

SUSTAINABLE PACKAGING RESEARCH: A BIBLIOGRAPHIC COUPLING-BASED CONCEPTUAL FRAMEWORK

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ABSTRACT

Over the past few decades, plastic consumption has become a global concern, resulting in extensive environmental impacts. One of the best ways to counter this issue and prevent further long-term environmental damage is through sustainable packaging. However, there is relatively little focus on a systematic analysis of the thematic and intellectual structures of sustainable packaging. Therefore, this study aims to examine the thematic patterns in the sustainable packaging literature by using bibliographic coupling analysis. Findings from the study indicate that, regardless of the country or organisation-level bibliographic coupling, sustainable packaging studies are influenced by contributions from both global and emerging economies. In addition, author-level bibliographic coupling reveals a mature and rapidly evolving research landscape, with a strong potential for interdisciplinary collaborations to advance sustainable packaging in the future. Lastly, findings from the document-level bibliographic coupling guide the development of a conceptual framework for future sustainable packaging research. The proposed conceptual framework indicates that sustainable packaging and consumer adoption are influenced by social media, public engagement, and recycling innovation, with behavioural determinants acting as a mediating factor. Further, these connections are theoretically supported by the Theory of Planned Behaviour, the Extended Theory of Planned Behaviour, and Social Cognitive Theory.

Keywords: Bibliographic coupling, conceptual framework, sustainable packaging.

1.0 INTRODUCTION

Plastic consumption has been steadily increasing globally over the past few decades. Significant growth in global plastic production occurred between 1950 and 2019, from around 2.0 million tonnes to around 460 million tonnes, representing an increase of almost 230-fold over the period (Ritchie et al., 2023). One major concern is that increased production leads to more waste. Almost 40% of global plastic waste originates from packaging-related activities (Samborska, 2024). This constitutes most of the plastic waste generated in major countries and regions, such as the United States, Europe, and China. Each year, an estimated 8.3 million tonnes of poorly managed plastic waste end up in the

ocean (Ceballos-Santos et al., 2024), causing severe environmental impacts by damaging marine ecosystems and food chains. The environmental impacts of plastic production and improper disposal of plastic waste add to greenhouse gas emissions. Therefore, there is a critical need to shift to sustainable packaging uses and solutions, including recycled materials, reuse systems, and environmentally friendly alternatives. This change can help reduce long-term environmental degradation.

A growing body of research has shown that sustainable plastic and packaging use is influenced by several factors, such as behavioural, technological developments, and policy-based perspectives. Past research has focused on the behaviours of consumers and their decision-making processes, emphasising that social media, attitudes, subjective norms, and perceived behavioural control have significant influences on sustainable use and reuse (Borg et al., 2020; De Fano et al., 2022; Gordon-Wilson et al., 2022; Wismantoro&Susilowati, 2025). Further literature examines the importance of digital technologies, machine learning, remote sensing, and Industry 4.0 solutions in supporting plastic reduction, recycling efficiency, and circular economy initiatives (Gonzaga et al., 2021; Schneikart et al., 2024; Yang et al., 2025). In addition, several studies have used theoretical frameworks such as the Extended Technology Acceptance Model, the Extended Theory of Planned Behaviour, and evolutionary game theory to explain the intention to use reusable packaging, refill delivery services, and plastic avoidance in e-commerce and fast-moving consumer goods (Casaca&Loureiro, 2023; Yu et al., 2023; Yue et al., 2024). Overall, previous studies have shown that advancing sustainable packaging requires a comprehensive approach that considers behavioural perspectives, social media influences, recycling innovations, and policy engagement to address plastic pollution effectively and foster long-term sustainable consumption.

Although previous studies have offered valuable insights, the literature on sustainable packaging lacks a systematic examination of thematic and intellectual structures. In addition, existing bibliometric studies mainly depend on the analyses of co-authorship, co-citation, and keyword co-occurrence or keyword distribution (Hael et al., 2025; Naini& Reddy, 2023). Bibliographic coupling remains underutilised in sustainable packaging studies, despite its merits for identifying emerging research relationships and intellectual similarities. Therefore, this study employs bibliographic coupling-based analyses across countries, organisations, authors, and documents to capture intellectual and thematic structures of research on sustainable packaging. Specifically, this study aims to derive a conceptual framework for future research.

2.0 DATA AND METHODOLOGY

In line with Suban (2025), publication records for this study were obtained from the Scopus database. This is because both Scopus and Web of Science are multidisciplinary databases (AIRyalat et al., 2019). Following Mohd Nasir et al. (2024), the search was conducted using the TITLE-ABS-KEY field in Scopus, and search terms included ("consumer plastic use*" OR "disposable plastic*" OR "food plastic packaging" OR "household plastic consumption" OR "macroplastic*" OR "microplastic*" OR "packaging consumption" OR "packaging waste" OR "plastic contaminants" OR "plastic consumption" OR "plastic demand*" OR "plastic debris" OR "plastic dependenc*" OR "plastic disposal" OR "plastic fragments" OR "plastic leakage" OR "plastic litter" OR "plastic packaging" OR "plastic particle*" OR "plastic pollution" OR "plastic product*" OR "plastic-related product*" OR "plastic residue" OR "plastic trash" OR "plastic use*" OR "plastic utilisation*" OR "plastic waste" OR "single-use packaging" OR "single-use plastic*") AND ("digital awareness" OR "digital campaign*" OR "digital education" OR "digital education platform*" OR "digital learning" OR "digital learning app*" OR "digital learning platform*" OR "digital literacy" OR "digital platform*" OR "digital solution*" OR "e-learning" OR "e-learning platform*" OR "e-platform*" OR "information

system*" OR "IoT" OR "knowledge management system*" OR "knowledge sharing" OR "mobile app*" OR "mobile learning" OR "online learning" OR "online learning platform*" OR "online platform*" OR "smart technology" OR "social media" OR "technology adoption" OR "technology-based education" OR "virtual learning" OR "web platform*" OR "web-based education"). This yields 590 publication records. The study then applied predefined inclusion and exclusion criteria. The inclusion criteria comprised: (i) publications written in English; and (ii) documents classified under the subject areas of Social Sciences (SOCI), Business, Management and Accounting (BUSI), and Economics, Econometrics and Finance (ECON). Conversely, the exclusion criteria were: (i) non-English publications; and (ii) records outside the selected subject areas. The dataset was reduced from 590 records to 582 records after applying the first screening step (i), and subsequently to a final sample of 122 publications after applying the second screening step (ii), which were used for the bibliometric analysis.

This study extends the bibliometric analysis of bibliographic coupling using VOSviewer (Van Eck & Waltman, 2020). Bibliographic coupling helps reveal the intellectual structure of the research field by generating groups based on the degree of similarity in the references cited by different documents (Lim et al., 2024). Moreover, bibliographic coupling examines country, organisation, author, and document levels. At the country level, it reveals how a country's research outputs are linked academically through shared references, highlighting geographical clusters. Organisation-level bibliographic coupling highlights relationships among universities, research institutes, and agencies. This reveals thematic alignments and organisational specialisation in similar research areas. Author-level bibliographic coupling reflects the similarity in authors' research interests. Finally, document-level bibliographic coupling connects individual publications through shared references. Accordingly, the resulting intellectual structures suggest thematic proximity or intellectual relatedness within the literature.

Examining bibliographic coupling at different levels provides a multidimensional understanding of how scholarly efforts in sustainable packaging are shared and have evolved across geographic, institutional, and intellectual domains. Therefore, this study applies bibliometric analysis, with a specific focus on bibliographic coupling, to identify thematic clusters from the shared sustainable packaging literature. Further, these clusters provide a structured representation of the research field and can be used to propose a conceptual framework that reflects the dominant themes and the intellectual relationships.

3.0 RESULTS AND DISCUSSION

3.1 Country-Level Bibliographic Coupling

Figure 1 illustrates country-level bibliographic coupling. Cluster 3 (blue) records the highest average citations (119) and an average publication year of 2022, indicating recent influential publications. It includes the United Kingdom, the United States, Belgium, and Australia, suggesting that developed countries lead global research in sustainable packaging through knowledge production and methodological advancement. Cluster 4 (yellow) shows a similar publication year (2022) with a high average citation count (94), comprising India, France, and Turkey. This reflects growing interest in sustainable packaging across both developed and developing economies, highlighting its expanding global relevance.

Clusters 1 (red) and 5 (purple) show lower average citations, with publications from 2022–2023, including Indonesia, China, the Philippines, Nigeria, and Malaysia. Despite lower citations, these emerging economies are recent contributors to sustainable packaging research, focusing on biodegradable materials, waste reduction, and circular economy practices.

Cluster 2 (green) includes Italy, the Czech Republic, Portugal, Russia, and Finland, with moderate citations (62) and older publications (2020). Cluster 6 (ocean blue) includes Germany, Spain, and Tunisia with lower citations. Both clusters focus on regulation-based sustainability and material efficiency in Europe. Overall, high-citation countries like the United States and the United Kingdom dominate, while Asia and Africa contribute as emerging clusters, highlighting global collaboration in advancing sustainable packaging research.

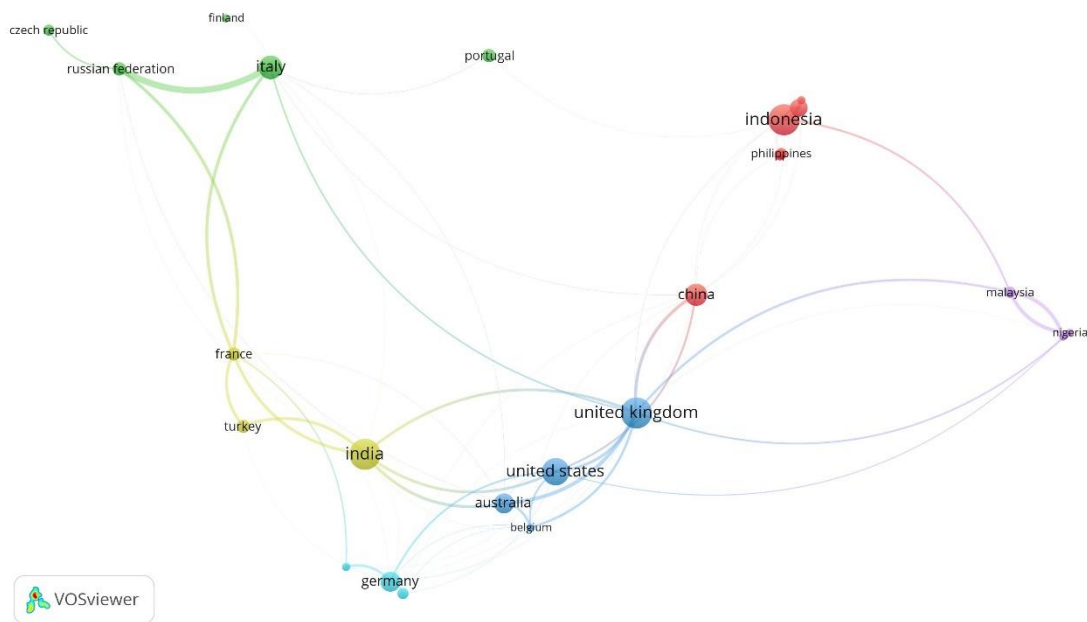


Fig. 1 Network visualization map of country-level bibliographic coupling

Notes: Minimum number of documents of a country = 2, minimum number of citations of a country = 2.

3.2 Organization-Level Bibliographic Coupling

Table 1 reports the research clusters in sustainable packaging derived from organization-level bibliographic coupling. Findings reveal patterns of organisational clustering guided by shared intellectual bases and research directions.

Cluster 1 focuses on practical challenges, including plastic recycling, marine litter management, and the circular economy. This cluster is led by organisations from Indonesia and Japan, with a recent average publication year (2023) and a high average citation count (31). The involvement of government agencies and industry-linked organisations highlights the emphasis on transforming research into policy action and real-world solutions. Cluster 2 is dominated by the most established group of institutions, mainly from Europe and the United States. This cluster features a moderate citation average and a strong focus on advanced materials, bioengineering, sustainable materials management, and eco-friendly design. This cluster of organisations contributes to both fundamental theoretical and methodological developments and further provides a knowledge base to guide applied and policy-oriented studies.

Moreover, Cluster 4 focuses on institutions in the United Kingdom, particularly in Northern Ireland. This cluster stresses the operationalisation of sustainable packaging concepts through regulatory frameworks, infrastructural strategies, and institutional management. The relatively strong citation count reflects the importance of governance-

oriented research in bridging the gap between technological innovation and implementation. In contrast, Clusters 3, 5, 6, and 7 are characterised by lower average citation count and, in some cases, more recent publication years. These clusters encompass various organisations from Europe, Asia, and Africa, and play a role in addressing region-specific sustainability challenges, resource use, and environmental management.

Overall, this clustering of organisations indicates multi-layered global research in sustainable packaging, where high-impact innovation, policy integration, and regional contributions collaborate to enhance the sustainable packaging field. This highlights the importance of knowledge exchange discussions across clusters in addressing sustainability challenges at both the global and local levels.

Table 1. Organization-level bibliographic coupling

No	Organization	Cluster	AC	APY
1	Asosiasi Daur Ulang Plastik Indonesia (ADUPI), Jakarta, Indonesia	1	31	2023
2	Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Chiba, Japan			
3	Korea-Indonesia Marine Technology Cooperation Research Centre (MTCRC), Jakarta, Indonesia			
4	Marine Science Department, Faculty of Marine and Fisheries, Udayana University, Jl. Kampus Universitas Udayana, Bukit Jimbaran, Bali, Indonesia			
5	Research Centre for Oceanography, National Research and Innovation Agency (BRIN), Jl. Pasir Putih I, Ancol Timur, Jakarta, 14430, Indonesia			
1	Center for Polymer and Material Technologies (CPMT), Department of Materials, Textiles and Chemical Engineering, Faculty of Engineering and Architecture, Ghent University, Zwijnaarde, 9052, Belgium	2	24	2021
2	Department of Bio-Engineering, University of Antwerp, Antwerp, 2020, Belgium			
3	Sustainable Materials Management Unit, VITO—Flemish Institute for Technological Research, Mol, 2400, Belgium			
4	Ubuntoo, The Environmental Solutions Platform, Atlanta, 30305, GA, United States			
5	School of Design and Creative Arts, Loughborough University, Loughborough, LE11 3TU, United Kingdom			
1	Laboratory of Microbial Biotechnologies, Agrosciences and Environment (BIOMAGE) Labeled Research Unit-CNRST No. 4, Faculty of Sciences Semlalia, Cadi Ayyad University Marrakech, Marrakech, 40000, Morocco	3	8	2024
2	Marine Research Institute, Klaipeda University, Universiteto Ave. 17, Klaipeda, LT-92294, Lithuania			
3	Research Unit—Coastal Seas and Society, Leibniz Institute for Baltic Sea Research Warnemünde, Seestrasse 15, Rostock, D-18119, Germany			
4	Tunis International Center for Environmental Technologies (CITET), Tunis, 2035, Tunisia			
5	Waste and Resource Management, Rostock University, Justus-von-Liebig-Weg 6, Rostock, D-18059, Germany			
1	Belfast City Council, Belfast City Hall, BT1 5GS, Belfast, United Kingdom	4	26	2022
2	Research Centre in Sustainable Energy, Queen's University Belfast, University Road, BT7 1NN, Belfast, United Kingdom			
3	School of Mechanical and Aerospace Engineering, Queen's University Belfast, Stranmillis Road, BT9 5AH, Belfast, United Kingdom			
4	Waste and Resources Action Programme, Northern Ireland, Bridge House, Paulett Avenue, BT5 4HD, Belfast, United Kingdom			
1	Department of Industrial and Production Engineering, Bangladesh University of Engineering and Technology, Dhaka, 1000, Bangladesh	5	20	2023
2	Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, 1208, Bangladesh			
3	Jagiellonian University, Institute of Environmental Sciences, Gronostajowa 7, Kraków, 30-387, Poland			
4	Jagiellonian University, Institute of Geography and Spatial Management, Gronostajowa 7, Kraków, 30-387, Poland			
1	School of Life Science and Technology, Lingnan Normal University, Guangdong, Zhanjiang, 524048, China	6	10	2023
2	Western Guangdong Provincial Engineering Technology Research Center of			

	Seafood Resource Sustainable Utilization, Lingnan Normal University, Guangdong, Zhanjiang, 524048, China			
3	Asian Institute of Technology, KhlongLuang, PathumThani, 12120, Thailand			
4	UNEP Regional Office for Asia and the Pacific, Bangkok, 10200, Thailand			
1	Faculty of Management, Science and Technology, Open University of the Netherlands, Valkenburgerweg 177, Heerlen, 6419, Netherlands			
2	Information Systems Department, Technical University of Madrid, Calle de Alan Turing SN, Madrid, 28001, Spain	7	22	2019
3	Institute for Arts, Music and Media, Heidelberg University of Education, ImNeuenheimer Feld 56, Heidelberg, 69120, Germany			

Notes: Minimum number of documents of an organization = 1, minimum number of citations of an organization = 5.
AC=Average citations, APY=Average publication year.

3.3 Author-Level Bibliographic Coupling

Table 2 presents the bibliographic coupling at the author level. Cluster 1 has an average of 17 citations and an average publication year of 2022. This cluster covers highly cited and well-established authors such as Jennings et al. (2021), likely addressing foundational topics in sustainable packaging. The major environmental issue caused by single-use plastics has spurred alternative solutions such as packaging-free shopping, where consumers use reusable containers to achieve a zero-waste lifestyle. The framework used to discuss the psychological drivers behind consumer adoption is Heider's Balance Theory (Gordon-Wilson et al., 2022).

Clusters 4 and 5 include authors such as De Fano et al. (2022) and Schneikart et al. (2024). Both clusters are characterised by moderate average citation counts (10 and 16) and recent publications from 2023 to 2024. These authors demonstrate growing scholarly influence by focusing on evolving research themes and by bridging foundational work with emerging directions. For example, these authors connect foundational concepts such as the Theory of Planned Behaviour and evolutionary game theory with emerging trends in social media influence and reusable e-commerce packaging (De Fano et al., 2022; Yue et al., 2024). On a similar note, key circular economy values and established sustainable consumption classification are integrated with cutting-edge Industry 4.0 technologies and advanced social media text-mining analytics (Schneikart et al., 2024; Sipilä et al., 2024). By adapting research to current digital shifts, these authors suggest new directions for improving sustainable packaging systems.

Clusters 2 and 3 cover authors such as Sharma and Singh (2024) and Yu et al. (2023), representing emerging research groups with recent publications in the years 2024–2025, and low average citation counts. Moreover, the collaboration patterns suggest early-stage networking among authors who are beginning to contribute to the field of sustainable packaging. The niche area lies at the intersection of digital technology, consumer behavioural psychology, and innovative resource management models to advance circular and sustainable economies. Lastly, Cluster 6 exhibits a relatively lower average citation count and often represents smaller-scale collaborations. This includes authors like Gonzaga et al. (2021) and Wismantoro and Susilowati (2025). The niche area focuses on addressing the serious plastic pollution crisis in Southeast Asia through a dual approach of advanced environmental monitoring and consumer behavioural analysis.

The author-level bibliographic coupling analysis reveals that the intellectual structure of sustainable packaging research ranges from highly cited foundational contributions to emerging and specialised studies. Overall, these patterns indicate a maturing yet rapidly expanding research landscape, with strong potential for future interdisciplinary collaboration in advancing sustainable packaging.

Table 2. Author-level bibliographic coupling

No	Author	Cluster	AC	APY
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1	(Jennings et al., 2021)			
2	(Schofield et al., 2021)			
3	(Gordon-Wilson et al., 2022)			
4	(Borg et al., 2020)	1	17	2022
5	(Vince et al., 2022)			
6	(Borg et al., 2022)			
1	(Sharma & Singh, 2024)			
2	(Chauhan & Kumari, 2025)			
3	(Nugawela et al., 2025)	2	0	2025
4	(Trenggono et al., 2025)			
5	(Umwanzisiwemuremy et al., 2024)			
1	(Yu et al., 2023)			
2	(Casaca & Loureiro, 2023)			
3	(Noubar et al., 2022)	3	4	2024
4	(Suminar et al., 2024)			
1	(De Fano et al., 2022)			
2	(Sipilä et al., 2024)			
3	(Fait et al., 2022)	4	16	2023
4	(Yang et al., 2025)			
1	(Schneikart et al., 2024)			
2	(Yue et al., 2024)	5	10	2024
3	(Zhao et al., 2025)			
1	(Gonzaga et al., 2021)			
2	(Wismantoro & Susilowati, 2025)	6	3	2023

Notes: Minimum number of documents of an author = 1, minimum number of citations of an author = 0. AC=Average citations, APY=Average publication year.

3.4 Document-Level Bibliographic Coupling

Table 3 presents bibliographic coupling at the document level, encompassing 24 papers across three categories. The first category includes papers focused on sustainable packaging and consumer adoption, which are considered the dependent variable (DV). The second category comprises papers that address independent variables (IVs), specifically (a) the influence of social media and public engagement, and (b) recycling innovations. The third category covers papers examining behavioural determinants that mediate the relationship between sustainable packaging and its influences.

3.4.1 The Dependent Variable of Sustainable Packaging and Consumer Adoption

Eco-friendly product purchase intention plays a crucial role in advancing sustainable packaging, as stronger consumer purchase intentions motivate firms to transition to environmentally and responsibly packaged products. Using primary data collected from 114 respondents through a questionnaire distributed on social media platforms such as Line, Instagram, WhatsApp, and Facebook (Wismantoro & Susilowati, 2025), the findings suggest that attitudes toward behaviour, subjective norms, and perceived behavioural control affect environmentally friendly plastic purchasing intention.

On a similar note, Zhao et al. (2025) suggested that consumers' intention to use single-use plastic substitutes is influenced by perceived ease-of-use, attitude, subjective norms, and perceived risk. Another DV identified is willingness to pay. It is the amount consumers are willing to pay for single-use plastic substitutes, measured via the contingent valuation method, and analysed as an outcome variable. According to Suminar et al. (2024), both injunctive and descriptive norms are influential factors in shaping consumers' intentions and behaviours towards pro-environmental behaviour (PEB) through a cross-sectional survey of 670 respondents in Indonesia, specifically from Generation Z aged 18 to 25.

On the other hand, the pharmaceutical (Schneikart et al., 2024) and e-commerce markets (Yue et al., 2024) have raised significant concerns about sustainability. These markets have brought significant benefits and convenience to consumers; however, they have also added to packaging waste and environmental pollution. In response, pharmaceutical companies and e-commerce platforms are required to adopt innovative circular economy solutions and utilize reusable packaging to reduce waste generation. Accordingly, Yue et al. (2024) examined the adoption of reusable packaging among green consumers in e-commerce markets while Schneikart et al. (2024) proposed a roadmap for advancing circular economy practices in pharmaceutical logistics through Returnable Transport Items (RTIs)-based solutions enhanced by Industry 4.0 technologies.

Table 3. Document-level bibliographic coupling

Authors	Title	Cluster
(Chauhan & Kumari, 2025)	Digital Technology to Address Plastic Pollution (Reduction of the Use of Plastic, Collection/Sorting, Recycling, Tracking System)	Social Media Influence & Public Engagement
(Sharma & Singh, 2024)	Exploring Consumers' Social Media Engagement in Addressing Plastic Pollution	
(Borg et al., 2022)	Communicating 'Normal' Behaviour: A Randomised Controlled Trial Experimenting with Plastic Avoidance Media Messages	
(Vince et al., 2022)	'Windows of Opportunity': Exploring the Relationship Between Social Media and Plastic Policies During the COVID-19 Pandemic	
(Jennings et al., 2021)	Social Media and Democracy: Fostering Political Deliberation and Participation	
(Borg et al., 2020)	When News Media and Social Media Meet: How Facebook Users Reacted to News Stories About a Supermarket Plastic Bag Ban	
(Schofield et al., 2021)	'COVID Waste' and Social Media as Method: An Archaeology of Personal Protective Equipment and Its Contribution to Policy	
(Yang et al., 2025)	How to Promote Sustainable Recycling of Plastic Packaging Waste? A Study Combining Machine Learning with Gaming Theory	Recycling Innovation
(Trenggono et al., 2025)	Innovation in the Blue Economy and Environmental Sustainability in Marine and Fisheries Strategy	
(Nugawela et al., 2025)	Migration, Pathways, and Management of Microplastics (MPS) Through Remote Sensing and GIS Techniques	
(Sipilä et al., 2024)	Exploration of Public Discussion Around Sustainable Consumption on Social Media	
(Noubar et al., 2022)	Identifying Factors Affecting Green Consumer Purchase Behavior on E-Commerce Websites	
(De Fano et al., 2022)	Empowering Plastic Recycling: Empirical Investigation on the Influence of Social Media on Consumer Behavior To Act or to React? The Role of Responsiveness in Corporate Social Performance Disclosure in Preventing Plastic Pollution in the Travel and Tourism Sector	
(Gonzaga et al., 2021)	Utilization of Sentinel-2 Imagery in the Estimation of Plastics Among Floating Debris Along the Coast of Manila Bay	
(Zhao et al., 2025)	Revealing Determinants Shaping the Sustainable Consumption of Single-Use Plastic Food Container Substitutes	Sustainable Packaging & Consumer Adoption
(Wismantoro & Susilowati, 2025)	Do Attitude Towards Behavior, Subjective Norms, and Perceived Control Behavior Matter on Environmentally Friendly Plastic Purchasing Intention?	
(Schneikart et al., 2024)	A Roadmap Towards Circular Economies in Pharma Logistics Based on Returnable Transport Items Enhanced with Industry 4.0 Technologies	
(Yue et al., 2024)	Reusable Packaging Adoption in E-Commerce Markets with Green Consumers: An Evolutionary Game Analysis	

(Suminar et al., 2024)	Predicting Pro-Environmental Behavior Among Generation Z in Indonesia: The Role of Family Norms and Exposure to Social Media Information	
(Gordon-Wilson et al., 2022)	Values, Personality Traits, and Packaging-Free Shopping: A Mixed-Method Approach	
(Umwanzisiwemuremy et al., 2024)	Spatial Assessment of Illegal Plastic Waste Dumping and Environmental Impacts in Babakan and Cikarawang in Bogor Regency	
(Casaca & Loureiro, 2023)	The Determinants of Non-Consumption of Disposable Plastic: Application of an Extended Theory of Planned Behaviour	Behavioral Determinants
(Yu et al., 2023)	Adoption Intentions of Home-Refill Delivery Service for Fast-Moving Consumer Goods	

3.4.2 Independent Variables

Social Media Influence and Public Engagement on Sustainable Packaging

Social media influence is the key IV in sustainable packaging. Existing studies show that consumers' recycling intentions and behaviours concerning plastic pollution may be affected by social media engagement, particularly when users receive targeted sustainable content on their feeds (Rapada & Yu, 2021). More precisely, the societal return in environmental marketing is understood as the anticipation of receiving social rewards via the sharing of green information, whereby individuals may act as catalysts in converting personal apprehension into socially responsible concern and socially conscious purchasing behaviour in others.

Alternatively, accessible and engaging social media narratives highlighting the benefits of reducing plastic waste have begun to shape social media awareness (Borg et al., 2022). Social media platforms foster large-scale changes in social norms, especially in behaviours that are more environmentally positive, assisting in the transition of sustainable packaging from a niche to a broadly accepted social value. Moreover, social media has a positive effect on enhancing citizens' information efficacy, especially in the context of access, comprehension, and application of environmental information.

During the COVID-19 pandemic, social media platforms were crucial for tracking public responses to government decisions driven more by industry pressure than consumer demand (Vince et al., 2022). This examination helps ensure that sustainable packaging ambitions do not slip off the political agenda entirely during bouts of second-order crises, which can help prevent us from fully regressing to unsustainable habits. However, beyond instant communication, social media is a "viral archive" of human behaviour and its physical impact on the environment. Combining research in social media analysis and environmental studies helps scholars understand the development of public discourse in relation to waste and sustainability, including the identification of themes and patterns in the discourse regarding unsustainable materials and reuse (Teh et al., 2022). This digital-physical bridge to the real-world supplies them with a solid basis from which they can enter policy debates and articulate what is at stake in a concrete way through the visualization of the repercussions of packaging waste. Add to this the infusion of next-gen technologies like AI into these digital ecosystems, and engagement strategies are becoming even more powerful. The role of digitalisation and artificial intelligence in developing sustainable communication strategies continues to grow, especially in the use of predictive AI and personalised marketing messaging, which positively influences consumer attitudes and promotes sustainability-oriented choices (Rosário & Dias, 2025). Such technologies can reduce consumer resistance by alleviating concerns about cost and performance and thus aiding consumers in making the shift to green purchasing decisions more seamlessly.

In conclusion, social media influence and public engagement are considered the IV in examining the "politics" of sustainability. As has been widely observed, studying the beliefs and digital interactions of policy actors is equally as important as researching the technical details of a policy proposal (Vince et al., 2022). Thus, a strong theoretical grounding of how digital interactions convert personal knowledge into collective social coercion and systemic policymaking is essential.

Recycling Innovation on Sustainable Packaging

Recycling innovation is one of the IVs in green and sustainable packaging models. Yang et al. (2025) recommend that promoting sustainable recycling of plastic packaging waste requires a complex combination of machine learning and game theory to develop optimally oriented systems. The effectiveness of sustainable packaging and consumer adoption increasingly relies on cutting-edge tracking and waste disposal technologies.

The "Blue Economy" promoting strategy development is essential for developing viable, eco-friendly packaging materials. It has been documented that the protective management of the ocean and fisheries integrated with various resource management innovations calls for packaging solutions that safeguard the most threatened ecosystems (Trenggono et al., 2025). Such packaging innovations focus on the eco-friendly design of materials that minimize environmental pollution. The success of sustainable packaging and its adoption by consumers depends largely on how recycling innovations are communicated to the public. Social media has emerged as a vital platform for examining public discourse on sustainable consumption and for understanding consumer perspectives on new packaging technologies (Sipilä et al., 2024). Such online conversations are particularly valuable for identifying the social and cultural barriers that may impede the uptake of innovative packaging solutions.

On the other hand, the digital world can positively affect consumer recycling behaviour through direct transparency (De Fano et al., 2022). Social media recycling innovation sharing and social media users' visible trust in the recycling system social media recycling innovation sharing and social media users visible trust in the recycling system sponsor the first instance of mass sustainable packaging adoption. This illustrates a strong correlation between tech innovation and consumer motivation.

The digital marketplace is also viewed as a significant channel for promoting adoption, as well as outlining factors impacting consumer buying behaviour on green e-commerce platforms (Noubar et al., 2022). Furthermore, sustainability information at the point of sale helps consumers make informed choices and connects regulatory frameworks, technical recycling, and market dynamics. In addition, corporate responsibility further moderates the indirect effect of innovation on its diffusion. For instance, organizations actively addressing plastic pollution will formulate robust social performance disclosures that enhance brand equity and motivate companies to adopt sustainable packaging (Fait et al., 2022). Thus, such corporate visibility implies that innovation in recycling can be considered as legitimate efforts towards sustainability, rather than just a 'greenwashing' agenda.

Finally, satellite-based technologies like Sentinel-2 imagery help estimate the abundance of floating plastic debris, which shows the advance of "big data" as a tool for verifying the necessity of packaging reform (Gonzaga et al., 2021). By providing a clear picture of the plastic crisis on a global scale, these innovations create the urgency needed to push the world to redesign its plastic packaging across all industries, as well as to drive individual behaviour change at an international scale.

3.4.3 The Mediating Role of the Behavioural Determinants

In previous studies (Casaca & Loureiro, 2023; Yu et al., 2023), mediating behavioural effects are often implicit and model-based. Casaca and Loureiro (2023) examined behavioural mechanisms within an extended TPB framework for predicting the non-consumption of disposable plastic by incorporating two additional variables, namely social media engagement and lifestyle values, with 466 participants through an online questionnaire. Similarly, Yu et al. (2023) discussed behavioural determinants, specifically attitudes and intentions, using an extended TAM, among 312 consumers in Indonesia. Meanwhile, environmental concerns, green perceived value, and trust were used to examine the factors underlying the adoption of an eco-oriented delivery service in Indonesia.

However, several studies have discussed the role of mediators in influencing behaviour related to plastic use and reduction. For instance, the intention to reduce plastic bag consumption acts as a mediator between social influence, family influence, community attachment, and pro-environmental behaviours.(Le et al., 2024). Additionally, attitudes towards behaviour and perceived behavioural control are important mediators of the intention to purchase environmentally friendly plastic products.(Wismantoro & Susilowati, 2025). On a similar note, attitude fully mediates the relationship between plastic risk perception and behavioural willingness to reduce plastic use.(B. Wang et al., 2024).

3.4.4 Theoretical Underpinnings

The proposed conceptual framework is theoretically grounded in three established behavioural and innovation theories that correspond directly to the thematic clusters identified in the document-level bibliographic coupling analysis of Table 3.

Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (Ajzen, 1991) explains that intention to perform a behaviour is determined by attitudes toward the behaviour, subjective norms, and perceived behavioural control. In the context of sustainable packaging, TPB explains how favourable evaluations of environmentally responsible choices and perceived capability to engage in such behaviour strengthen intention. Empirical evidence supports the relevance of TPB constructs in plastic-related decisions, demonstrating significant influences of attitudes and perceived behavioural control on environmentally friendly plastic purchasing intention (Wismantoro&Susilowati, 2025), reinforcing TPB as an appropriate basis for explaining behavioural determinants in Figure 2.

Extended Theory of Planned Behaviour (ETPB)

The Extended Theory of Planned Behaviour builds upon TPB by recognising that environmentally oriented decisions are not driven solely by rational evaluation but are also shaped by broader psychological and value-based influences. ETPB acknowledges the role of additional factors, such as lifestyle values, value orientations, and socially conditioned engagement, in shaping pro-environmental behaviour. Studies demonstrate that TPB constructs continue to play a significant role in explaining sustainable consumption intention, while value-driven motivations, lifestyle orientations, and personal characteristics also influence participation in environmentally responsible consumption contexts, including packaging-related behaviours (Casaca&Loureiro, 2023; Gordon-Wilson et al., 2022; Wismantoro&Susilowati, 2025). Collectively, this supports the argument that behavioural intention toward sustainable packaging can be influenced not only by attitudes and perceived capability but also by deeper value orientations and socially shaped engagement, thereby strengthening the mediating role of behavioural determinants in the proposed framework.

Social Cognitive Theory (SCT)

Social Cognitive Theory (Bandura, 2001) explains how environmental influences, cognitive processes, and behaviour interact dynamically, with observational learning, modelling, and perceived self-efficacy as central mechanisms. SCT underpins the social media influence and public engagement construct by explaining how individuals learn sustainable behaviours through exposure to environmental communication, social reinforcement, and digital discourse. Studies in Table 3 confirm that social media platforms shape environmental awareness, strengthen perceived capability, and normalise sustainable practice (Borg et al., 2022; Sharma & Singh, 2024; Sipilä et al., 2024; Vince et al., 2022). Accordingly, in Figure 2, SCT explains how social exposure contributes to the development of TPB and ETPB determinants, thereby indirectly influencing sustainable packaging adoption.

4.0 The Proposed Conceptual Framework of Sustainable Packaging

Figure 2 shows the proposed conceptual framework of sustainable packaging and the drivers of circular packaging solutions by incorporating the theories of TPB, ETPB, and SCT. The first IV, social media influence and public engagement, focuses on the effects of social media and the related pro-environmental attitudes, and their impacts and their effects. The second IV, recycling innovation, emphasizes the development of new technologies for recycling, including machine learning with game theory for sustainable recovery.

The mediating variable, behavioural determinants, captures the key drivers affecting the core outcomes. It integrates innovation combined with behavioural factors, social norms, individual attitude, and perceived behavioural control. These determinants jointly shape the DV, sustainable packaging adoption by consumers, which is operationalized through (i) sustainable packaging adoption, (ii) behavioural intention, and (iii) willingness to pay.

Ultimately, the proposed framework yields positive environmental outcomes whereby the efforts help reduce waste, increase recycling, and foster responsible consumption. Results can be tracked through creative and innovative management and monitoring processes; for example, remote sensing and GIS can be used to monitor microplastics and Sentinel-2 imagery to assess plastic litter. This integrated approach will ensure that packaging design and the strategic environmental priorities for marine and fisheries ecosystems are sustained and aligned with the global aspirations for the long-term Sustainable Blue Economy.

In sum, grounded in the TPB, ETPB, and SCT theories, the framework suggests that social media and recycling innovation shape consumers' attitudes and perceived behavioural control, thereby increasing behavioural intention and willingness to pay for sustainable packaging adoption.

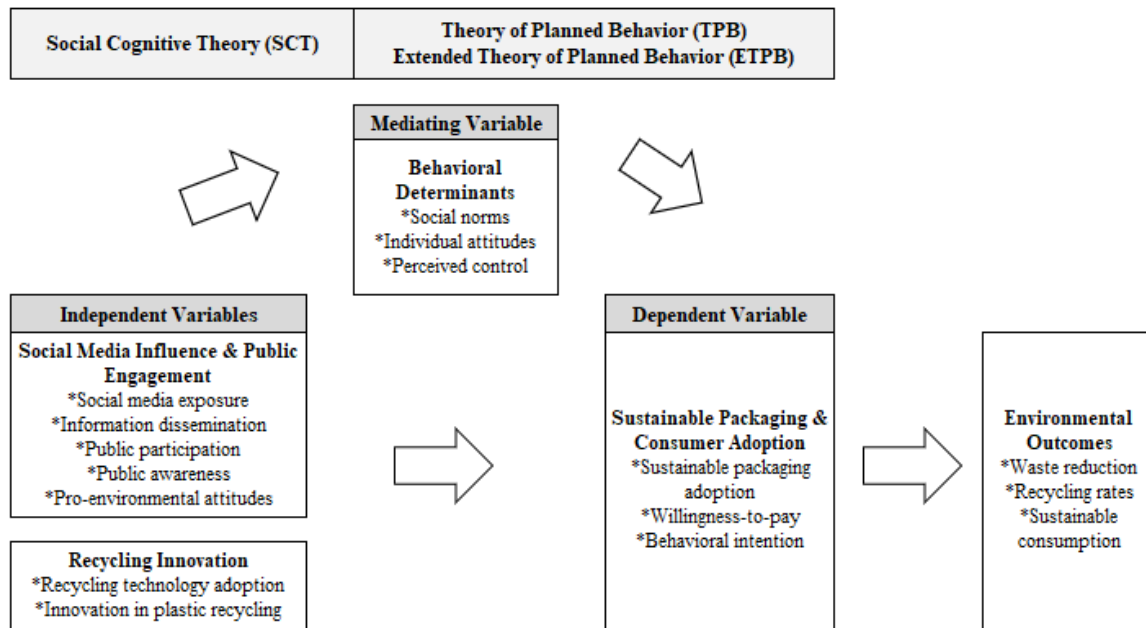


Fig.2 Proposed conceptual framework of sustainable packaging

5.0 CONCLUSION

Plastic consumption has become a global environmental issue, making sustainable packaging increasingly important for long-term impact reduction. Despite growing scholarly attention, a comprehensive analysis of the thematic and intellectual structure of sustainable packaging remains necessary. This study applies bibliometric analysis, with a focus on bibliographic coupling, to examine emerging research patterns across country, organisation, author, and document levels. It identifies current thematic trends in the literature and develops a conceptual framework to guide future sustainable packaging research.

Based on country-level bibliographic coupling, high-citation countries such as the United States and the United Kingdom occupy central positions, while emerging clusters from Asia and Africa contribute to developing research networks. This indicates that sustainable packaging research is shaped by both developed and developing economies, highlighting the importance of international knowledge exchange in advancing sustainability goals. At the organisational level, the findings suggest a multidimensional global research agenda addressing sustainability challenges across both global and local contexts. At the author level, bibliographic coupling reveals an intellectual structure ranging from highly cited foundational works to emerging specialised studies, with collaboration patterns indicating a maturing and expanding research field with strong potential for interdisciplinary collaboration in future sustainable packaging research.

Document-level bibliographic coupling findings indicate that social media significantly influences consumer perceptions and behaviours toward sustainable packaging. Public engagement through awareness campaigns, educational initiatives, and related programs further promotes its adoption, while advances in recycling technology and infrastructure enhance consumer uptake. These effects operate through key behavioural determinants, including attitudes, subjective norms, and perceived behavioural control. Theoretical perspectives such as the TPB, the ETPB, and SCT collectively explain these influences by highlighting psychological, social, and technological factors. Overall, the conceptual framework derived from the document-level analysis integrates these dimensions and guides future research to support long-term sustainable packaging.

The limitation of this study lies in its reliance on the Scopus database for data retrieval. Although the Scopus database provides broad coverage, future research could expand the research scope by utilising the Web of Science Core Collection database to improve the coverage of the database and enhance the robustness of the results, as it includes additional high-quality journals.

CO-AUTHOR CONTRIBUTION

The authors affirm that there is no conflict of interest in this article. The authors' contributions are as follows: N.A.S. contributed to the writing of the results and discussion and manuscript editing. M.I. and Z.A. contributed to the results and discussion. S.M.Y. developed the theoretical underpinning of the study and carried out proofreading. YL.T. was responsible for the introduction, data collection, data analysis, conclusion, manuscript editing, and overall coordination of the writing process. All authors reviewed and approved the final manuscript.

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DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

This work was prepared with the assistance of Grammarly, QuillBot, and ChatGPT to improve language clarity, consistency, and readability. These tools were used solely for editing and refinement, and the author(s) take full responsibility for the content, interpretation, and conclusions of the publication.

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