Green Intellectual Capital Research: Bibliometric Insights into Performance and Sustainability

Nur Syuhada Adnan*[1], Syafiq Abdul Haris Halmi[1], Noor Emilina Mohd Nasir[1], Suraya Ahmad[1], Muhammad Shaqif Azfar Afandi[1] and Ratna Mulyany[2]

[1] Universiti Teknologi MARA Cawangan Terengganu, Sura Hujung, 23000 Dungun, Terengganu, Malaysia
[2]Universitas Syiah Kuala, Jln. Teuku Nyak Arief Darussalam, Banda Aceh, Aceh 23111 Indonesia
*nursyuhada@uitm.edu.my

Abstract. This study explores the evolving landscape of Green Intellectual Capital (GIC) and its role in driving sustainability and business performance. GIC aligns closely with several United Nations Sustainable Development Goals (SDGs), including SDG 4 (Quality Education), SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals). Through a bibliometric analysis of 145 Scopus-indexed publications from 2014 to 2025, this research identifies key themes, influential scholars, and emerging trends in the field. Employing citation metrics, co-occurrence mapping, and network visualization, the study systematically examines the intellectual structure of GIC research. Data was retrieved from the Scopus database and analyzed using Publish or Perish, Microsoft Excel, and VOSviewer to assess publication trends, citation impact, and collaborative networks. The findings reveal a significant surge in GIC-related research, particularly between 2021 and 2024, reflecting the increasing global emphasis on sustainability. The study underscores the pivotal role of green human capital, green structural capital, and green relational capital in fostering corporate sustainability. Notably, Malaysia and Pakistan emerge as leading contributors to GIC literature, demonstrating a growing commitment to sustainable business practices. This study not only contributes to the academic discourse on GIC but also provides valuable insights for industry practitioners seeking to integrate intellectual capital into sustainability strategies. Future research should focus on industry-specific applications, the impact of digital transformation, and the role of GIC in ESG (Environmental, Social, and Governance) reporting, ensuring its relevance in the rapidly evolving business landscape.

Keywords: Green Intellectual Capital, Sustainable Development Goals, Bibliometric Analysis, Performance, Sustainability

1 Introduction

In recent years, the nexus between environmental sustainability and business performance has garnered significant attention from academics, practitioners, and policymakers. As firms navigate the complexities of a rapidly changing global landscape, the integration of sustainable practices into their core operations has emerged as a critical determinant of long-term success (1). Hence, the concept of Green Intellectual Capital (GIC) has emerged as a critical factor in achieving this equilibrium.

N. A. Mohamad Azmin et al. (eds.), *Proceedings of the 9th Terengganu International Business and Economics Conference 2025 (TiBEC IX 2025)*, Advances in Economics, Business and Management Research 341,
https://doi.org/10.2991/978-94-6463-801-1_17

GIC, which encompasses the knowledge, skills, and innovations related to sustainable practices, plays a pivotal role in enhancing firms' sustainability and performance regardless of profit or non-profit oriented (2). According to (3), GIC represents the collective intellectual assets, capabilities, and resources within an organization that facilitate the development and execution of environmentally sustainable initiatives. It is instrumental in driving sustainable business practices and enhancing organizational performance through three main components: green human capital, green structural capital, and green relational capital (4). By leveraging these components, firms not only improve their environmental footprint but also achieve a competitive edge in the marketplace (2). (5) suggest that GIC has the potential to revolutionize small medium enterprises' (SMEs) operations, by mitigating negative environmental impacts and boosting both market and financial performance.

In understanding the evolving landscape of GIC and its impact on firms' sustainability and performance, this study employs a bibliometric analysis. Bibliometric analysis is a quantitative method for assessing the volume, impact, and trends of academic research (6). Bibliometric analysis studies generally encompass mapping and visualizing literature through network analyses, evaluating research impact using specific metrics, and investigating research productivity by analysing publishing trends (7). Through the systematic examination of scholarly publications, citations, and collaboration networks, this analysis aims to provide a comprehensive overview of the intellectual advancements in this field.

The primary objective of this article is to map the bibliometric landscape of GIC and its relationship with organizational sustainability and performance. By identifying key authors, influential publications, and emerging research themes, this study seeks to elucidate the current state of knowledge and highlight avenues for future investigation. The findings will offer valuable insights for academics, business leaders, and policymakers striving to foster sustainable and high-performing organizations.

2 Literature Review

2.1 GIC and Sustainability

The concept of GIC has been a prominent issue in both academic literature and practical applications, particularly within the context of sustainability and corporate performance. According to (8), GIC encompasses a variety of intangible assets, knowledge, capabilities, and relationships related to environmental protection and green innovation, both at the individual and organizational levels within a company. (9) similarly suggests that GIC encompasses the knowledge, skills, and intangible resources necessary for implementing environmentally sustainable activities.

Green Human Capital is a crucial element of GIC, encompassing the knowledge, skills, and competencies of employees that contribute to sustainable practices (4). This component is instrumental in fostering the development of green structural capital and green relational capital (10). Green Structural Capital refers to internal policies, processes, and organizational culture that support sustainability (4). Conversely, Green Relational Capital pertains to external relationships and networks with stakeholders aimed at achieving sustainability goals (4). Researchers suggest that a company's ability to leverage these forms of intellectual capital can enhance both its environmental and financial performance by fostering innovation, efficiency, and strong stakeholder relationships (11).

Businesses are increasingly acknowledging that sustainability is crucial for long-term profitability and competitiveness. (12) defines sustainability as fulfilling current needs without hindering future generations' ability to meet their own needs. This principle forms the foundation of corporate sustainability, which encompasses social,

economic, and environmental performance (13). Companies that prioritize sustainability often see improvements in their reputation, profitability, and competitive edge (14). Additionally, international environmental regulations, such as the Rio Earth Summit and the Kyoto Protocol, have further urged companies to adopt sustainable practices (4). Therefore, the connection between GIC and sustainability is essential.

The integration of GIC into organizational strategies is closely aligned with global frameworks such as the Sustainable Development Goals (SDGs) and Environmental, Social, and Governance (ESG) criteria. In the context of SDGs, GIC contributes to achieving specific goals through its three components. Green human capital fosters expertise and awareness of sustainability practices, advancing SDG 4 (Quality Education) and SDG 13 (Climate Action). Green structural capital drives innovation in sustainable technologies and processes, thereby supporting SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production). Green relational capital strengthens collaboration with stakeholders, aligning with SDG 17 (Partnerships for the Goals) and fostering collective action toward sustainable development.

In line with the SDGs, introduced by the United Nations in 2015 to guide global sustainability efforts until 2030, companies play an important role in driving economic, social and environmental progress (15). The activities of businesses have a significant impact on the natural environment and the global ecosystem, making sustainable business practices essential. The SDGs provide a universal framework to drive meaningful economic, social and environmental change and ensure corporate accountability through responsible business strategies. Understanding the interaction between GIC and SDGs shows how organizations can leverage their intellectual capital to contribute to philanthropic initiatives, social impact investments and long-term sustainability goals.

Similarly, GIC complements ESG strategies, which emphasize corporate responsibility across three dimensions: environmental, social, and governance. In the environmental dimension, GIC facilitates the adoption of eco-friendly practices, fosters innovation in green technologies, and supports partnerships aimed at reducing environmental impacts. In the social dimension, GIC enhances corporate social responsibility by empowering employees and building sustainable relationships with stakeholders. In the governance dimension, GIC promotes ethical and transparent governance, underscoring the importance of sustainability reporting as a core component of ESG strategies.

Sustainability reporting, as part of ESG strategies, plays a crucial role in transparently communicating an organization's sustainability efforts to stakeholders. Such reporting highlights the impact of GIC-driven initiatives on business operations and provides firms with opportunities to gain a competitive edge. Organizations that embrace sustainability reporting as a strategic tool can improve their reputation, attract environmentally conscious consumers and investors, and strengthen their positioning in the green economy transition. Moreover, sustainability reporting demonstrates how firms align their efforts with SDG objectives, underscoring the alignment between corporate sustainability practices and global development goals.

As industries evolve, sustainability will remain a pivotal factor in shaping business strategies. Companies must adopt innovative approaches to fully leverage GIC while ensuring long-term environmental and economic resilience. By strategically developing their GIC, companies can improve environmental performance, gain a competitive edge, and achieve sustainable growth. GIC fosters the adoption of eco-friendly practices, optimal resource utilization, and effective stakeholder engagement (16). Human capital, as a component of GIC, enhances the triple bottom line and supports sustainable business practices (17). Additionally, green relational capital strengthens stakeholder relationships, leading to improved environmental actions (18). Structural

capital, which includes sustainable supply chains and knowledge management systems, drives environmental value creation and business sustainability (8, 19). Consequently, the growing recognition and utilization of GIC positively impact a company's sustainability and financial performance (20).

2.2 GIC and Performance

Research has consistently shown that GIC contributes to enhanced environmental performance by enabling firms to adopt more sustainable practices, reduce their ecological footprints, and comply with environmental regulations. A study by (21) emphasizes that GIC fosters the development of sustainable technologies, which can help organizations meet environmental goals such as waste reduction, resource optimization, and the implementation of renewable energy sources. Similarly, (22) found that firms with higher GIC tend to achieve superior environmental performance due to their ability to integrate sustainability into their operational strategies. For instance, green human capital allows employees to identify and implement innovative solutions that reduce environmental impacts, while green structural capital provides the infrastructure needed to support these solutions (23). In this way, GIC does not only enhance environmental sustainability but also offers a means for organizations to gain a competitive edge by responding proactively to increasing consumer demand for eco-friendly products and services.

In addition to its role in enhancing environmental performance, GIC has been shown to have a positive impact on overall corporate performance, particularly in terms of financial and social outcomes. Companies that invest in GIC are often better positioned to capitalize on emerging market opportunities driven by consumer demand for sustainability (24). For example, firms with strong green relational capital may enjoy enhanced brand reputation and customer loyalty, which translates into increased sales and market share (25). Furthermore, green structural capital, through the implementation of efficient processes, can lead to cost savings by reducing waste and improving resource utilization, which directly enhances profitability (26). As such, the integration of GIC Into business strategies is increasingly recognized as a key driver of corporate success, particularly in industries where environmental responsibility is a critical competitive differentiator.

Several studies have examined the impact of GIC on firm financial performance, and the results are generally positive. Nevertheless, the benefits of GIC on financial performance are often long-term and may not be immediately reflected in short-term financial results. (27) for instance, argue that while investments in green initiatives such as cleaner technologies or sustainable product lines might not yield immediate financial returns, they can significantly enhance the firm's competitive position over time. This delay in the financial payoff is particularly evident in industries where initial green investments are high, such as in renewable energy or green manufacturing. However, the strategic integration of GIC into corporate culture and decision-making processes helps companies build resilience and adaptability, which are essential for long-term financial success (28). Therefore, while short-term financial outcomes may fluctuate, the long-term financial benefits of GIC in terms of market competitiveness, risk reduction, and cost efficiency are evident.

Finally, the importance of GIC for corporate performance is also evident in its influence on social performance. Green relational capital, for example, plays a crucial role in shaping relationships with external stakeholders, including government agencies, NGOs, and local communities. Firms with strong green credentials are often perceived as more socially responsible, which can enhance their reputation and lead to more favourable interactions with regulators, investors, and customers (29). Moreover, companies that engage in socially responsible environmental practices may experience

improved employee satisfaction and retention, as employees tend to favour organizations that prioritize sustainability (25). Therefore, GIC not only enhances environmental and financial performance but also contributes to a company's social performance, further bolstering its overall corporate standing.

3 Research Methodology

This study uses a bibliometric analysis approach to examine the intellectual structure and research trends of "Green Intellectual Capital" regarding performance and sustainability. The metadata for this study was retrieved from the Scopus database using the search string: (TITLE-ABS-KEY("green intellectual capital" AND ("performance" OR "sustainability"))) as illustrated in Figure 1. Scopus was selected as the primary data source as it provides comprehensive coverage of peer-reviewed scientific literature in various disciplines. The search was conducted on 13 February 2025 to ensure that relevant publications up to the most recent period were included. The extracted metadata, including document titles, authors, years of publication, sources, citations and keywords, were exported in CSV and RIS format.

The extracted data was then processed using Publish or Perish (PoP) software, which facilitated citation analysis by calculating key bibliometric indicators such as h-index, total citations and average citations per article. PoP also enabled an initial assessment of the most cited documents contributing to this research area. Microsoft Excel was used for the organisation and initial descriptive statistical analysis of the extracted bibliometric data. Functions such as frequency distributions and graphical representations were used to analyse annual publication trends, leading journals and prolific authors. The VOSviewer software was used to visualise the bibliometric networks. The software created network maps that visualised the relationships between authors, institutions and important research topics. Clustering techniques were used to identify key research areas and emerging trends in GIC. These visualisations provided deeper insights into collaborative networks and thematic developments.

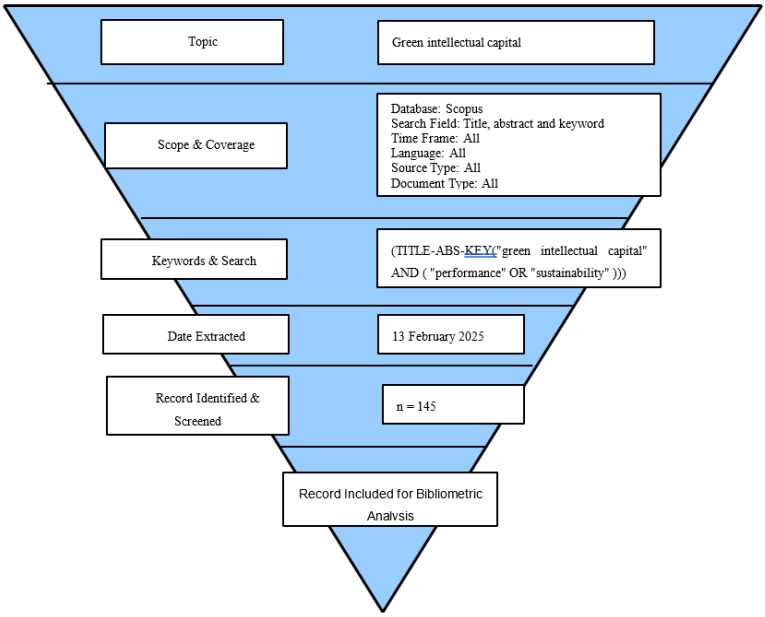

Figure 1. Flow Diagram for Bibliometric Analysis (Source: (30))

4 Results and Discussion

Researchers published 145 documents on GIC and performance, of which 110 are cited publications, over the past decade. A total of 3,817 citations were generated from the cited papers, signifying that the area of study is gaining prominence in contemporary scholarly debate. h-index of 31 signifies the impact of a publication in which 31 publications are being cited at least 31 times. Meanwhile, a cumulative total of 3600 citations are generated from at least 60 publications in the research domain. These publications are contributed by 530 authors worldwide.

Table 1: Citation's Metric

Main Information	Data
Publication Years	2014 - 2025
Total Publications	145
Number of Cited Papers	110
Total Citations	3,817
Citation per Paper	6.32
Citation per Cited Paper	34.70
Citation per Author	7.20
Author per Paper	3.66
h-index	31
g-index	60

The number of publications in the research scope has significantly increased from 2021 to 2024, as shown in Table 2 and Figure 2. A growing number of authors are interested in examining and offering scholarly perspectives on the issue. Remarkably,

there are already 8 publications in 2025, despite being early in the year. This indicates a continued and growing interest in GICs and their impact on sustainability, environmental performance and corporate strategy. The number of cited publications is evidence that there is a high intellectual impact from the selected publications in the year. In addition, the citation per cited publication indicates that these publications hold significant importance in scholarly discussions.

Table 2: Publication trends

Year	TP	NCP	TC	C/P	C/CP	*h*	*g*
2014	1	1	100	100.00	100.00	1	1
2018	2	1	1	0.50	1.00	1	1
2019	8	6	307	38.38	51.17	5	8
2020	4	3	443	110.75	147.67	3	4
2021	12	12	1286	107.17	107.17	11	12
2022	16	16	773	48.31	48.31	10	16
2023	42	39	712	16.95	18.26	14	26
2024	52	32	195	3.75	6.09	8	12
2025	8	0	0	0.00	0.00	0	0
Total	145	110	3817	26.32	34.70	31	60

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index

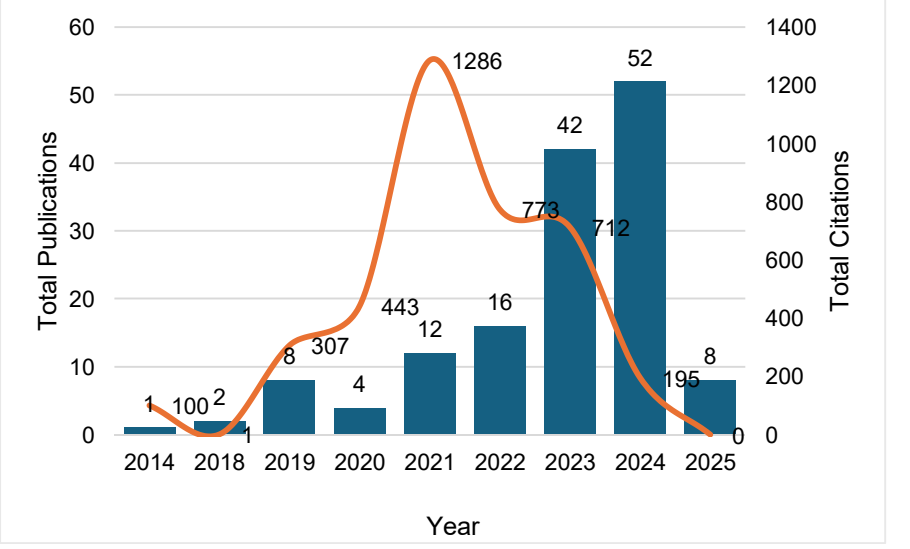

Figure 2: Total Publications and Citations by Year

Table 3 depicts the prominent source title in the research scope. Although the publications in each source title are less than 20 publications, the number of citations is significantly high. The Journal of Intellectual Capital records the highest number of publications, which indicates its research interest relevancy with GIC and performance discussions. It is intriguing that, despite the fact that the Journal of Cleaner Production and Business Strategy and the Environment contain only six publications, both titles generate significantly more citations than the other source. This suggests that these source titles significantly influence the scholarly discourse on the subject.

Table 3: Most Productive Source Title with a minimum of four publications

Source Title	TP	NCP	TC	*h*	*g*
Journal of Intellectual Capital	15	12	335	8	15
Environmental Science and Pollution Research	7	6	163	5	7
Journal of Cleaner Production	6	6	761	5	6
Business Strategy and the Environment	6	6	502	5	6
Sustainability (Switzerland)	5	4	269	4	5
International Journal of Learning and Intellectual Capital	4	3	35	2	4
International Journal of Energy Economics and Policy	4	4	77	3	4
International Journal of Innovation Science	4	3	49	2	4

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; h=h-index; and g=g-index.

The article titled "Analyzing the Relationship Between Green Innovation and Environmental Performance in Large Manufacturing Firms" by Rehman et al. (2021) is the leading publication in this research domain. This publication, with 467 citations, has become the primary reference for numerous authors. Four out of ten highly cited documents were authored by the Malaysian researchers. These documents entitled “A structural model of the impact of GIC on sustainable performance”, “Do all elements of GIC contribute toward business sustainability? Evidence from the Malaysian context using the Partial Least Squares method”, “Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance” and “Green intellectual capital and ambidextrous green innovation: The impact on environmental performance” were authored by researchers from well-known universities in Malaysia. In fact, the documents are extensively cited by scholars globally.

The presence of highly cited papers from these countries, as highlighted in Table 4, emphasises their significant role in promoting GIC studies. These publications, especially those by Yusliza et al. (2020) and Nisar et al. (2021) from Malaysia, have contributed significantly to the understanding of the relationship between GIC, environmental management and corporate sustainability. Pakistani scholars such as Rehman et al. (2021) have also provided valuable insights into green innovation and environmental performance of large firms. Given the increasing academic focus on GIC in Pakistan and Malaysia, future research should explore industry-specific applications, particularly in manufacturing, hospitality and small and medium enterprises (SMEs). In Malaysia, where research has extensively explored the impact of GIC on business sustainability, further studies could focus on how digital transformation, artificial intelligence and big data analytics influence the utilisation of green intellectual capital. In addition, longitudinal studies are needed to assess the long-term impact of GIC on business performance and regulatory compliance. In the case of Pakistan, policy-oriented research could further investigate how government incentives, sustainability strategies and corporate environmental responsibility initiatives influence the adoption of GIC. Given the growing interest in green finance and ESG reporting, studies could examine the integration of GIC into corporate sustainability reporting and investment strategies. In addition, cross-country comparative studies between Malaysia, Pakistan and other emerging economies could provide deeper insights into regional challenges and best practises in GIC adoption.

Table 4: Top 10 highly cited documents

No.	Author(s)	Title	TC
1	Rehman S.U.; Kraus S.; Shah S.A.; Khanin D.; Mahto R.V. (2021)	Analyzing the relationship between green innovation and environmental performance in large manufacturing firms	469

2	Haldorai K.; Kim W.G.; Garcia R.L.F. (2022)	Top management green commitment and green intellectual capital as enablers of hotel environmental performance: The mediating role of green human resource management	264
3	Yusliza M.-Y.; Yong J.Y.; Tanveer M.I.; Ramayah T.; Noor Faezah J.; Muhammad Z. (2020)	A structural model of the impact of green intellectual capital on sustainable performance	262
4	Nisar Q.A.; Haider S.; Ali F.; Jamshed S.; Ryu K.; Gill S.S. (2021)	Green human resource management practices and environmental performance in Malaysian green hotels: The role of green intellectual capital and pro-environmental behavior	239
5	Yusoff Y.M.; Omar M.K.; Kamarul Zaman M.D.; Samad S. (2019)	Do all elements of green intellectual capital contribute toward business sustainability? Evidence from the Malaysian context using the Partial Least Squares method	187
6	Malik S.Y.; Cao Y.; Mughal Y.H.; Kundi G.M.; Mughal M.H.; Ramayah T. (2020)	Pathways towards sustainability in organizations: Empirical evidence on the role of green human resource management practices and green intellectual capital	175
7	Wang C.H.; Juo W.-J. (2021)	An environmental policy of green intellectual capital: Green innovation strategy for performance sustainability	172
8	Asiaei K.; Bontis N.; Alizadeh R.; Yaghoubi M. (2022)	Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance	135
9	Asiaei K.; O'Connor N.G.; Barani O.; Joshi M. (2023)	Green intellectual capital and ambidextrous green innovation: The impact on environmental performance	106
10	Delgado-Verde M.; Amores-Salvadó J.; Martín-De Castro G.; Navas-López J.E. (2014)	Green intellectual capital and environmental product innovation: The mediating role of green social capital	100

Notes: TC=total citations.

The researchers from Asian countries contributed a significant number of publications in the area, while the European and North American contributions are comparatively smaller. The highest cited paper is authored by researchers from Pakistan. Pakistan leads with the highest number of publications (46), followed by Malaysia (28) and China (25). This trend suggests that research on GIC is particularly important in developing Asian economies, where there is a growing interest in sustainable business practices and environmental performance. The number of publications in the subject matter is increasing due to the initiative of these countries to enhance their current sustainability in GIC.

Table 5: Most influential countries

Country	Continent	TP
Pakistan	Asia	46
Malaysia	Asia	28
China	Asia	25
Indonesia	Asia	16
Saudi Arabia	Asia	13
Spain	Europe	13
India	Asia	11
Vietnam	Asia	8
Romania	Europe	7
Italy	Europe	6

Country	Continent	TP
United States	North America	6

Notes: TP=total number of publications

Analysing the most important keywords is important to understand the intellectual structure and research trends in a particular field. This study provides an analysis of the top 10 keywords as shown in Figure 3. The result shows that intellectual capital related to sustainability, especially in the context of business and environmental management, has received much academic attention. This also suggests that green human capital and knowledge management play a crucial role in improving organisational sustainability by enhancing employees' skills and transferring environmental knowledge. Furthermore, the existence of green relational capital and competitive advantage emphasises that companies can achieve market differentiation and long-term growth with sustainability collaborations.

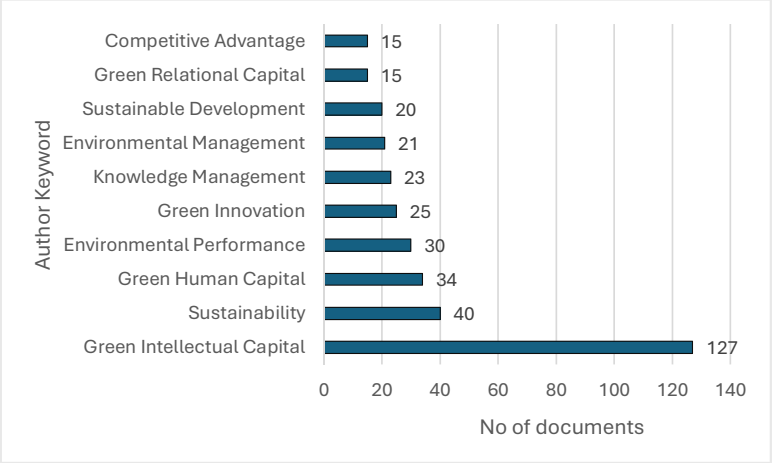

Figure 3: Top 10 keyword

Furthermore, understanding the co-occurrence of keywords helps to map the development of GIC research, identify gaps in the literature and direct future studies to unexplored or underdeveloped areas. The network map shown in Figure 4 illustrates the common occurrence of keywords in the field of "Green Intellectual Capital"(GIC) and the associated research areas. The central node in red is the most prominent keyword, indicating its importance in the dataset, where it is strongly linked to environmental performance and sustainable performance, suggesting that much of the research focuses on the relationship between GIC and corporate sustainability outcomes.

The green cluster, on the other hand, highlights aspects of green human capital, green structural capital and green organisational capital, suggesting a focus on companies' internal capabilities in managing GIC. The blue cluster links GIC with corporate social responsibility (CSR) and shows the growing interest in integrating CSR and sustainability with intellectual capital. Another emerging theme is the yellow cluster, which relates to green innovation and corporate sustainability, suggesting that innovation plays a crucial role in leveraging GIC for competitive advantage. The presence of Malaysia as a distinct node suggests that a significant number of studies on GIC originate from this region, possibly reflecting regional policy initiatives or industry practices that emphasise GIC.

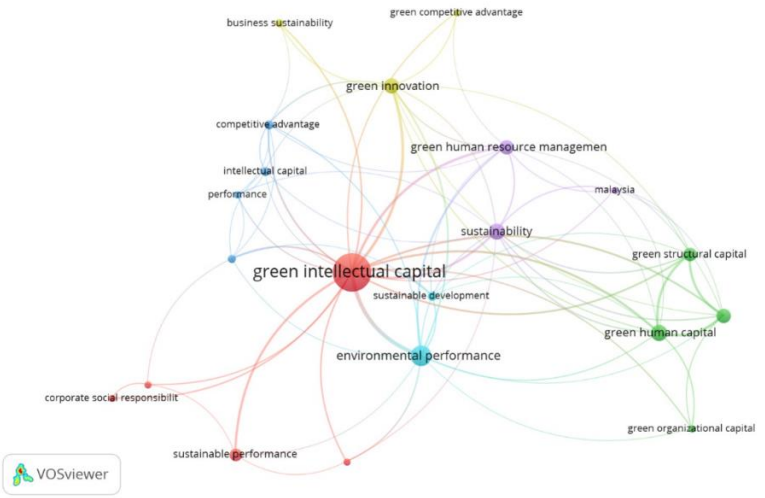

Figure 4: Network Visualization Map of The Co-Occurrence by Author's Keywords

5 Conclusion and Recommendations

In conclusion, this study highlights the growing academic interest in GIC and its impact on sustainability and business performance. Over the past decade, 145 publications have explored this subject, with 110 cited documents generating 3,817 citations. The increasing number of publications from 2021 to 2024 reflects a rising scholarly focus on integrating sustainability into business strategy. The h-index of 31 further confirms the intellectual impact of this research area. Notably, researchers from Malaysia and Pakistan have made substantial contributions, producing some of the most cited works in the field.

The study reveals that GIC is closely linked to corporate sustainability, environmental performance, and innovation. The keyword analysis indicates that green human capital, green structural capital, and green relational capital remain core themes in the literature, while newer areas such as corporate social responsibility (CSR) and green innovation are gaining traction. The Journal of Intellectual Capital has the highest number of publications, while the Journal of Cleaner Production and Business Strategy and the Environment generate the most citations, demonstrating their influence in shaping the discourse on GIC. The results of this study provide valuable practical suggestions for companies, policy makers and academia by emphasising the role of GIC in promoting sustainability, innovation and competitive advantage. Companies can utilise green human, structural and relational capital to improve environmental performance, operational efficiency and stakeholder engagement, while policy makers can use these insights to develop incentives, regulations and sustainability frameworks that encourage corporate investment in GIC. In addition, the study emphasises the importance of GIC in ESG reporting, enabling companies to integrate sustainability into their corporate disclosures. Academic institutions can also benefit by focussing their curricula on green intellectual capital management and training future professionals with sustainability skills. Overall, this study bridges the gap between

theory and practise and provides actionable insights to improve corporate sustainability and long-term economic resilience.

Despite these advancements, limitations remain. Most studies focus on conceptual frameworks rather than empirical validation, and regional disparities in GIC implementation are underexplored. Additionally, the role of emerging technologies, such as artificial intelligence and blockchain, in enhancing GIC is still in its infancy. The growing number of studies shows that GIC remains a dynamic and evolving field of research. Therefore, it is important that researchers continue to explore the theoretical foundations, practical applications and industry-specific implications.

Future research should address these gaps by examining industry-specific applications, integrating digital innovations into GIC strategies, and assessing the long-term impact of sustainability-driven intellectual capital. By doing so, scholars and practitioners can further harness GIC's potential to drive business competitiveness while fostering a sustainable global economy.

Acknowledgments. Gratitude to Universiti Teknologi MARA Cawangan Terengganu and Universitas Syiah Kuala, Banda Aceh for their invaluable support and resources, which were instrumental in the successful completion of this research.

References

1. Silva, L., Costa, V., & Loureiro, P. (2024). Green intellectual capital and organizational sustainability: a bibliometric study. *International Conference of Applied Business and Management (ICABM2022)* (pp. 567 - 580). Porto, Portugal: ISAG - European Business School.
2. Adnan, N., Kamaluddin, A., & Kasim, N. (2013). Intellectual Capital in Religious Organisations: Malaysian Zakat Institutions Perspective. *Middle-East Journal of Scientific Research 16 (3)*, 368-377.
3. Nawangsari, L. C., Siswanti, I., Arijanto, A., & Wahyu, M. (2024). From Knowledge to Action: Exploring Green Intellectual Capital's Role in Sustainable Organizational Performance for Millennials. *International Review of Management and Marketing*, 82-90.
4. Chen, Y. S. (2008). The positive effect of green intellectual capital on competitive advantages of firms. Journal of Business Ethics, 77(3), 271–286.
5. Kumar, J., Rani, V., Rani, M., & Rani, G. (2025). Linking green intellectual capital and firm performance through green innovation and environmental performance in small and medium-sized enterprises. *Journal of Intellectual Capital*.
6. Ahmi, A. (2022). *Bibliometric Analysis for Beginners.* UUM Press.
7. Awang, Y., Mohd Nasir, N., Taib, A., Mohamed Shuhidan, S., & Ifada, L. M. (2024). Digitalization of Accounting Profession: A Decade of Bibliometric Analysis. Advances in Social Sciences Research Journal – Vol. 11, No. 5, 103-120.
8. Asiaei, K., G O'Connor, N., Barani, O., & Joshi, M. (2022). Green intellectual capital and ambidextrous green innovation: The impact on environmental performance. *Business Strategy and The Environment*, 369-386.
9. Mwemezi, P. (2023). Decentralization in delivering public social services: A critical review in secondary education in Tanzania. International Journal of Contemporary Issues in Social Sciences, 2(1),1-8.
10. Yong, J.Y., Yusliza, M.Y., Ramayah, T., Chiappetta Jabbour, C.J., Sehnem, S. & Mani, V. (2020), Pathways towards sustainability in manufacturing organizations: empirical evidence on the role of green human resource management. *Business Strategy and the Environment*, Vol. 29 No. 1, 218-228

11. Bos-Brouwers, H. E. J. (2010). Corporate sustainability and innovation in SMEs. International Journal of Sustainable Development & World Ecology, 17(3), 204-219.
12. World Commission on Environment and Development. (1987). Our Common Future. Oxford University Press.
13. Sartori, S., Latrônico, F., & Campos, L. M. (2014). Sustainability and sustainable development: A taxonomy in the field of literature. Journal of Cleaner Production, 156, 299–307.
14. Longoni, A., & Cagliano, R. (2015). Environmental and social sustainability priorities: Their integration in operations strategies. International Journal of Operations & Production Management, 35(2), 216-245.
15. Jones, P., G Wynn, M., Hillier, D., & Comfort, D. (2017). The Sustainable Development Goals and Information and Communication Technologies.
16. Toyyib, O. M., Mustapha, Enikanselu, H. A., & Adebayo. (2023). Assessment of political participation of physically challenged persons in Ondo State, Nigeria. International Journal of Contemporary Issues in Social Sciences, 2(1), 68-78.
17. Yusliza, M. Y., Yong, J. Y., Tanveer, M. I., Ramayah, T., Faezah, J. N., & Muhammad, Z. (2020). A structural model of the impact of green intellectual capital on sustainable performance. Journal of Cleaner Production, 249, 119334.
18. Yusoff, Yusmazida & Omar, Muhamad & Zaman, Maliza & Samad, Sarminah. (2019). Do All Elements of Green Intellectual Capital contribute toward Business Sustainability? Evidence from the Malaysian Context using the Partial Least Squares Method. Journal of Cleaner Production. 234. 10.1016/j.jclepro.2019.06.153.
19. Buhaya, M. I., & Metwally, A. B. M. (2024). Green intellectual capital and green supply chain performance: do external pressures matter? *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2349276
20. Daat, S. C. (2019). Pengaruh Pengungkapan Relational Capital Pada Kinerja Keuangan Perusahaan (Studi Empiris Pada Perusahaan High-Ic Intensive Industries Yang Terdaftar Di Bursa Efek Indonesia). Nominal: Barometer Riset Akuntansi dan Manajemen, 8(2), 255–273.
21. Martínez-Conesa, I., Palacios-Manzano, M., & García-Sánchez, P. (2017). Green intellectual capital as a determinant of corporate sustainability: A study of SMEs. Sustainability, 9(5), 849.
22. Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. Strategic Management Journal, 35(1), 1-23.
23. Teece, D. J. (2010). Business models, business strategy and innovation. Long Range Planning, 43(2-3), 172-194.
24. Schaltegger, S., Hansen, E., & Lüdeke-Freund, F. (2012). Business cases for sustainability: The role of business model innovation for corporate sustainability. International Journal of Innovation and Sustainable Development, 6(2), 95-119.
25. Pérez, A., & Sánchez, J. L. (2007). The effect of corporate social responsibility on firm value: The role of customer satisfaction. Corporate Social Responsibility and Environmental Management, 14(2), 11-21.
26. Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. Journal of Cleaner Production, 65, 42-56.
27. Henriques, A., & Sadorsky, P. (1999). The relationship between environmental commitment and managerial perceptions of stakeholder importance. Academy of Management Journal, 42(1), 89-103.
28. Wang, Y., Dou, J., & Jia, H. (2014). Corporate social responsibility and firm innovation. Journal of Business Ethics, 129(3), 485-497.
29. Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. Academy of Management Journal, 43(4), 717-736.

30. Suraya Ahmad, and Noor Emilina Mohd Nasir, and Syafiq Abdul Haris Halmi, and Nur Syuhada Adnan, (2024) *A bibliometric analysis: navigating publication trends in academic dishonesty in higher education.* AKADEMIKA, 94 (2). pp. 419-437. ISSN 0126-5008
31. https://sdgs.un.org/goals
32. www.scopus.com (retrieved on 13 February 2025)
33. www.vosviewer.com (retrieved on 13 February 2025)