossover of central articles with the investment cluster may indicate a divided attempt to directly couple investments to sustainable development and entrepreneurship.

3.4 Theory-Context-Method Structure Analysis

3.4.1 Theoretical Underpinnings

The theoretical corpus demonstrates a rich and yet fragmented intellectual framework in the field of green venture capital (refer Table I). The dominance of Institutional Theory clearly shown by (Morrar et al., 2025; De Sisto et al., 2025; Xie & Lin, 2025; Iwata et al., 2025; Dell'Acqua et al., 2025; Kato & Manchidi, 2025; Futre, 2025; Shuajibi et al., 2025; Shuwaikh, 2024; Rehman et al., 2023; Holtslag et al., 2021; Ezangina & Malovichko, 2021) suggests that the majority of investigations conceptualise the firm behaviour reaction to external institutional factors. At the below ground, Resource-Based View (RBV) Theory (Morrar et al., 2025; De Sisto et al., 2025; Manolopoulos et al., 2025; Futre, 2025; Shuwaikh, 2024; Kato, 2024; Kang, 2020; Jeong et al., 2020; Liu & Jiang, 2019), Socially Responsible Investment (SRI) theory explained by (Jeffers et al., 2024; Li, 2023; Gigante et al., 2023; Lin, 2022; Prelipcean & Boscoianu, 2020; Antarciuc et al., 2018; Bocken, 2015), ESG frameworks (Dell'Acqua et al., 2025; Drobetz et al., 2024; Kato et al., 2024; Li, 2023; Gigante et al., 2023; Prelipcean & Boscoianu, 2020), indicates an established trend of moderately increased convergence between resource integration, responsible investing and ESG discipline together resulting to sustainable competitive outcomes for green ventures.

In addition, the field widens itself to reflect the emerging theories, Signalling Theory (Du et al., 2025; Xie & Lin, 2025; Zhang et al., 2024; Yu et al., 2024; Roma et al., 2023) underlying investor relations, Information Asymmetry Theory (Huang et al., 2025; Wang et al., 2024; Dhayal et al., 2023; Diekel et al., 2023; Ochinanwata et al., 2021), Stakeholder Theory (Samal & Dash, 2025; Dell'Acqua et al., 2025; Futre, 2025; Shuwaikh, 2024) that pays attention towards stakeholder's interests and Triple Bottom Line (Yamini et al., 2025; Siefkes et al., 2025; Dhayal et al., 2023; Bocken, 2015) pushes the concern to firm's actions. Also, Venture Capital Theory (Huang et al., 2025; Shuwaikh et al., 2025; Putrevu et al., 2025; Khan & Hussain, 2024), Agency Theory (Cihangir et al., 2025; Sadiq et al., 2022; Dong et al., 2021), Entrepreneurial Ecosystem Theory (Morrar et al., 2025; Kamysbayev et al., 2025; Al-Maadeed & Yesuf, 2025) and Human Capital Theory (Assanova et al., 2025; Manolopoulos et al., 2025; Du et al., 2024) explaining investor relations and overall ecosystem conditions affecting the investing opportunity.

Although understated and poorly integrated in the GVC research but theoretical relevance of Social Capital Theory (Morrar et al., 2025; Miralam et al., 2025), Sustainability Capitalism Theory (Koh, 2025; Fligstein & Huang, 2025), System of Innovation Theory implied by (Prasad et al., 2023; Döme et al., 2025), SDG framework (Bansal et al., 2025; Gucciardi, 2024), CSR Theory (Drobetz et al., 2024; Khan et al., 2024), Resource Allocation Theory (Hu et al., 2023; Yahya et al., 2022), Theory of Green Innovation (Wang et al., 2025; Bendig et al., 2022) all draw attention towards social and developmental contribution and innovation-led practises.

Finally, the STIRPAT Theory (Jabeen et al., 2023), Open Innovation Framework mentioned in (Döll et al., 2022), which reflects a rather narrow attention to adaptive, innovation-driven sustainability transitions. Likewise, there is a large gap between behavioural and micro foundational approaches, i.e., Behavioural Economic Theory (Tao & Wu, 2025), Cognitive Theory (Miralam et al., 2025), and Emotional Contagion Theory (Wöhler & Haase, 2022). The other critical observation is that there is a marginal presence of Global Value Chain (GVC) theory in (Mac Clay et al., 2024) study, Dynamic Capabilities Theory studied by (Zhang et al., 2024), Rational Choice Theory (Roma et al., 2023), Theory of delegated Philanthropy (Drobetz et al., 2024), Go-Green Framework (Hegeman & Sørheim, 2021) and Supply-side and Demand-side GVC theory elaborated by (Owen et al., 2019), Attribution Theory (Kuschel et al., 2017), Responsible Innovation Framework (Alami et al., 2024), Infrastructural Power Perspective (Cooiman, 2023) and Self-Determination Theory (Dinh et al., 2024) yet they are quite marginal in number and are often discussed in their individual regard to firm-level strategic models. This shows a lack of alignment between macro environmental performance and micro level firm performance. The findings show a discipline that is theoretically abundant but structurally divided, with fewer interdisciplinary syntheses and less focus on dynamic, behavioural, and global aspects. Lastly, (Criscuolo & Menon, 2015 & Liza et al., 2024) have not stated any theoretical underpinning, instead relying on empirical contribution stating the gap that the research field is theoretically inconsistent.

Table I

THEORETICAL/ CONCEPTUAL UNDERPINNING	POSITION	THEORETICAL INSIGHTS
Institutional Theory	Dominant	Investigates the broader role of institutional pressures, norms and policies which affect the green investment behaviour.



Table I

Resource-Based View Theory; Socially Responsible Investment Theory ; ESG Framework	Established	Highlights the resource interdependencies, investment preferences and ESG disclosure activities responsible for sustainable investment decisions.
Stakeholder Theory; Triple Bottom Line Theory; Venture Capital Theory; Signalling Theory; Information Asymmetry Theory; Agency Theory; Entrepreneurial Ecosystem Theory;	Emerging	Shows the stakeholders preferences, financing decisions, interpersonal relations with investor, information disclosure and the business ecosystem that enable green venture funding.
Social Capital Theory; Human Capital Theory; Sustainability Capitalism Theory; SDG Framework; CSR Theory; Resource Allocation Theory; Theory of Green Innovation	Underrepresented	This cluster gives narrow understanding of social relations, human capacity, sustainable goals, optimum resource usage, corporate responsibility and innovation related theories towards adaption of green venture capital.

Table I

STIRPAT Theory; System of Innovation Theory; Behavioural Economic Theory; Cognitive Theory; Open Innovation Framework; Global Value Chain Theory; Dynamic Capability Theory; Rational Choice Theory; Theory of Delegated Philanthropy; Emotional Contagion Theory; “Go Green Framework; Supply- side/Demand-side Theory; Attribution Theory; Responsible Innovation Framework; Self- Determination Theory; Infrastructural Power Framework	Marginal	Limited understanding of how system induced innovation, behavioural and cognitive factors affecting green funding decisions, how venture capital firms show dynamic adaption, global supply chain support scaling of those firms, internal and external pressures, leaving a huge gap.
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Note: Theoretical Context is not Mutually Exclusive

Source: Author’s Synthesis based on Bibliometric Analysis

3.11.2. Contextual Orientation: Industry

The industrial sectoral spread of the GVC literature reveals a huge uneven concentration across sectors (refer Table II). The Financial Services and Investment Sector a dominant sector in (Fligstein & Huang, 2025; Huang et al., 2025; Bansal et al., 2025; Shuwaikh et al., 2025; Siefkes et al., 2025; Dell’Acqua et al., 2025; Futre, 2025; Gucciardi, 2024; Yu et al., 2024; Jeffers et al., 2024; Shuwaikh, 2024; Dinh et al., 2024; Kato, 2024; Diekel et al., 2023; Hu et al., 2023; Gigante et al., 2023; Cooman, 2023; Wöhler & Haase, 2022; Döll et al., 2022; Lin, 2022; Yahya et al., 2022; Holtslag et al., 2021; Ezangina & Malovichko, 2021; Jeong et al., 2020; Prelipcean & Boscoianu, 2020; Owen et al., 2019; Antarciuc et al., 2018; Bocken, 2015) primarily focusing on sustainability, ESG, and responsible investment discourse. This implies that sustainability is being largely packaged in terms of capital distribution, risk management, and the way investors act as opposed to operational/level of production changes. The Technology Sector backed in by (Putrevu et al., 2025; Manolopoulos et al., 2025; Shuajibi et al., 2025; Du et al., 2025; Assanova et al., 2025; Zhang et al., 2024; Li, 2023; Roma et al., 2023; Hu et al., 2023; Hegeman & Sørheim, 2021; Kuschel et al., 2017) and Startups/SMEs and Entrepreneurial Ecosystem (Shuajibi et al., 2025; Kamysbayev et al., 2025; Miralam et al., 2025; Al-Maadeed & Yesuf, 2025; Wang et al., 2025; Kato & Manchidi, 2025; Drobetz et al., 2024; Kato et al., 2024; Sadiq et al., 2022; Ochinanwata et al., 2021; Kang, 2020) are also given significant coverage with a focus on the perceived contribution of innovation and entrepreneurship towards

sustainability transitions. These areas tend to be linked to disruptive abilities, digitalisation, and scalable remedies, which solidifies the argument that sustainability is becoming more and more tied to technology and business dynamism. Likewise, the Energy and Green Sector (Yamini et al., 2025; Iwata et al., 2025; Tao & Wu, 2025; Jabeen et al., 2023; Li, 2023; Dhayal et al., 2023; Bendig et al., 2022; Döll et al., 2022; Dong et al., 2021; Criscuolo & Menon, 2015) is also indicative of a high interest in environmental sustainability, especially with regard to renewable energy, mitigation of climate change, and green innovation. Beneath them comes the Agri-Food & Agriculture Sector targeted by (Morrar et al., 2025; Koh, 2025; Manolopoulos et al., 2025; Döme et al., 2025; Mac Clay et al., 2024; Prasad et al., 2023) in their respective fields has grown to be well established in the GVC field.

Further, production and service based industries like Manufacturing (Manolopoulos et al., 2025; Döme et al., 2025; Wang et al., 2025; Khan et al., 2024; Du et al., 2024), Hospitality & Tourism (Morrar et al., 2025; Manolopoulos et al., 2025; Cihangir et al., 2025; Samal & Dash, 2025; Liu & Jiang, 2019), Healthcare (Manolopoulos et al., 2025; Putrevu et al., 2025; Alami et al., 2024; Döll et al., 2022) are still emerging even though they have high impact on the environment and socio-economic state. Alongside, (De Sisto et al., 2025; Khan & Hussain, 2024) discussed the Trade and Retail as underrepresented despite of their central presence in the distribution process. The Handicrafts (Morrar et al., 2025) and Construction (Döll et al., 2022), which have a marginal presence, indicate that they have not been given the attention they deserve as the key sectors that contribute to employment, cultural preservation, and local economic development. In general, the findings indicates that high-growth, capital-intensive, and technology-driven sectors taking the centre stage as the rest, labor-intensive and traditional industries, are poorly researched. Such an unbalanced distribution suggests that the existing body of knowledge might not be sufficient in capturing the dynamics of sustainability in various industrial settings, especially in developing economies where the traditional sectors are an important part of the economy.

Table II

INDUSTRIAL CONTEXT	POSITION	CONTEXTUAL ORIENTATION
Financial Services & Investment Sector	Dominant	Green Venture Capital creates a financial foundation focusing on how sustainability mechanisms are applied in capital allocation decisions and investment behaviour.



Table II

Technology Sector	Dominant	Green Venture Capital supports businesses using capital towards technology enabled green innovations.
Startups, SME's & Entrepreneurial Ecosystem	Dominant	Green Venture capital is positioned as source of entrepreneurial financing for helping existing and emerging sustainable businesses.
Energy, Renewable, Environmental (Green Sector)	Dominant	Green Venture Capital has influenced energy transitions and climate risk reduction activities.
Agriculture & Agri-Food Sector	Established	GVC has shown its relevance towards eco conscious resource dependent sectors.
Manufacturing; Hospitality & Ecotourism Sector	Emerging	GVC supports the sustainable transformation in production intensive and service sector sector.
Life Science & Healthcare Sector	Emerging	GVC has focused on environmental sustainable biological and medical innovations.

Table II

Trade & Retail Sector	Underrepresented	GVC is rising steadily by transforming the distribution and consumption market to sustainable focused market.
Handicrafts ; Construction Sector	Marginal	Green venture capital has limited application among the sustainable transition among traditional and development sector.

Note: Industry Classification is not Mutually Exclusive

Source: Author's Syntheses based on Bibliometric Analysis

3.11.3. Contextual Orientation: Countries

The contextual distribution by country indicates that there is a great geographical concentration in the literature on green venture capital (refer Table III). The evidence indicates a great concentration of research by (Xie & Lin, 2025; Fligstein & Huang, 2025; Du et al., 2025; Kamysbayev et al., 2025; Tao & Wu, 2025; Wang et al., 2025; Yu et al., 2024; Du et al., 2024; Hu et al., 2023; Rehman et al., 2023; Dong et al., 2021; Liu & Jiang, 2019) in China and (De Sisto et al., 2025; Shuajibi et al., 2025; Fligstein & Huang, 2025; Huang et al., 2025; Shuwaikh et al., 2025; Drobetz et al., 2024; Li, 2023; Bendig et al., 2022; Yahya et al., 2022; Jeong et al., 2020) in USA. The dominant role of China is an indication of its increasing significance of GVC research within sustainability transitions, especially in green innovation, manufacturing change, and state-led policy interventions. Likewise, the strong presence of the USA implies the emphasis on financial markets, ESG investing, and technological innovation.

Afterwards, Europe stand-alone as a regional focus by (De Sisto et al., 2025; Fligstein & Huang, 2025; Drobetz et al., 2024; Cooman, 2023; Jabeen et al., 2023) along with European country such as Germany targeted by (Shuajibi et al., 2025; Siefkes et al., 2025; Dinh et al., 2024; Wöhler & Haase, 2022; Döll et al., 2022), play a vital role in terms of regulatory frameworks, sustainability governance, and circular economy models. But the representation is thin and diffused as they are still suck in the emerging cluster. Similarly, countries like India (Kamysbayev et al., 2025; Samal & Dash, 2025; Rehman et al., 2023; Khan et al., 2024) and Russia (Rehman et al., 2023; Yahya et al., 2022; Ezangina & Malovichko, 2021) fall under the same position. At the same square, OECD nations (Qamruzzaman, 2025; Döme et al., 2025; Criscuolo & Menon, 2015) reflects a broader spectrum than single country analysis.

With countries such as Japan (Iwata et al., 2025; Kamysbayev et al., 2025), Korea (Kamysbayev et al., 2025; Kang, 2020), Singapore (Koh, 2025; Shuajibi et al., 2025), Kazakhstan (Kamysbayev et al., 2025; Assanova et al., 2025), Saudi Arabia (Miralam et al., 2025; Antarciuc et al., 2018), Norway and Sweden (Siefkes et al., 2025; Yahya et al., 2022), Kenya & Uganda (Kato & Manchidi, 2025; Kato, 2024), Canada (Alami et al., 2024; Yahya et al., 2022), Pakistan (Khan & Hussain, 2024; Sadiq et al., 2022), South Africa (Kato, 2024; Rehman et al., 2023) with United Kingdom (Gigante et al., 2023; Owen et al., 2019) are getting little coverage as compared to emerging countries. Irrespective of the country based classification, the existence of regional and cross-country studies (e.g., Latin America (Jabeen et al., 2023; Kuschel et al., 2017) and MENA (Putrevu et al., 2025; Jabeen et al., 2023) are also under explored.

At the bottom, Palestine, Egypt, and Jordan studied by (Morrar et al., 2025) with Australia (De Sisto et al., 2025), Greece (Manolopoulos et al., 2025), Israel (Shuajibi et al., 2025), Turkey (Cihangir et al., 2025), Brazil (Rehman et al., 2023), Nigeria (Ochinanwata et al., 2021) and Iceland, Denmark and Finland studied by (Yahya et al., 2022). Also, Romania (Prelipcean & Boscoianu, 2020) which is broader region specific study all are specific to one individual study, which means that the literature is incomplete to discuss sustainability issues in the resource-constrained and institutionally weak settings.

Additionally, (Drobetz et al., 2024 & Kato et al., 2024) studied Asia and East Africa, with perspectives of Sub-Saharan Africa, Central Asia, East Asia and Pacific by (Jabeen et al., 2023) and G-20 (Liza et al., 2024) which also indicates a required effort to extrapolate results at larger economic blocs, although such studies are frequently lacking in terms of their ability to capture country-specific institutional and socio-economic dynamics.

Overall the findings indicate a geographical clustering in production of knowledge in relation to green venture capital with a high inclination to economically developed and politically powerful nations. The less representation of the relevance of results to developing and underdeveloped areas together with low level of comparative and cross-country research. This restricts the possibility to determine GVC context-specific drivers. Moreover, institutional diversity such as informal institutions, quality of governance, and regulatory differences and variations have not been adequately explored. Although some regional studies provide limited local implementation and context-specific realities on the grassroots. Future research should target sustainability in fragile states and low-income countries.

Table III

GEOGRAPHICAL CONTEXT	COUNTRY/ REGION	POSITION	CONTEXTUAL ORIENTATION
Country	China; USA	Dominant	Represents the strongest scale in green investment activity.

Table III

Country	Germany; India; Russia	Emerging	Showcases the second largest emerging countries contributing to the research field.
Region	Europe; OECD nations	Emerging	Presents the upcoming regions studying the sustainable investment beyond single country analysis.
Country	Singapore; Japan; Kazakhstan; Korea; Saudi Arabia; Norway; Sweden; Kenya; Uganda; Canada; Pakistan; South Africa; UK;	Underrepresented	Indicates developing and developing countries across multiple countries lacking behind in terms of substantial research outcomes.
Region	Middle East and North Africa; Latin America	Underrepresented	Shows broad regional studies, limited in number studying GVC.
Country	Palestine; Egypt; Jordan Australia; Greece; Israel; Turkey; Brazil; Nigeria; Iceland; Denmark; Finland; Romania	Marginal	Points the gap, as marginal representation is shown by these countries.

Table III

Region	Asia; East Africa; Sub-Saharan Africa; Central Asia; East Asia and Pacific	Marginal	Gives regional specific generalisation. Though relevant but very narrow.
Cross-Country	G-20	Marginal	Extracts cross-country references, but appears to be in only one study.

Note: Geographical Context is not Mutually Exclusive

Source: Author's Syntheses based on Bibliometric Analysis

3.11.4. Methodological Approaches

The methodological distribution (see Table IV) of the reviewed literature is polarised towards Quantitative Statistical Analysis discussed by (Xie & Lin, 2025; Manolopoulos et al., 2025; Huang et al., 2025; Du et al., 2025; Tao & Wu, 2025; Miralam et al., 2025; Wang et al., 2025; Shuwaikh et al., 2025; Dell'Acqua et al., 2025; Kato & Manchidi, 2025; Khan et al., 2024; Du et al., 2024; Kato et al., 2024; Shuwaikh, 2024; Zhang et al., 2024; Roma et al., 2023; Hu et al., 2023; Gigante et al., 2023; Jabeen et al., 2023; Rehman et al., 2023; Yahya et al., 2022; Dong et al., 2021; Kang, 2020; Jeong et al., 2020; Liu & Jiang, 2019) and Qualitative approach (Morrar et al., 2025; Koh, 2025; Fligstein & Huang, 2025; Cihangir et al., 2025; Döme et al., 2025; Yamini et al., 2025; Iwata et al., 2025; Samal & Dash, 2025; Bansal et al., 2025; Al-Maadeed & Yesuf, 2025; Futre, 2025; Dinh et al., 2024; Mac Clay et al., 2024; Alami et al., 2024; Dhayal et al., 2023; Cooman, 2023; Prasad et al., 2023; Wöhler & Haase, 2022; Lin, 2022; Holtslag et al., 2021; Ochinanwata et al., 2021; Hegeman & Sørheim, 2021; Ezangina & Malovichko, 2021; Kuschel et al., 2017; Bocken, 2015). The field is equally divided between empirical measurement and theory-building research (refer Table 4).

A mark down stands Mixed-method (Shuajibi et al., 2025; (Kamysbayev et al., 2025; Assanova et al., 2025; Khan & Hussain, 2024; Kato, 2024; Bendig et al., 2022); Döll et al., 2022; Owen et al., 2019; Antarciuc et al., 2018) and Econometrics applied in (Qamruzzaman, 2025; Gucciardi, 2024; Drobetz et al., 2024; Yu et al., 2024; Li, 2023; Sadiq et al., 2022; Criscuolo & Menon, 2015) which are well established as they are great use in sustainability research studies since they enable the combination of numerical rigour, contextual depth and use of longitudinal econometric models.

Whereas at bottom, stands Statistical & Econometric (Putrevu et al., 2025; De Sisto et al., 2025; Liza et al., 2024; Jeffers et al., 2024) which are relatively minor. On the same note, Case Study Approach (4.1%: Siefkes et al., 2025; Diekel et al., 2023; Prelipcean & Boscoianu, 2020) is surprisingly scanty, even though it is relevant in the study of complex, real-world sustainability practices at firm and industry levels. The findings indicate that the field is diverse in terms of methods but tends to lean toward either quantitative or qualitative approaches, and there is a lack of integration between the two.

Lastly, the use of panel data models, instrumental variable methods, and causal inference methods in future research ought to enhance the integrity and authenticity of the results. A great necessity to combine quantitative and qualitative approaches is felt. Mixed-method designs may offer both statistical confirmation and the richness of context and result in more profound insights.

Table IV

METHODOLOGICAL CONTEXT	PERCENTAGE	POSITION	METHODOLOGICAL ORIENTATION
Statistical Analysis	34.25%	Dominant	Suggest conducting experimental analysis of how green venture capital, firms and sustainable outcomes are interconnected.
Qualitative Analysis	34.25%	Dominant	Indicates the usage of exploratory method to understand the GVC field.
Mixed-Method Approach	12.32%	Established	Reveals an established but less use of combination of qualitative and quantitative evidence in green venture investing.

Table IV

Econometrics	9.6%	Established	Shows established application of econometric models to know the relation between investment practises, economic perspective and sustainability.
Statistical & Econometric	5.48%	Emerging	Presents an emerging trend of descriptive and econometric tools used to analyse GVC complexity.
Case Study	4.1%	Emerging	Demonstrates case-based results to capture the relevance of sustainable investment practises.

Note: Methodological Context is Mutually Exclusive

Source: Author's Syntheses based on Bibliometric Analysis

4. Implications

4.1 Practical Implications

The results of this paper have significant practical implications for four different groups of actors interested in GVCs: investors and fund managers, entrepreneurs and green startup founders, policymakers and regulatory bodies, and development finance institutions in emerging and underrepresented regions and countries. All sets of implications are directly based on the empirical and analytical results generated during the bibliometric, thematic, and TCM analyses.

4.1.1 Implications for Investors and GVC Fund Managers

Thematic mapping analysis reveals venture capital, innovation, and capital as basic themes—very central to the GVC discourse but, within themselves, lacking theoretical depth. To investment practitioners, this conclusion carries with it a direct, practical implication: the sector has narrowed in on the idea that VC is a central process through which green innovation is generated in addition to (Yang et al., 2022) research, but the investment community is not yet in a position to enjoy the fruits of a sound, evidence-based insight into what sort of investment strategies, governance structures, and portfolio constructions reliably generate green results. Investors working in this field are advised to thus take current GVC research as a helpful but imperfect guide and be cautious in applying models created in more traditional VC settings to sustainability-appropriate deal-making.

The co-occurrence network analysis identifies four different investment logics presently in operation in the GVC discourse: sustainable investment and entrepreneurship financing (Cluster 1), foundational capital allocation and economic development (Cluster 2), strategic sustainability integration by SDG alignment (Cluster 3), and venture capital as an enabler of green innovation using CSR and ESG processes (Cluster 4). The implications of this cluster structure for fund managers is that a consistent GVC portfolio approach involves purposeful placement in more than one of these logics at the same time instead of maximising one dimension at a time. In particular, the fact that the CSR/ESG orientation of Cluster 4 is positively correlated with the innovation-catalysis role of venture capital suggests that funds that implement ESG due diligence procedures as an integral part of their operations, as opposed to using ESG as a reporting tool, are in a better position to detect high-potential green ventures and address the reputational and regulatory risks associated with sustainability-linked investments.

The Bradford Law analysis singles out six core journals as the nucleus of the GVC knowledge base, which jointly contribute to about a third of the total scholarly output in the area. Investment professionals will find this finding useful as a roadmap: to get the best and most effective sustainability (Switzerland) research, they need to consult *Monitoring Sustainability* (Switzerland), the *Journal of Cleaner Production*, the *Journal of Environmental Management*, *Business Strategy and the Environment*, *Energy Economics*, and *Research in International Business and Finance*. As GVC is interdisciplinary, investment teams that have built specific research functions must comprehensively scan these outlets, as opposed to relying on traditional finance journals, which have limited GVC literature.

The analysis of the Lotka Law shows that the productivity of authors in GVC is clustered in a very small number of prolific researchers, and the rest of the contributors make only one publication. As an implication for the investment practitioners, this structural aspect of the knowledge base means that the discipline does not have cumulative, sustained communities of experts that can produce reliable, policy-relevant information over time. Investment choices in GVC thus involve more epistemic uncertainty than in more established asset classes—a risk that advanced investors ought to take into explicit consideration in their due diligence procedures and portfolio diversification practices. The practical implication is to invest in proprietary research development as opposed to just using published academic evidence, as it is both thick and episodic.

The fact that the GVC research is characterised by the predominance of the institutional theory and resource-based view frameworks with little involvement of dynamic capabilities theory also has practical implications for investors. The RBV lens and (Wang, Yusof, et al., 2025)

suggests that the internal resource endowments such as intellectual property, technical capabilities, and proprietary processes are the key determinants of competitive advantage in green ventures. This is especially essential considering the instability of the regulatory climate within which the green ventures operate, as witnessed in the recent change in climate policy within the key economies.

4.1.2 Implications to Entrepreneurs and Green Startup Founders.

The temporal distribution analysis, with the projection of the logistic growth model on the maximum scholarly output at the period of 2029-2030, shows that GVC is passing the most active stage of expansion nowadays. This trend is a strategically good window to green entrepreneurs: investor interest in GVC is growing faster, the language of green finance is increasingly standardised and understandable to capital markets, and a policy environment in large economies is further enhancing the risk-return profile of green projects. The founders who locate their ventures on the border between technological innovation and sustainability, which is highly noticeable in Cluster 4 of the keyword co-occurrence network, will have the highest chances of GVC funding in the current climate. The TCM analysis of the sectoral nature of GVC research and investment focus is highly skewed towards financial services, technology, and startup/SME ecosystems, as other sectors of the economy, including manufacturing, agriculture, construction, healthcare, and retail, are systematically underrepresented. This twofold observation, namely that GVC capital movements have traditionally avoided their industries and that the existing academic tools to comprehend GVC in such situations have been underdeveloped, suggests a challenge and an opportunity to entrepreneurs in these underserved industries. The difficulty is that current investor due diligence technology and investment theses are tuned to high-growth says (González-Uribe et al., 2026), digitally scalable enterprises, posing structural constraints to business owners in capital-intensive conventional markets. The opportunity is that the lack of competition by well-capitalised counterparts in manufacturing, sustainable agriculture, and green construction would make differentiated positioning more feasible, given that founders are capable of rendering the green value proposition in the communication that mediates sector-specific operational reality and investor expectations about scalability and returns. The country-level map with the Netherlands, France, Germany, and Norway as citation leaders and China, which has the most research volume, being the first to offer access to GVC, is an indicator to the entrepreneur in a high-impact new economy (India, Pakistan, Brazil, and Sub-Saharan Africa) that access to GVC is still highly concentrated within a developed-economy ecosystem. The structural advantage of visibility, credibility, and network access of green founders in these areas is disadvantageous compared to those in developed innovation hubs. The gap in cross-country collaboration that the citation analysis revealed is just as significant an opportunity as the structural value of the role of founders capable of credibly connecting developed-economy investors to sustainability issues in emerging economies. The niche nature of the thematic map, which identifies sustainable development goals (SDGs) and environmental sustainability, i.e., internal density, yet is not sufficiently linked to the overall financial discourse, has a direct impact on the manner in which green entrepreneurs frame and communicate their value propositions. The result is an implication that, although SDG-oriented or environmental impact discourses are consistent within sustainability science circles, they have not yet become central to the general discourse of GVC research and investment. Entrepreneurs are thus encouraged to translate their environmental impact metrics to the financial and strategic language that GVC investors read—green performance not necessarily as carbon reduction or ecological value, but as regulatory risk avoidance,

supply chain robustness (Chotia et al., 2026), long-term market positioning, and competitive divisions generated by sustainability-linked product differentiation.

4.2 Policy Implications

The life cycle analysis, which suggests that the GVC field will be approaching its fast growth stage until around 2030, when it will reach maturity and saturation, gives policymakers an important time marker. The present day is a precious time when policy action can still influence the intellectual and institutional direction of a growing field before it solidifies around, perhaps, suboptimal models or more or less geographically confined best practices. Policymakers who intervene at this stage of expansion can have much more impact on the future of the discipline than those who step in when the field has already consolidated through commissioning specific research, investing in interdisciplinary GVC research initiatives, and the creation of evidence-based green investment models. The problem of geographical imbalance in the production of research as well as in citation is a direct challenge of governance. Chinese, USA, and European dominance in the creation of GVC knowledge implies that the policy frameworks, institutional theories, and investment models incorporated in the literature are based on the advanced-economy conditions: the high level of regulation, the developed financial system, and the developed system of innovations. The policymakers in developing and emerging economies must be wary of importing GVC models off the shelf since the models are not well matched to environments where the institutional voids, underdeveloped capital markets, informal economies, and various settings of environmental challenge exist. DFI, national innovation agencies, and multilateral agencies like the World Bank, UNDP, and the African Development Bank should invest in commissioning and financing GVC research specifically adapted to Global South realities, as opposed to thinking that results of advanced-economy research will be directly applicable. The domination of the literature on the GVC with the institutional theory has its own practical policy implication. The institutional theory is the view that the regulatory, normative, and cognitive pillars in the institutional environment of firms play a significant role in shaping firm behaviour. The high representation of the theoretical lens in GVC research is, in fact, an empirical confirmation of the hypothesis that GVC flows are deeply dependent on policy architecture, i.e., at least the volume, direction, and quality of green venture investment are significantly predetermined by regulatory frames, incentive designs, and legitimacy cues that governments construct and maintain. This result gives policymakers the evidence about policies they make count: properly designed green investment taxonomies, carbon pricing frameworks, green procurement guidelines, sustainability disclosure regulations, and innovation incentives (through R&D tax credits to green ventures) are not marginal support structures to market-based GVC development but its foundational infrastructure. This mechanism is empirically demonstrated by the success of the EU Green Deal transition in energy efficiency (Salim et al., 2026) to draw GVC flows in Europe, which is reflected in the high presence of citation or research in Europe.

The observation that financial services, technology, and energy sectors control GVC research and traditional sectors are underrepresented hints at a structural imbalance between the distribution of climate risk and the distribution of GVC attention. The bulk of greenhouse gas emissions, resource use, and environmental harm in the world is contributed by manufacturing, agriculture, construction, and healthcare, but they receive a disproportionately low share in green venture investment and related academic interest. To handle this mismatch, policymakers can employ sector-specific GVC incentive schemes, such as blended finance instruments, de-risking facilities, and green venture matching schemes, which particularly

focus on capital-intensive sectors traditionally neglected. The establishment of sector-specific government-supported green venture funds targeting agricultural sustainability, green building, sustainable production, and medical innovation would not only right the existing sectoral imbalance but also create the empirical foundation required to produce sector-specific GVC designs.

The methodological observation that the GVC research systematically depends on cross-sectional and simple statistical procedures to a large extent with little application of longitudinal designs, causal methods of inference, and experimental methods has immediate implications for evidence-driven policymaking. Correlational outcomes of cross-sectional research cannot support policy decisions based on incentives to promote green investment; the design of regulations and co-investment structure between the government and the business should not be the basis of predicting the impact of policy change on GVC. The active commissioning and funding of longitudinal impact evaluation of GVC-related policy interventions by policymakers should thus be undertaken to employ both quasi-experimental and panel data to obtain the causal evidence base that the current academic research lacks.

4.3 Research Implications

The overlapping of results in the geographical, sectoral, and theoretical analyses is indicative of a structural gap that can only be filled with the help of development finance institutions (DFIs), such as the International Finance Corporation, the European Investment Bank, the Asian Development Bank, and national development banks. The GVC literature is methodically tilted towards the developed economies and high-growth and technology-intensive areas, and, as a result, the largest majority of the most environmentally exposed populations, geographies, and economic sectors in the world are left without an adequate financial structure, investment paradigm, or empirical data to inform resource allocation. There are three dimensions that this study has shown can be catalysed by DFIs. To begin with, they can be anchor investors in GVC funds that specifically focus on underrepresented geographies—Sub-Saharan Africa, Central Asia, East Asia (Jabeen et al., 2023) and Latin America (Kuschel et al., 2017) —and in the process de-risk these markets to private GVC capital and create the track record and deal flow data that academic research currently lacks. Second, they can finance the evolution of context-specific GVC models that are fine-tuned to institutional, cultural, and economic environments that are fundamentally different than the ones of the developed economies where the current theories have been created. The fact that research on the dynamics of GVC in fragile states, least-developed economies, and areas with institutional voids is virtually non-existent is not only a knowledge gap but also a development finance opportunity that DFIs are well positioned to occupy through co-investment in research collaboration between universities in the South and foreign research institutions. Third, DFIs would be able to facilitate the sectoral rebalancing that market forces have been unable to generate—by directing concessional and blended finance into GVC-supported projects in the manufacturing sector, sustainable agriculture, green construction, and healthcare, both enhancing the presence of GVC and creating the sector-specific evidence base on which future investment practice will be informed. The theoretical deficiency of the TCM framework, namely the parallel and non-integrated application of the ESG, CSR, Triple Bottom Line, and SRI frameworks and lack of a coherent conceptual framework, has direct implications on the way DFIs build their impact measurement and management systems. This evidence should be used by DFIs and

international organisations with convening authority, including the OECD, UN Environment Programme Finance Initiative, IFC Operating Principles of Impact Management, and Global Impact Investing Network, to justify and speed up the harmonisation of green investment taxonomies and impact reporting standards, which minimises the measurement inconsistency that currently hinders cross-portfolio comparison and evidence synthesis across the GVC literature. Lastly, the fact that the study has found that GVC is at a dynamic stage of expansion that is nearing an inflection point in 2030 gives DFIs a strategic planning horizon that is of true importance.

5. Future Research Agenda for GVC Research

The research agenda is structured around seven research frontiers (refer Table V), which are individually and internally coherent lines of inquiry. Collectively they form a strategy of the vision that the GVC field can take over the next decade between today and its assumed intellectual peak of around 2029–2030.

Table V

RESEARCH FRONTIER	GAP	FUTURE RESEARCH AGENDA/ QUESTIONS



Table V

Toward a Unified Theory of GVC—Institutional and Dynamic Capability Views	The TCM analysis shows that the Institutional Theory has dominated GVC research, which is applied in a rather siloed, confirmatory way whereas Dynamic Capabilities Theory, the system of innovation theory, open innovation frameworks etc. all are closer to explaining adaptive, process-oriented phenomena such as green venture scaling—are conspicuously peripheral.	Further studies ought to seek an exclusive program of theory integration to develop what this agenda would be called Dynamic Green Venture Theory (DGVt)—an integrated conceptualisation that integrates the why firms react to external legitimacy pressures and the mechanisms of adaptation of the Dynamic Capabilities Theory. This framework predicts empirically that longitudinal panel designs following green ventures between founding and exit in multiple institutional settings would be used to isolate the changing relative salience of institutional pressures, resource endowments, and adaptive capabilities at different points in the venture lifecycle. One such fruitful empirical location would be a cross-national study of green ventures that exist in jurisdictions with radically different regulatory trajectories.
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Table V

Cognitive Biases, Decision Heuristics, and the Psychology of Sustainability-Oriented Capital Allocation—The Behavioural Microeconomics of Green Investment Decisions	The most notable gap in the GVC literature is perhaps that Behavioural Economic Theory, Cognitive Theory (Tao & Wu, 2025), and Emotional Contagion Theory (Wöhler & Haase, 2022) are marginally shown, although individual and organisational cognition in decision-making about GVC investments is deeply embedded— how cognitive biases distort due diligence, and how social and emotional processes in investment committees shape their deal choices.	Future studies ought to set up a specified Behavioural Research Program in GVC that implements the instruments of cognitive and experimental economics to the particular decision setting of green investment. Specific research questions could be framed as: RQ1: Are GVC investors susceptible to a green halo effect—systematically overrating the technical feasibility of projects with highly environmental stories? RQ2: Do they use varying rates of discounting of environmental returns, compared to financial returns, and in what ways would this influence portfolio construction? RQ3: What do the organisational culture and composition of teams in GVC funds mean in terms of the incorporation of ESG criteria in the investment decision-making process? RQ4: Is ESG screening more of a cognitive or social compliance process or a truly analytical one?
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Table V

GVC in Institutional Voids— Rethinking Investment Frameworks for the Global South	The country-level and geographical breakdowns of GVC scholarship are dramatic and disturbing, with advanced economies disproportionately focusing on the study, where Sub-Saharan Africa, South Asia, Latin America, and the Middle East have received very little consideration in light of being the most challenged regions in the world in terms of sustainability.	Future studies will need to build what this agenda calls an Institutional Void Green Venture Framework (IVGVF) and the Base-of-the-Pyramid Literature on Innovation into a specific theory of how green ventures are identified, financed, governed, and scaled.
Sectoral Heterogeneity and GVC - Unlocking the Overlooked Economy	The TCM framework shows the manufacturing, Agriculture, Construction, Healthcare, Trade and Retail, and handicrafts sectors, which contribute most of global employment, resource consumption, and environmental impact, are barely covered by scholarly attention.	This is where the frontier can be seen as the creation of what could be referred to as “Sector-Calibrated Green Venture Models”—styles of investment that break down the generic category of green startup into sector-specific archetypes that have different financial structures, risk profiles, and impact measurement models.

Table V

Digital Technologies as Disruptors and Enablers of GVC AI, Blockchain, and the Data Infrastructure of Sustainable Finance	The GVC literature has identified a severe gap that the transformative potential of digital technologies—artificial intelligence, blockchain, satellite remote sensing, and big data analytics— as a tool to fundamentally change the information environment within which GVC decisions are made.	One of the most radical research agendas of this frontier is studying the consequences of AI's massive and fast-increasing energy consumption on GVC environmental credentials . With AI infrastructure now emerging as a key venue of VC capital confirms (Yazici, 2025)—absorbing a quarter of world VC flows by 2025.
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Table V

The Geopolitics of GVC - Capital Flows, Technology Sovereignty, and the Political Economy of Sustainable Innovation	One of the dimensions that are completely lacking in the current GVC literature is the geopolitical dimension of green investment flows. The production at the country level indicates that two geopolitical blocks, namely the USA and China, lead in GVC scholarship, but each one of them follows an entirely different pattern of green industrial policy, technology regulation, and capital market formation.	Further studies ought to define a political economy of GVC to determine how geopolitical processes, such as the technology competition between the US and China in the clean energy sector, the green infrastructural elements of the Belt and Road Initiative in China, and the new competition over the critical mineral supply chains needed by green technology, influence GVC flows at the global level. In particular, it is essential that the researchers explore the impact of US-China strategic competition in solar, battery, and electric vehicle technology on the provision of cross-border GVCs; the claims of technology sovereignty are redefining European GVC ecosystems to domestic investments; and how the global south is coping with competing Chinese and American models of financing green development.
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Table V

Measuring What Matters - Towards a Causal Science of GVC Impact	The methodological discussion shows that cross-sectional, correlational research designs dominate the GVC field and cannot structurally provide the answer to the most significant practical question in the whole field: Does GVC actually work? Is GVC investment causally related to the environmental effects that it warrants preferential treatment against by policymakers, institutional investors, and development finance institutions—or does it mostly fund investment projects that would have been green in any case, with the losses of capital allocation efficiency?	Further studies ought to continue a causal identification program in GVC studies that is founded on three methodological pillars. The former are natural and quasi-experimental designs that are based on policy discontinuities, regulatory threshold effects, and exogenous shocks to GVC-relevant regulation as tools to establish the causal impact of green investment on firm-level environmental performance, innovation output, and economic sustainability. The second is tracking a longitudinal cohort of GVC-supported and similar non-GVC-supported ventures across investment horizons of five to fifteen years. The third is a portfolio-level experimental and quasi-experimental study of whether GVC funds with less permissive and systematically applied ESG due diligence mechanisms.
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6. Conclusion

The aim of this study was to map the intellectual map of the GVC research by an integrated systematic review of 73 peer-reviewed documents obtained in the SCOPUS database through a focused bibliometric analysis. Informed by three research questions concerning the evolutionary course of the field, its thematic structure and theoretical-contextual-methodological structure, the analysis has created a full and thoroughly based portrait of the GVC scholarship in its current manifestation, its successes, its logics, and its structural constraints. The results narrate a sensible and educative tale. Over the past ten years or so, GVC has transformed, moving, so to speak, from a conceptually unclear and scholarly periphery issue to a well-known and fast-growing research area. The logistic growth model confirms that the field is in the steepest stage of growth, and the annual volumes of publications are expected to reach a peak at around 2029-2030 before reaching a stage of gradual maturation. This trend is not just academic chic but a true reflection of the alignment between the issues of the field and some of the most urgent issues of the twenty-first century—climate change, sustainability transitions, and mobilisation of private capital to serve environmental purposes.

But the most valuable contributions of the study are not its record of the development of the field but rather a diagnosis of its structural state. Under the accelerated pace in the number of publications, the analysis shows a discipline that has been theoretically rooted in classical management paradigms—institutional theory and the resource-based view—not intended to explain the processes of sustainability-oriented capital allocation but not yet in a way sufficient to understand the behavioural, dynamic, and innovation-systems perspective. The theoretical location of research production and citation is highly skewed towards fewer developed economies, so the sustainability issues of the Global South, where environmental pressures are the most intense and institutional contexts most diverse, have been largely disaggregated. The GVC research focus on the sectoral level is clustered around financial services, technology, and energy, whereas manufacturing, agriculture, construction, and healthcare (sectors that have caused most environmental damage in the world) are left behind in the periphery of research. And the methodological arsenal used throughout the field is principally cross-sectional and uses mere statistical methods that cannot be used to determine the causal relationships that evidence-based policy and investment practice demand.

These diagnoses are not made as criticisms of the scholars who have created this field out of almost nothing into a research area in the space of ten years. They are put forth as the wisest, most upright way that the energy of the field needs to go next. The seven frontiers of research suggested in the future agenda—between the construction of a unified dynamic green venture theory, to the behavioural microeconomics of green investment decision-making, to the political economy of cross-border GVC flows, to the causal impact that science the field currently lacks—are all elements that would turn GVC scholarship into a mature, policy-relevant, and globally inclusive science of sustainable capital allocation.

The practical uses are also very concrete. To investors, the analysis gives a map of what knowledge base they can and cannot count on and which dimensions of analysis—especially dynamic capability assessment and due diligence—are underserved by the current research. To entrepreneurs, it is an indicator of which industries and localities continue to be systematically underserved by GVC and which localities have the highest probability of differentiated positioning. To policymakers, it offers empirical confirmation of the pivotal role of

institutional architecture in GVC development and the sectoral and geographical misallocations that cannot be resolved by the market forces alone. To development finance institutions, it lays down the scale and urgency of the investment it requires to establish GVC knowledge infrastructure sufficient to the sustainability challenges of the global South.

GVC is at a crossroads—not of its practical growth as a type of asset, but of its conceptual growth as a discipline of study. The 10-year period prior to the logistic growth curve peaking and the field consolidating can be viewed as a window of opportunity that is both rare and consequential in determining what GVC research will look like. The results and plan offered in this paper are provided as a contribution to how best to make the most of that window—to make the knowledge infrastructure currently under construction be wide enough to capture the diversity of the world, rigorous enough to permit actual causal inference, and ambitious enough to be worthy of the scale of the sustainability challenge that makes GVC matter in the first place.

Ethics Statement

Ethics approval and informed consent were not required for this study because it did not involve human participants, animal subjects, or personal data. The study is based exclusively on the analysis of previously published literature and bibliographic records retrieved from the Scopus database.

Informed Consent

Not applicable.

Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contribution

Author 1: Ananya Gupta - Conceptualisation, Methodology, Writing Original Draft.

Author 2: Dr. Farah S. Choudhary - Writing- Review and Editing, Formal Analysis.

Use of Generative AI

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