Review

Green marketing in the promotion of environmentally responsible and sustainable practices in the development of resilient infrastructure in Peru: A systematic review

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Abstract: The objective of the study was to analyze green marketing in the promotion of environmentally responsible and sustainable practices in the development of resilient infrastructure in Peru. The methodology used was qualitative and interpretative, the documentary design based on the systematic review of scientific literature. The PRISMA model was applied for the selection of units of analysis, resulting in 36 articles out of an initial total of 950. Content analysis was used to examine the documents, following a detailed procedure that included the use of Grounded Theory to categorize and analyze the data. The results highlighted the importance of integrating green marketing and sustainable practices into resilient infrastructure planning and development. Key strategies were identified that include promoting environmental responsibility, adopting sustainable technologies in construction, and implementing policies that foster urban resilience and sustainability. The findings highlight the adoption of a comprehensive approach that combines green marketing with resilient infrastructure planning and development to address environmental challenges and promote sustainable development in Peru.

Keywords: green marketing; resilient infrastructures; sustainable practices; construction; sustainable technologies; sustainable development; sustainable development; economic development; circular economy

1. Introduction

The need to move towards resilient infrastructure is a global imperative, reflected in efforts to promote environmentally responsible practices. The United Nations Sustainable Development Goal 9 emphasizes the importance of building resilient infrastructure, promoting sustainable industrialization and fostering innovation as fundamental pillars for economic growth, social development and climate action (Moran, 2023). Adopting an integrated approach to the resilience of infrastructure services highlights the balance between resilience, efficiency and sustainability as key to sustainable development in each region, as logistics services rely on transportation networks and other services such as energy and telecommunications (Comisión Económica para América Latina y el Caribe (CEPAL), 2021).

Lack of resilient infrastructure increases recovery costs, asset overload and loss of competitiveness. "Floods are examples of events responsible for causing major disruptions to transportation systems in urban areas" (Fabio, 2020, p. 7). Similarly, it can be said that, without climate policies, the amount of energy consumed, for example, in building construction could increase by 46% to 73% by 2050 due to population expansion, increased diffusion and use of energy-consuming technologies, and rising living standards in emerging countries. This highlights the significant impact of the building sector on global greenhouse gas emissions (Jaglan and Korde, 2023).

According to the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C, taking immediate action to limit global warming and mitigate its devastating impacts on the environment and society is a fundamental task. The construction and infrastructure sector, worldwide, has a considerable impact on the environment and on the capacity to adapt to climate change (Abbass et al., 2022; Dwivedi et al., 2022).

Climate-resilient infrastructure is instrumental in reducing direct losses, reducing indirect costs from disruptions, and building resilience to climate change impacts on infrastructure service delivery. In addition, by being climate resilient, infrastructure can support climate change adaptation, contribute to the goals of the Paris Agreement and the Sustainable Development Goals, as well as implement the Sendai Framework for Disaster Risk Reduction. (Foxon et al., 2015; Organización para la Cooperación y el Desarrollo Económicos (OCDE), 2018).

This global approach is reflected in the Peruvian context, where the promotion of resilient infrastructure has become critical in the face of current environmental and social challenges. Environmental degradation and vulnerability to extreme events such as floods and droughts are key concerns that require concrete and strategic actions to promote resilient infrastructure (Ward et al., 2020). Peru, located in an area of high seismicity, also faces the risk of flooding. Intense rains, especially in the highlands and jungle, can cause rivers and streams to overflow, affecting homes, infrastructure and crops. The most vulnerable regions are Piura, Tumbes, Lambayeque, La Libertad, Cajamarca, Amazonas, San Martin, Loreto, Ucayali and Madre de Dios.

In this regard, comprehensive actions are carried out by the National Civil Defense Institute (INDECI), Ministry of Housing, Construction and Sanitation (MVCS), National Meteorology and Hydrology Service of Peru (SENAMHI), among others, to prevent floods and droughts, including the rehabilitation and maintenance of hydraulic infrastructure such as canals, dykes and reservoirs to improve drainage and reduce the risk of flooding, the construction of dams and reservoirs to regulate water flow and mitigate flooding, the promotion of sustainable drainage systems in urban areas to effectively manage excess water, and the development of green infrastructure such as urban parks and permeable areas to absorb rainwater and prevent soil erosion, thus contributing to resilience to extreme weather events (Kuroiwa, 2014; McNaught, 2024; Parodi et al., 2021).

However, the lack of adequate funding to carry out the rehabilitation and maintenance of water infrastructure, which could result in its deterioration and increased risk of flooding; the opposition of local communities to the construction of dams and reservoirs due to potential environmental and social impacts, which could delay or prevent their implementation; the lack of integrated urban planning that

hinders the promotion of sustainable drainage systems in urban areas, limiting the ability to effectively manage excess water; and the lack of environmental awareness and government support for the development of sustainable drainage systems in urban areas, limiting the ability to effectively manage excess water; lack of integrated urban planning that hinders the promotion of sustainable drainage systems in urban areas, limiting the ability to effectively manage excess water; and lack of environmental awareness and government support for the development of green and resilient infrastructure, which could hinder their implementation and reduce their effectiveness in preventing floods and droughts.

Given the situation described above, the integration of green marketing in this area offers an opportunity to reinforce the commitment to environmentally responsible practices, while promoting greater awareness and adoption of these practices among consumers and companies. Through effective communication strategies, green marketing raises awareness and educates the public on the importance of adopting sustainable practices by highlighting the environmental and social benefits of environmentally friendly products and services. In addition, by highlighting companies' commitment to corporate social responsibility, green marketing enhances corporate reputation and attracts consumers and business partners who value sustainability. It also drives economic growth by demonstrating that sustainable practices can generate significant long-term savings, encouraging more companies and governments to invest in sustainable projects.

On the other hand, resilient infrastructure is an indispensable and important pillar for achieving sustainable development in Peru, providing critical services to communities, supporting economic functions and serving as a first line of defense against shocks and disasters. These infrastructures not only protect communities by reducing the risks associated with natural phenomena, but also improve the quality of life by providing safer and healthier environments. Implementing sustainable practices in the construction and maintenance of resilient infrastructure, such as energy efficiency, waste management and the use of clean technologies, ensures effective resource management and promotes a circular economy. In this way, resilient infrastructures are essential for climate change adaptation, as they enable communities and economies to recover quickly from adverse impacts. It is for this reason that, given the intensification of climate and environmental risks, it is imperative to strengthen these infrastructures to ensure a sustainable future for the country.

Against this backdrop, the study of the "Green marketing in the promotion of environmentally responsible practices in the development of sustainable and resilient infrastructure in Peru: a systematic review" aims to analyze in a comprehensive and detailed manner the impact of green marketing in the promotion of environmentally responsible and sustainable practices in the construction of resilient infrastructure in the Peruvian context through a systematic review, which allows identifying effective strategies and benefits obtained in the construction of resilient infrastructure in the country. This study seeks to contribute to the existing academic body by providing a deeper understanding of the role of green marketing in shaping a more sustainable and resilient future for Peru.

2. Materials and methods

The study was based on a qualitative and interpretative approach of systematic review of scientific literature and institutional documents, with a documentary research design. The PRISMA model was used to identify units of analysis by means of key words (Hutton et al., 2016). A total of 950 information sources were identified in the Scopus and Web of Science databases. The articles were then reviewed and selected using the content analysis method (Lucas and Noboa, 2013), excluding 914 and selecting 36 for their relevance and pertinence to the subject of the study according to the selection criteria (inclusion and exclusion). In addition, documents with duplicate citations verified in the Zotero reference manager were discarded.

The SMART guide was used to define the objectives of the study, the PRISMA method was used to select the units of analysis, and the PRISMA method was used to select the units of análisis (Hutton et al., 2016) and the Grounded Theory (GT) phases to carry out the data analysis (Strauss and Corbin, 2002). Following the next steps:

Stage 1: Topic Definition and objective formulation.

The research topic and objectives were defined, along with the formulation of research questions taking into consideration the SMART guide for specific, measurable, achievable, relevant and time-bound objectives: (a)Evaluate the strategies implemented in Green Marketing to promote environmentally responsible and sustainable practices; (b) Analyze the sustainable practices applied in building resilient infrastructures to minimize environmental impact and promote sustainability in the construction sector; and (c) Evaluate the adoption of sustainable and green marketing practices in promoting resilient infrastructures. As for the questions, they are presented in **Table 1**.

Table 1. Characteristics of the units of analysis.

N	Unit of analysis	Database	Language	Author's key words
1	Chen et al. (2021)	Scopus	Inglés	green competitiveness; quality criteria; Ukrainian companies; digital marketing; digital marketing channels marketing
2	Chavalittumrong and Speece (2022)	Scopus	Inglés	sustainability; brand image; corporate image; sustainable production; corporate culture; corporate social responsibility; green marketing; Thailand
3	Wang and Li (2022)	Scopus	Inglés	green advertising; quality of information; green confidence; consumer response
4	Yang and Chai (2022)	Scopus	Inglés	green marketing; green consumption intention; type of green marketing activity; image management theory
5	Panopoulos et al. (2023)	Scopus	Inglés	green purchase intent; eco-labels; attitudes towards green brands; user-generated content; influencers; environmental concerns; environmental marketing; environmental marketing
6	Huang et al. (2024)	Scopus	Inglés	environmental labeling; consumer behavior; green innovation; marketing strategies; sustainable development; sustainable development
7	Huang and Yu (2021)	Scopus	Inglés	advertising cooperation; R&D strategy; green technology; R&D strategy; green technology
8	Vilkaite-Vaitone et al. (2022)	Web of Science	Inglés	green marketing scale; scale development; scale validation; internal marketing; external marketing; strategy; tactics; operations; cleantech

Table 1. (*Continued*).

N	Unit of analysis	Database	Language	Author's key words
9	Chang (2020)	Scopus	Inglés	shared green vision; green organizational identity; psychological ownership of the green product; organizational citizenship behavior for the environment
10	Jamal et al. (2023)	Scopus	Inglés	green marketing; brand confidence; industrial property; structural equation modeling
11	Shang et al. (2021)	Scopus	Inglés	cooperation among retailers; consumers' green preference; intensity of competition; competitive supply chains
12	Khachatryan et al. (2023)	Web of Science	Inglés	consumer behavior; green products; green marketing; green technology; responsible consumption; green products
13	Apaza et al. (2024)	Scopus	Inglés	green marketing; green consumption; green products; environment; green products
14	Júnior et al. (2023)	Web of Science	Inglés	sustainable practices; sustainable development; civil construction sector; sustainable development
15	Manzini and Menichinelli (2021)	Scopus	Inglés	Community; community; platform; place; resilience; distributed systems
16	Singh et al. (2022)	Web of Science	Inglés	Subjects; construction supply chains; artificial intelligence; sustainability.
17	De Rosa et al. (2023)	Web of Science	Inglés	cities; renewable energy; energy efficiency; positive energy districts; urban transportation; financing mechanisms; project management; project management
18	Corvalan et al. (2020)	Scopus	Inglés	climate resilience; environmental sustainability; climate change and health; medical facilities
19	Liang (2021)	Scopus	Inglés	climate-resilient cities; multilevel gray system assessment method; evaluation; difference-in-differences model
20	Niu et al. (2022)	Scopus	Inglés	community resilience; COVID-19; comparative study; Sarajevo
21	Tarar et al. (2022)	Scopus	Inglés	transportation infrastructure; sustainable pavements; sustainable pavements; durable pavements; warm mix asphalts; bioagglutinants; life cycle
22	Hussain et al. (2022)	Scopus	Inglés	sustainability; road construction; resilient module; reclaimed asphalt pavement; surface course
23	Salata and Uzelli (2024)	Scopus	Inglés	urbanization; Smyrna; soil properties; risk-hazard; risk-hazard
24	Mustaffa et al. (2023)	Web of Science	Inglés	sustainable infrastructures; challenges; strategies; sustainable development; key drivers
25	Amaratunga et al. (2018)	Web of Science	Inglés	Construction; built environment; education; disaster resilience; knowledge gaps
26	Waqar et al. (2024)	Scopus	Inglés	green building design; certification standards; life cycle assessment; renewable energy integration; resilient infrastructure;social equity and inclusionwaste management
27	Chirisa et al. (2016)	Scopus	Inglés	African cities; resilient infrastructure; resilience; governance; participatory democracy; resilience; resilient infrastructure
28	Oliveira et al. (2023)	Scopus	Inglés	industry 4.0; Technologies; circular economy; cleaner production; textile industry
29	Aboalsamh et al. (2023)	Scopus	Inglés	green financial technology; consumer behavior; smart city; sustainability; perception; Middle East; Saudi Arabia; The City on the Line; digital service; IoT; economy; pioneer; pioneering
30	Assis et al. (2023)	Scopus	Inglés	best practices; sustainable logistics; transportation company
31	Lee et al. (2023)	Scopus	Inglés	adoption of sustainable development; telecommunication ecosystem stakeholders; drivers; constraints; structural equation modeling (SEM); multilayer perceptron (MLP)

Table 1. (*Continued*).

N	Unit of analysis	Database	Language	Author's key words
32	Alghuried (2023)	Scopus	Inglés	BIM; construction industry; sustainable practice; project; benefits; barriers; Saudi Arabia
33	Desalegn and Solomon (2021)	Web of Science	Inglés	nation building process (NBP); institutional capacity (IC); infrastructure governance (IG); infrastructure capital (IE); federalism; Ethiopia's regional states
34	Dalei et al. (2021)	Scopus	Inglés	maritime tourism; sustainable development; environmental protection; governmental institutions and regulators
35	Li et al. (2024)	Scopus	Inglés	clean energy; food security; low-carbon economy; sustainable agricultural practices; sustainable development
36	Singh et al. (2023)	Scopus	Inglés	issues; construction supply chains; artificial intelligence; sustainability; artificial intelligence; sustainability

Stage 2: Elaboration of the protocol and selection of criteria.

A detailed protocol was elaborated that included selection criteria in consulted databases (Scopus and Web of Science) applying search strategies with keywords such as: "green marketing", "environmental practices", "responsible practices", "sustainable practices", "resilient infrastructure"; subsequently, the content analysis method was applied for each result to obtain the units of analysis in a general way.

Within the selection criteria applied in the databases were established:

a) Scientific articles published in the range of years 2015 to 2024; b) Articles published in Spanish and English language; c) Articles limited to social sciences, environmental sciences, engineering, earth and planetary sciences; d) Articles limited in advanced search to resilience, sustainability, sustainable development, infrastructure, infrastructure planning, disaster management, green infrastructure, urban development, infrastructure development, green spaces, risk management, urban resilience, natural disasters and infrastructure resilience. e) Articles related to the topic of study.

A visualization network analysis through VOSviewer (**Figure 1**), based on co-occurrences by author keywords, was obtained as a result of the Scopus database search which revealed an interdisciplinary approach around key concepts, proceeding and finding 8047 keywords, 615 meeting the minimum frequency threshold in 556 articles related to "resilience", "sustainability" and "infrastructure" in the context of urban planning and environmental policy. The prominence of these terms suggests a significant interconnection between them, along with other relevant topics such as "climate change", "governance" and "spatial planning". This visual representation highlights the importance of addressing urban resilience and sustainability together, underscoring the need for integrated strategies to address current challenges in urban development and environmental management.

The second search found 2785 keywords, 164 meeting the threshold in 394 papers in the Web of Science database. The network visualization (**Figure 2**) reveals a comprehensive approach around key concepts such as "sustainability", "green marketing", "corporate social responsibility" and "renewable energy" in the context of corporate sustainability. The centrality of "sustainability" suggests its fundamental importance in the network, with interrelated terms encompassing economic, environmental and social aspects of corporate sustainability. The presence of thematic

groupings and connections between terms indicates significant interdependence between them, highlighting the need to integrate sustainable practices into the business arena to address current challenges and promote responsible and sustainable business development through green marketing.

Figure 1. Scopus bibliometric network map.

Note: Own elaboration with VOSviewer software.

Figure 2. Web of science bibliometric network map.

Note. Own elaboration with VOSviewer software.

After obtaining the documents, a content analysis of the selected units was carried out following the PRISMA method to establish standards of quality and relevance for

the performance and presentation of the systematic review. This method was chosen because of its systematic nature and transparency, which guarantees a rigorous and standardized methodology that facilitates reproducibility and critical evaluation of the included studies. PRISMA promotes clarity in the review process, from literature search to data synthesis, which reduces publication bias and improves the quality and validity of the results. In addition, its international recognition and acceptance, together with its applicability in various disciplines, enhance the credibility of the review. (Lucas and Noboa, 2013). **Figure 3** shows the protocol and its overall results for the units of analysis.

Figure 3. Selection process of analysis units.

Note. Prepared by the authors based on Lucas and Noboa (2013).

Derived from the selection process of information sources with the Prisma Method, **Table 1** was constructed, describing the main characteristics of the units of analysis selected for the study, highlighting the author, year of publication, database, language and key words.

Figure 4. Key words of the units of analysis according to author.

Note: Own elaboration with MAXDDA software version 20.

Figure 4 below shows the visual result of the most frequent key words by authors extracted from the units of analysis consulted. This collage of concepts represents the synthesis of ideas and predominant themes that have emerged from the research. Through this graphic representation, we seek to encapsulate the diversity and depth of knowledge generated by scholars and experts in various fields.

Stage 3: Coding and analysis according to grounded theory.

The coding process was applied according to grounded theory to categorize and analyze the contributions of the units of analysis to the study. According to grounded theory, it is carried out in three interrelated phases (Du et al., 2024; Strauss and Corbin, 2002):

a) Open coding: initial concepts were identified from the raw data. This process involved a detailed and thorough review of the data, where they were fragmented into meaningful units and codes were assigned to each fragment. These codes represented relevant ideas, events or phenomena that emerged directly from the text, thus allowing the identification of recurrent patterns and themes.

b) Axial coding: the codes generated in the previous stage were grouped to form higher-level categories. This process consisted of relating the codes to each other, seeking connections and logical groupings that reflected a more coherent and comprehensible structure of the data. The properties and dimensions of each category were examined, establishing relationships between them to build a more organized and meaningful framework.

c) Selective coding: the central categories and their relationships with other categories were determined. In this stage, a central category was identified as the main axis of the research, around which the other categories were organized and related. This process allowed the construction of a coherent theoretical narrative, where the interactions and dependencies between the different categories were explained, providing a deep and holistic understanding of the phenomenon studied. **Figure 5** shows the methodological path implemented for this phase.
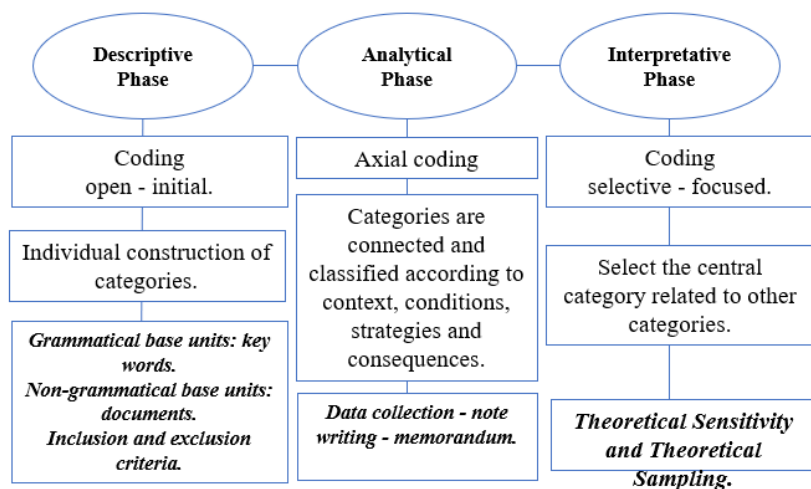

Figure 5. Methodological process of grounded theory.
Note: Own elaboration.

3. Results and discussion

This section presents the results derived from an exhaustive systematic review of the scientific literature of 36 relevant articles. These results offer a detailed and well-founded vision of the subject of study, providing answers to each of the questions posed, contributing to the existing knowledge in this field of research. In the same way, they are presented in the interpretation phase by means of the theoretical sampling sensitization, where it is intended to contrast the results through the triangulation of sources and theories related to the emerging categories.

3.1. Descriptive phase or open coding

In this analysis phase with Open coding, the data collected are decomposed to identify emerging concepts and categories, laying the groundwork for a theory rooted in empirical evidence. It is critical for revealing patterns and paving the way for deeper analysis. **Table 2** is presented below, with the coding open:

Table 2. Open coding.

Question: What are the strategies implemented in Green Marketing to promote environmentally responsible and sustainable practices?	
Code	**Unit of analysis and contribution**
omnichannel approach, green competitiveness digitalization of commercial processes, communication channels, remarketing activities, etc.	For Chen et al. (2021), indicates that, the implementation of an omnichannel approach in marketing strategies to develop the green competitiveness of companies. The digitization of business processes is crucial for communication channels, such as page load speed, failure rate, imaging and remarketing activities.
green marketing, brand image, sustainable, attractive image, consumers concerned about sustainability.	Chavalittumrong and Speece (2022) states that, the implementation of green marketing strategies can create a sustainable brand image, attractive to consumers concerned about sustainability.
usefulness, attractiveness, veracity of green advertising information, relevant information, communication strategies, impact on the community.	According to Wang and Li (2022), green marketing strategies focus on the usefulness, attractiveness and truthfulness of green advertising information, which provides relevant information on the communication strategies in green marketing and the impact generated in the community.
reduction of environmental impact, production and creation of environmentally friendly products, collaboration with environmental organizations, awareness campaigns, sustainable brand image, attractive to consumers, concerned, sustainability.	Yang and Chai (2022), egreen marketing includes substantive activities such as reducing environmental impact in production and creating environmentally friendly products, as well as symbolic activities such as collaboration with environmental organizations and awareness campaigns. These actions are essential to establish a sustainable and attractive brand image for consumers concerned about sustainability.
eco-labels, influencer influence, green purchasing behavior, user-generated content, sustainable purchase intent.	Panopoulos et al. (2023) believes that, the use of eco-labels, the influence of influencers on the green purchasing behavior of Generation Z, and the impact of user-generated content on sustainable purchase intent are some of the key strategies in green marketing.
sustainability practices, sustainable procurement, waste reduction social responsibility, green marketing.	Huang et al. (2024), highlight the implementation of sustainability practices ranging from sustainable procurement to waste reduction and social responsibility through green marketing.
joint advertising, platform advertising, green manufacturer advertising, promote green products, improve environmental performance.	Huang and Yu (2021) indicate that, the joint advertising (JPA) strategy between the platform and the green manufacturer might be the most effective for promoting green products and improving environmental performance.
green marketing strategies, internal marketing, product marketing, marketing communications, formation of environmental environmental committees, use of environmentally friendly materials, green price promotion.	Vilkaite-Vaitone et al. (2022), indicates that, the green marketing strategies are sized in Internal marketing, product and Marketing communication. These strategies range from the formation of internal environmental committees to the use of green materials in products and the promotion of green pricing.

Table 2. (*Continued*).

Question: What are the strategies implemented in Green Marketing to promote environmentally responsible and sustainable practices?	
Code	**Unit of analysis and contribution**
green marketing strategies, green organizational identity, psychological ownership of green products behavior, organization members, green consumers, sustainable consumption model.	Chang (2020), the green marketing strategies influence the green organizational identity and the psychological ownership of green products in the behavior of the members of the organization. It is important to attract green consumers and achieve a sustainable consumption model.
Integrated Brand Trust model green marketing, credibility of information, customer involvement, communication tools communication tools, green purchasing intention, eco-labeling.	Jamal et al. (2023), indicates that, an integrated brand trust model for green marketing includes key variables such as information credibility, customer engagement, communication tools, green purchase intent, ecolabeling.
green marketing strategies, environmentally friendly materials, eco-friendly production processes, green channel agreements promotion of labeled products, energy efficiency.	According to Shang et al. (2021) green marketing strategies such as the introduction of environmentally friendly materials, eco-friendly production processes, green channel agreements with retailers, and the promotion of products with energy efficiency labels.
green marketing strategies, cognitive tools to influence consumer behavior, eco-labeling, product information, marketing policies, promotion of green consumption.	Khachatryan et al. (2023) considers that, the green marketing strategies, such as the use of cognitive tools to influence consumer behavior, the eco-labeling, the provision of product information, marketing policies and promotion of green consumption can generate community impact.
environmental protection, promote sustainable practices, recycling and reuse, raise consumer awareness.	For Apaza et al. (2024) Implementing green marketing strategies is based on the need to promote environmental protection, offer fair and competitive prices, promote sustainable practices such as recycling and reuse, and raise consumer awareness of the importance of preserving these natural environments.

Question: Which sustainable practices are applied in the construction of resilient infrastructures to minimize environmental impact and promote sustainability in the construction sector?	
Code	**Unit of analysis and contribution**
sustainable practices, events focused on sustainability, sustainability education, water treatment, community projects, Sustainable Development Goals.	Júnior et al. (2023), in its study indicates that, sustainable practices such as encouragement and promotion of sustainability-focused events, sustainability education, water treatment, development of projects together with the community contribute to achieving the Sustainable Development Goals (SDGs) of the UN.
designing emerging hybrid community platforms, building resilient infrastructures, flexibility of activities, resources and their redistribution.	For Manzini and Menichinelli (2021), the importance of designing emerging hybrid community platforms, focusing on building resilient infrastructures. The need to design platforms that favor redundancy of activities and resources over specialization, as well as flexibility of activities and resources and their redistribution, is highlighted.
technologies, edge computing, augmented reality, resilient infrastructure, photovoltaic integration, solar energy, buildings, real-time monitoring, intelligent control, fault detection, BIPV systems.	According to Singh et al. (2022) technologies such as computing at the edge and augmented reality in improving resilient infrastructure through photovoltaic integration (roofs, facades and windows, to generate solar energy in a building-integrated manner) in buildings by enabling real-time monitoring, control De Rosa et al. of system failures BIPV (Building Integrated Photovoltaics). In addition, these technologies contribute to improving the efficiency and lifetime of BIPV systems.
energy transition in the building sectors, urban transport, positive energy buildings, use of renewable energy, sustainable mobility, resilient urban infrastructure, circular economy practices and recycling.	From Rosa et al. (2023) state that, measures to support the energy transition in the building and urban transport sectors include the construction of energy positive buildings, use of renewable energy, promotion of sustainable mobility, creation of resilient urban infrastructures, implementation of circular economy practices and recycling.
sustainable practices, resilient infrastructure, public facilities; technologies, processes and products with a low environmental impact; optimization in the use of natural resources, water, energy water, energy; sustainable water management plans reduction of waste generation through the prevention, reduction, recycling and reuse of materials. prevention, reduction, recycling and reuse of materials.	From Corvalan et al. (2020) the sustainable practices to implement resilient infrastructures in public facilities seek the adoption of technologies, processes and products with low environmental impact, optimization of the use of natural resources such as water and energy, implementation of sustainable water management plans, reduction of waste generation through prevention, reduction, recycling and reuse of materials.

Table 2. (*Continued*).

Question: Which sustainable practices are applied in the construction of resilient infrastructures to minimize environmental impact and promote sustainability in the construction sector?	
Code	**Unit of analysis and contribution**
sustainable practices, implementation, resilient infrastructures, multifunctionality in urban design redundancy and modularization in infrastructure, adaptive designs.	Liang (2021) points out that, within the sustainable practices to implement resilient infrastructures, the multifunctionality in urban design, redundancy and modularization in infrastructure, adaptive design can be chosen.
preserve and strengthen urban communities, perceived resilience, develop public transportation systems, increase infrastructural resilience, foster collaboration, mutual understanding among residents, strengthening the resilience of social capital.	According to Niu et al. (2022), one should preserve and strengthen urban communities with a long history, as they have been observed to have higher perceived resilience, develop public transportation systems such as subways, buses, and cabs, to increase infrastructural resilience and foster collaboration and mutual understanding among residents to strengthen the resilience of social capital in communities are just some of the sustainable practices that can be implemented in urban communities.
sustainable practices, building resilient infrastructures, use of renewable bio-ligants, soybean oil in the modification of asphalts to reduce the stiffness of the mixtures and reduce crack formation.	Tarar et al. (2022) argues in their study that, some of the sustainable practices applied in the construction of resilient infrastructure include the use of renewable bio-binders, such as soybean oil in the modification of asphalts to reduce the stiffness of mixtures and reduce crack formation in pavements.
sustainable practices, use of recycled asphalter use of materials, mix optimization to improve road resilience, construction of road infrastructures.	For Hussain et al. (2022), the application of sustainable practices such as the use of recycled asphalt, material reuse and mix optimization to improve road resilience can contribute to more sustainable practices in road infrastructure construction.
regular geotechnical investigations in high-risk areas; divide the area into zones with different degrees of seismic risk; adapt land use regulations; encourage retrofitting and strengthening of existing buildings to improve their seismic resistance; develop measures to address potential disasters.	Salata and Uzelli (2024), consider that, conduct regular geotechnical investigations in high-risk areas; divide the area into zones with different degrees of seismic risk and adapt land use regulations consequently; incentivize or require retrofitting and strengthening of existing buildings to improve their seismic resistance; develop measures to address potential disasters, such as fires, explosions, and mass movements, quickly and effectively.
assessing sustainable performance throughout the life cycle of life cycle of the infrastructure; promote, training and educating construction companies about sustainable, strategies, strengthen legislation on sustainable building standards and regulations, encourage the inclusion of sustainable practices in program management. encourage the inclusion of sustainable practices in program management.	Mustaffa et al. (2023), it highlights the importance of integrating elements of resilient infrastructure into all projects, as well as the need to assess sustainable performance throughout the life cycle of infrastructure. It also mentions the importance of promoting, training and educating construction companies on sustainable strategies, strengthening legislation on sustainable construction standards and regulations, and encouraging the inclusion of sustainable practices in program management.
environmental impact assessment and management, development of resilient technologies, engineering and infrastructure, effective supply chain management.	For Amaratunga et al. (2018), environmental impact assessment and management, development of resilient technologies, engineering and infrastructure and effective supply chain management to ensure uninterrupted services during disasters are some of the actions to promote sustainable practices.
green building design, renewable energy integration, waste management, certification standards, life cycle assessment and the promotion of disaster-resistant infrastructure.	According to Waqar et al. (2024) some sustainable practices in building resilient infrastructure include green building design, renewable energy integration, waste management, standards certification, life cycle assessment and promotion of natural disaster resilient infrastructure.
"gray" and "green" infrastructure, policies to encourage behavioral changes, strengthen ecosystem resilience, community participation in the development of resilient infrastructure.	From the point of view of Chirisa et al. (2016) practices in building resilient infrastructures, the implementation of "gray" and "green" infrastructure measures are highlighted, along with participatory approaches and policies to encourage behavioral changes. The importance of strengthening ecosystem resilience and community participation in the development of resilient infrastructure are also mentioned.

Table 2. (*Continued*).

Question: How is the adoption of sustainable practices and green marketing in the promotion of resilient infrastructure?	
Code	**Unit of analysis and contribution**
implement regulations and policies that encourage sustainable practices, adopt sustainable measures, require more sustainable textile products, adopt responsible practices.	According to Oliveira et al. (2023), the government should implement regulations and policies that encourage sustainable practices in the textile industry. Businesses should adopt sustainable measures, even in a competitive environment, recognizing the long-term benefits. Society in general should demand more sustainable textile products and support companies that adopt responsible practices.
green financial technology, encourage companies to invest in renewable energy, access funds with lower interest rates.	Aboalsamh et al. (2023) suggests in his study that, green financial technology fosters sustainability by encouraging companies to invest in renewable energy to access funds with lower interest rates, as well as its role in financial inclusion and current regulatory challenges.
the level of maturity of the implementation of best practices, environmental impact and complexity of implementation, optimizing resources and improving sustainability and competitiveness. holistic approach, ecosystem stakeholders, promoting sustainable practices, address environmental challenges.	The study of Assis et al. (2023) proposes a model to evaluate the priority of best practices in transportation in Brazil. It considers factors such as the level of maturity of the implementation of best practices, the environmental impact and the complexity of implementation. By classifying them, it identifies the priority ones and the easiest to implement, optimizing resources and improving sustainability and competitiveness.
	Lee et al. (2023) highlights the importance of a holistic approach that involves all ecosystem players in the telecommunications industry (such as operators, device manufacturers, technology providers and content providers) to encourage sustainable practices and effectively address environmental challenges.
Building Information Modeling (BIM), reducción de barreras de entrada, costos iniciales y falta de capacitación.	The study of Alghuried (2023) suggests that in order to integrate the implementation of Building Information Modeling (BIM)into government and business policies, it is important to consider the reduction of barriers to entry, such as upfront costs and lack of training. In addition, it is recommended that further research be conducted to evaluate the long-term effects of sustainable practices and BIM implementation in the construction industry. and implementation of BIM in the construction industry.
institutional capacity assessment, governance of the infrastructure, equity, equitable allocation of infrastructure.	Desalegn and Solomon (2021) in his study suggests that institutional capacity assessment, infrastructure governance and equity are factors that influence the equitable allocation of infrastructure and, therefore, its acceptance and effectiveness in society.
government policies, regulations; public institutions, sustainability of ocean tourism.	According to Dalei et al. (2021) the government policies, regulations and public institutions play a significant role in the sustainability of ocean tourism. For example, well-designed policies and regulations can drive the sustainability of ocean tourism.
promote the development of clean energy, sustainable use of resources.	Li et al. (2024) highlights the importance of policies that promote the development of clean energy and at the same time ensure the sustainable use of resources to mitigate possible negative impacts on food security.
new technologies, Artificial Intelligence (AI), efficient infrastructure, Internet connectivity.	For Singh et al. (2023) construction organizations need to understand the benefits of new technologies such as Artificial Intelligence (AI) and for the government to issue policies that encourage their incorporation into daily operations. Also mentioned is the need for efficient infrastructure and Internet connectivity to use AI-based systems effectively.

Note: Own elaboration.

Analytical phase.

In this stage, axial coding is used to link and organize the emerging categories according to their context, conditions and results. During this process, we continue with the collection of information, the elaboration of comprehensive notes and the writing of memoranda.
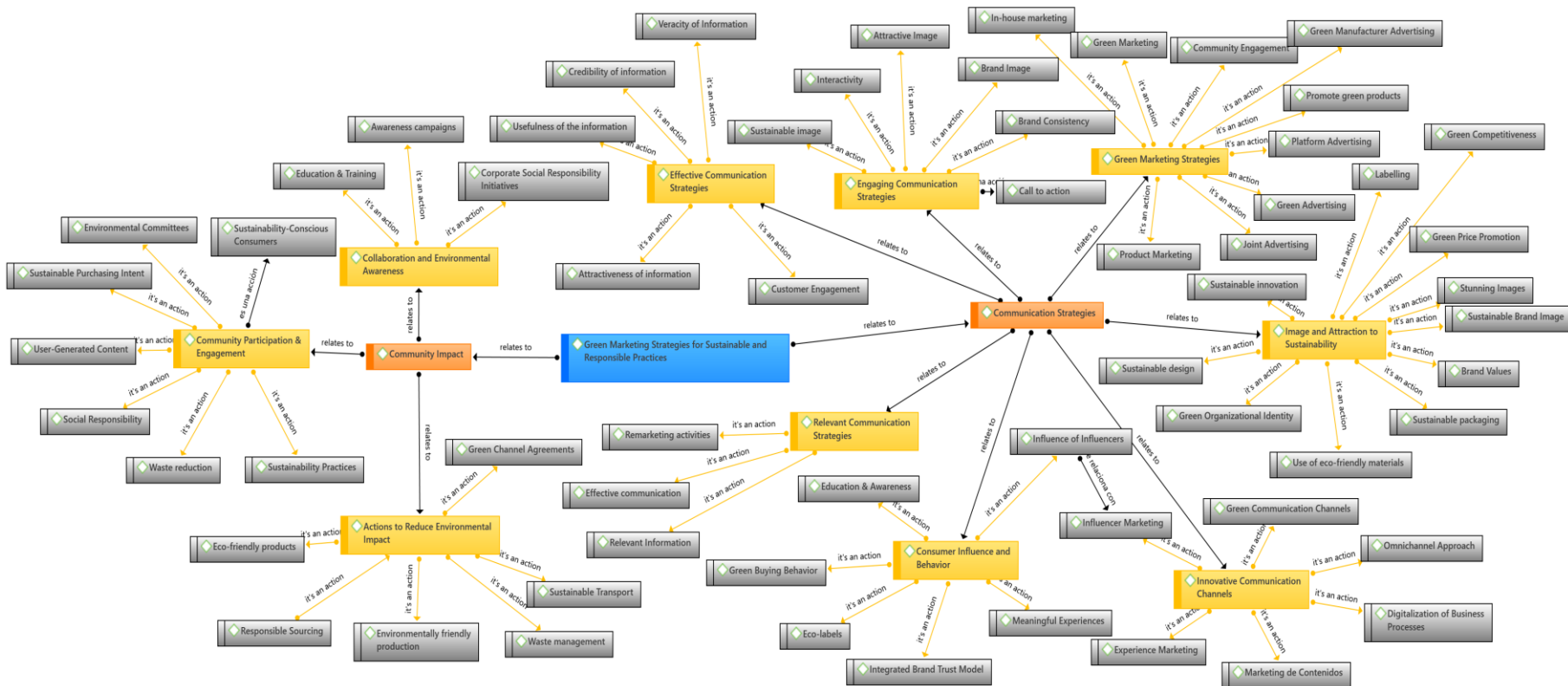
Figure 6. Semantic network of strategies implemented in green marketing to promote environmentally responsible and sustainable practices.
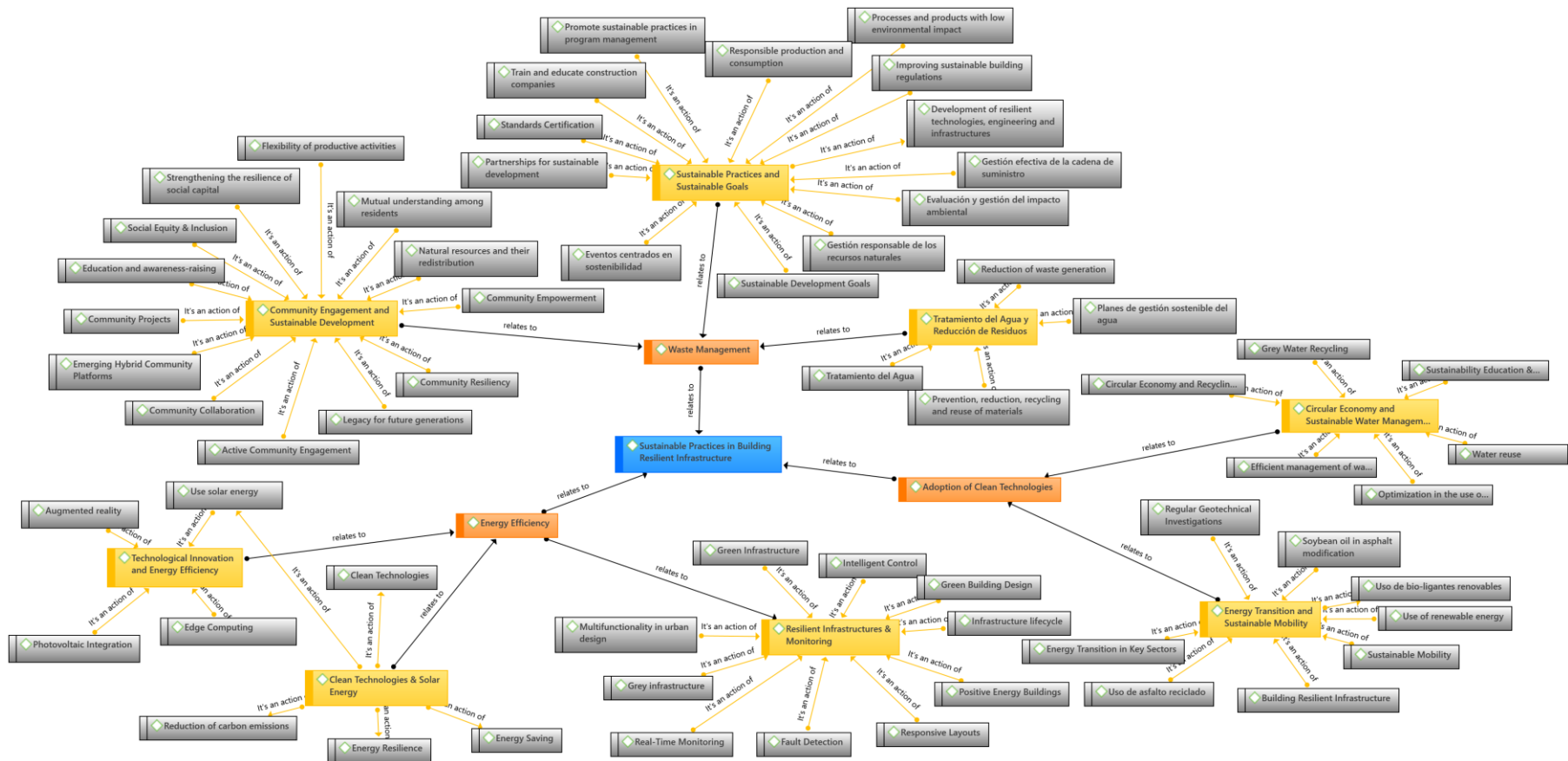Note. Own elaboration with ATLAS.Ti. version 9 software.

Figure 7. Semantic network of sustainable practices applied in the construction of resilient infrastructures.
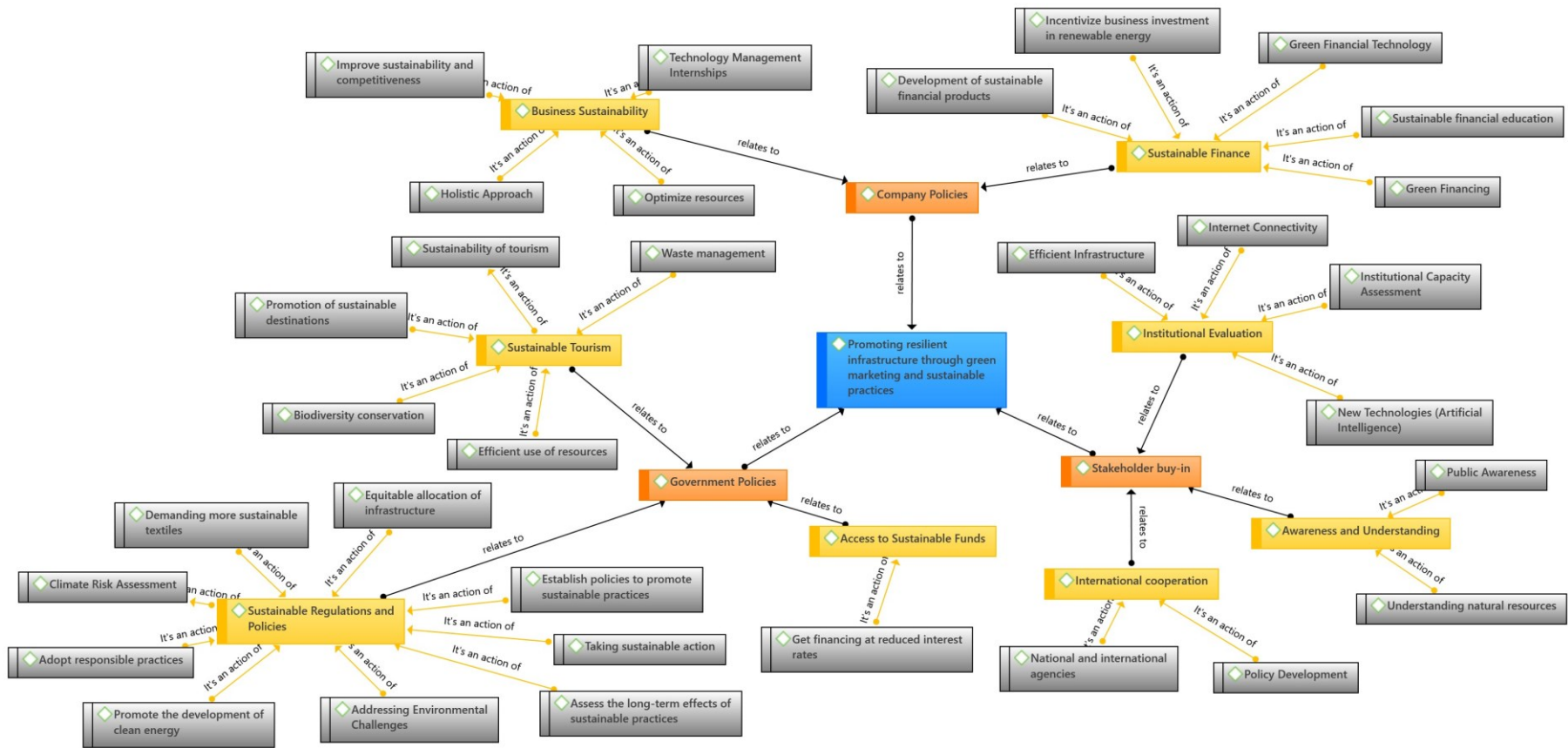Note. Own elaboration with ATLAS.Ti. version 9 software.

Figure 8. Semantic network of adoption of sustainable practices and green marketing in the promotion of resilient infrastructures.
Note. Own elaboration with ATLAS.Ti. version 9 software.

3.2. Analytical phase or axial coding

In the next phase, the essential component of the methodology used in the study, based on Grounded Theory, will be presented. This phase constitutes the core of the analysis, in which the central category is highlighted and examined in detail, outlining its interaction with other categories that have emerged throughout the research process given the answers to the questions posed and consulted in the units of analysis.

Hence, the application of theoretical sensitivity and theoretical sampling were fundamental at this point, since they provide a solid and coherent basis for the interpretation of the emerging data. Thus, it is possible to construct a comprehensive narrative that encapsulates the most significant findings of the study, offering valuable insights and original contributions to green marketing and how it can strengthen the promotion of environmentally responsible and sustainable practices in the development of resilient infrastructures. Thus, the interpretative phase is the moment when all the previous analytical effort is synthesized, revealing the underlying dynamics and intrinsic relationships between the elements studied.

3.3.1. Theoretical sensitivity and theoretical sampling

In the context of the research, when addressing the generative question on? What are the strategies implemented in Green Marketing to promote environmentally responsible and sustainable practices? two emerging categories of fundamental importance were identified through axial coding (**Figure 6**): *communication strategies and community impact*. It is recognized that the effectiveness of green marketing strategies depends crucially on the ability to effectively, attractively and relevantly communicate the environmental and social benefits associated with sustainable practices. This is achieved by using innovative communication channels that promote direct and meaningful interaction with the consumer. Green marketing strategies not only aim to promote sustainable products or services, but also to generate a significant change in consumer behavior towards more responsible choices.

For this reason, green marketing communication is considered one of the most sensitive and controversial areas due to its significant impact on a wide range of audiences and its role in presenting green products as simplified solutions to complex environmental problems (Mihai, 2021; Nygaard, 2024). According to Kotler and Armstrong (2021), the importance of companies' environmental responsibility in their marketing strategies is fundamental; these encompass marketing efforts to produce, promote and sell products that do not harm the environment (Kerin and Hartley, 2023).

Hence, there are several theories that support the study of communication in green marketing and the impact it generates in the community, such as the Theory of Planned Behavior (TCP) of Icek Ajzen; the Theory of Social Exchange of George C. Homans; the Cost-Benefit Theory, and the framework of Corporate Social Responsibility (CSR) to the development of strategies in Green Marketing is essential to promote environmentally responsible and sustainable practices.

According to Ajzen (1991), the TCP highlights how consumers' intention to purchase green products is influenced by attitudes, subjective norms, and perceptions of control, thus providing a basis for designing messages that positively shape these perceptions and encourage sustainable purchasing behaviors. Social Exchange Theory, on the other hand, suggests that companies can leverage the social and environmental

benefits of their products to attract consumers who value these benefits, creating an exchange where prestige and social approval act as valuable resources (Ahmad et al., 2023; Jahan and Kim, 2020). As for the Cost-Benefit Theory, it provides an economic perspective from which consumers weigh environmental benefits against additional costs, indicating that green marketing should focus on maximizing the perception of environmental value to justify premium prices (Liu et al., 2014; Wu and Ma, 2022). Finally, CSR is conceived as an ethical framework that not only encourages companies to adopt sustainable practices but also to communicate these initiatives effectively to consumers, thus reinforcing their brand image and alignment with environmental values (Brin and Nehme, 2019).

Therefore, green marketing strategies not only seek to influence and modify consumer behavior towards more sustainable options, but also to build a positive image that attracts towards sustainability. In parallel, the importance of generating a positive impact on the community through actions that reduce environmental impact, promoting collaboration and environmental awareness, as well as encouraging community participation and engagement is highlighted. This integration of effective communication strategies with community wellness initiatives underscores the potential of green marketing to lead the way towards more responsible and sustainable business practices. **Figure 9** shows the findings obtained after the discussion of the results:

Figure 9. Core green marketing categories.

Note. Own elaboration with ATLAS.Ti. version 9 software.

Next, the question "What sustainable practices are applied in the construction of resilient infrastructure to minimize environmental impact and promote sustainability in the construction sector?" was answered through axial coding (**Figure 7**), which revealed an interconnection between the emerging categories of energy efficiency, waste management and adoption of clean technologies.

Energy efficiency and interconnections between codes are manifested through the integration of clean technologies and solar energy, which are essential for effective and continuous monitoring. This approach not only enhances long-term sustainability, but also drives technological innovation, vital for optimizing resource use and minimizing environmental impact in building resilient infrastructure. According to Sen and Ongsakul (2018) and Yang et al. (2024). energy efficiency emerges as a fundamental pillar in building disaster-resilient urban infrastructure, underscoring the critical importance of strategic investments in the energy sector to ensure that urban areas can cope with disasters while maintaining energy security and access, thus contributing to a safer and more sustainable urban environment. For Meerow (2017) investment in energy-efficient infrastructure is a way to simultaneously address the challenges of climate change, vulnerability to natural disasters, energy dependence and social inequalities in access to energy services.

In parallel, waste management is addressed through sustainable practices that align development objectives with waste reduction and water treatment, emphasizing the importance of community engagement to foster sustainable development. This dimension underscores the relevance of adopting holistic approaches that link environmental sustainability with social well-being. Datta and Kapoor (2023) emphasizes that urban waste management must be comprehensive and sustainable, combining efficient logistics, innovative solutions, citizen participation, economic viability and adaptability. This will make it possible to face current challenges and prepare cities for a more sustainable future. For its part, Mitra (2023) indicates that sustainable waste management is an integrated approach that seeks to minimize environmental impact and maximize the value extracted from waste through an optimized logistics supply chain. Sustainable solid waste management faces barriers such as lack of adequate infrastructure and legal and institutional gaps. These barriers limit the adoption of sustainable practices and require solutions to move towards more efficient and responsible waste management (Boemi et al., 2010; Mandpe et al., 2023).

Regarding, the adoption of clean technologies is essential to facilitate an energy transition towards sustainable mobility and promote circular economy principles, especially in sustainable water management. This aspect highlights how innovation and efficiency can lead to greater infrastructure resilience, ensuring that construction practices not only meet current challenges, but are also prepared for future contingencies. In the opinion of Lima et al. (2023) ensure that clean technologies are widely available and easily accessible to end users. This implies adequate distribution, ease of acquisition and competitive prices. Thus, it can be said that the adoption of clean energy represents a paradigm shift in the way we generate and consume electricity and energy.

This process involves gradually replacing polluting fossil fuel-based energy sources with more environmentally friendly solutions, such as solar, wind, hydroelectric, geothermal and other renewable technologies (Amir et al., 2020;

Mohammadi et al., 2024; Wu et al., 2023). Mandpe et al. (2023) emphasizes that the Circular Economy (CE) approach minimizes waste generation and reduces overexploitation of resources. CE involves processing products, materials and components at the end of their useful life into valuable resources to make new ones. This involves initiatives at both the individual and supply chain level to close the industrial cycle. The circular economy through recycling and remanufacturing activities positively impacts sustainable industrialization and promotes innovative ideas (Patyal et al., 2022).

To support the above, several theories ranging from sustainability to integrated project management are highlighted in order to expand the knowledge of sustainable practices in the construction of resilient infrastructure, starting with the Theory of Sustainability, originated in the Brundtland report of 1987, which emphasizes the importance of a development that balances economic growth, environmental protection and social equity, highlighting the satisfaction of current needs without compromising future generations (Holden et al., 2014; Purvis et al., 2019). Similarly, the Ecological Theory proposed by Urie Bronfenbrenner, which emphasizes the role of the environment in the development of resilience, bases resilience on the capacity of ecological systems to absorb disturbances and reorganize themselves while maintaining their functions, structure, identity and feedbacks (De Montis et al., 2019).

In the context of ecological resilience as applied to systems such as rail transport (Bešinović, 2020). It also focuses on how communities and ecosystems can not only survive but also benefit from disturbances and reorganizations (Hayes et al., 2019). For its part, the Theory of Energy Efficiency contributes to this study with its postulate of the rational use of energy, ensuring that systems and processes consume the least amount of energy possible to perform their functions. This includes from the optimization of industrial processes to the efficient design of buildings (Palm and Reindl, 2018; Tang et al., 2018; Yang et al., 2021). From the Circular Economy approach, we propose an economic model that maximizes the reuse and recycling of materials, applicable to construction through the use of recyclable materials and practices that promote sustainability (Densley, 2022; Kennedy and Linnenluecke, 2022). As it relates to Integrated Project Management, it emphasizes collaboration among all stakeholders to effectively incorporate sustainable practices throughout the project. These theories provide a comprehensive framework for implementing sustainable and resilient practices in the construction sector, promoting a more sustainable and equitable future (Lewin et al., 2024; Subramanya et al., 2022). **Figure 10** shows the findings obtained after the discussion of the results.

Finally, the question How is the adoption of sustainable practices and green marketing in the promotion of resilient infrastructures? was answered, for which it could be deduced through the intercessions presented in the axial coding in **Figure 8** that, the promotion of resilient infrastructures through green marketing and sustainable practices represents an integrated approach ranging from government policies to stakeholder acceptance. Government policies play a crucial role, establishing sustainable regulations and policies that encourage access to sustainable funds and promote initiatives such as sustainable tourism. These government actions not only create a favorable regulatory framework, but also incentivize investment in projects that contribute to infrastructure resilience and sustainability.
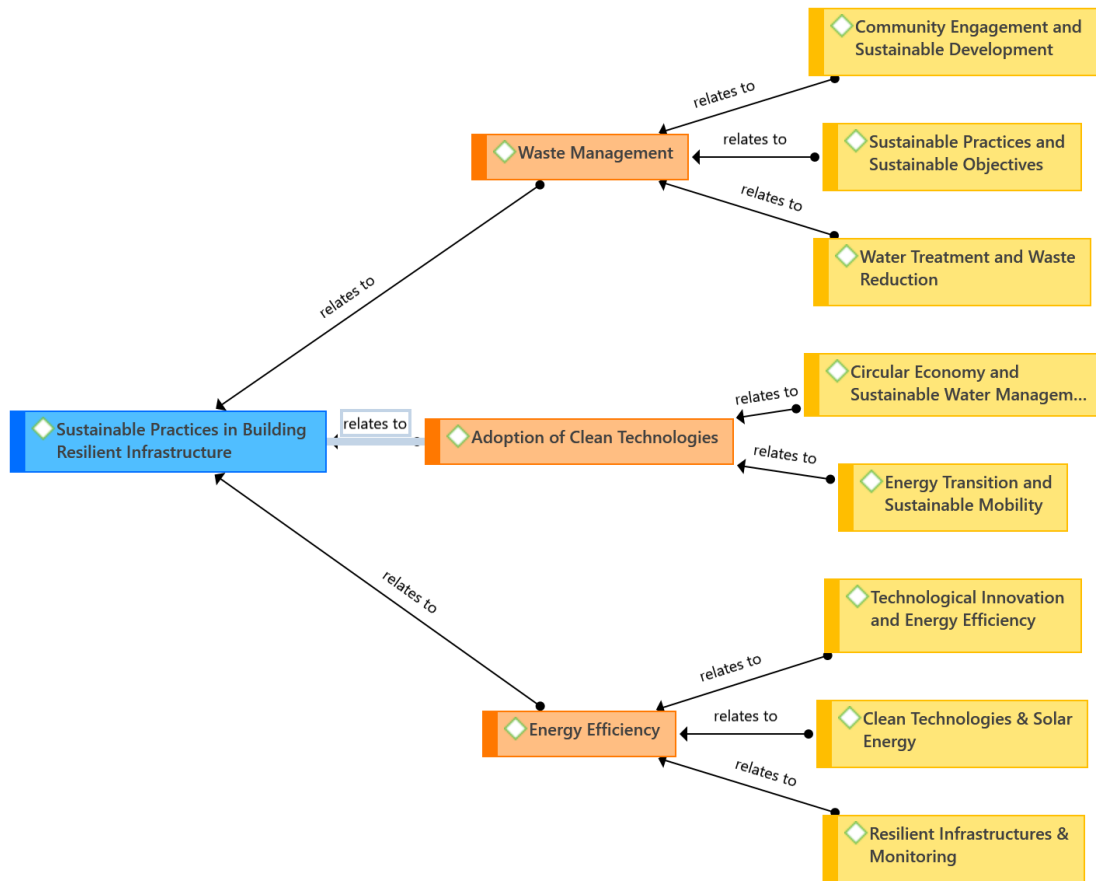
Figure 10. Core categories of sustainable practices.
Note. Own elaboration with ATLAS.Ti. version 9 software.

Finally, the question How is the adoption of sustainable practices and green marketing in the promotion of resilient infrastructures? was answered, for which it could be deduced through the intercessions presented in the axial coding in **Figure 8** that, the promotion of resilient infrastructures through green marketing and sustainable practices represents an integrated approach ranging from government policies to stakeholder acceptance. Government policies play a crucial role, establishing sustainable regulations and policies that encourage access to sustainable funds and promote initiatives such as sustainable tourism. These government actions not only create a favorable regulatory framework, but also incentivize investment in projects that contribute to infrastructure resilience and sustainability.

In this way, governments and organizations can provide economic, fiscal or regulatory incentives that encourage and facilitate the adoption of clean technologies by individuals and companies. This helps reduce initial cost or implementation barriers (Lima et al., 2023). On the other hand, corporate policies reflect a commitment to sustainability through the adoption of sustainable finance and responsible business practices. By aligning their strategies with sustainability principles, companies contribute significantly to the development of resilient infrastructures, demonstrating that it is possible to achieve a balance between profitability and environmental responsibility (Assis et al., 2023; Chen et al., 2024; Liu et al., 2024).

Furthermore, stakeholder acceptance and support are critical to the success of these initiatives. Awareness and understanding of the importance of sustainability,

along with international cooperation and positive institutional assessments, are essential to generate significant change. Collaboration between different actors allows for more effective implementation of sustainable and resilient projects, ensuring that infrastructures are not only able to withstand future challenges, but also promote sustainable and responsible development.

Together, these interconnected categories: government policy, business policy and stakeholder buy-in create a robust ecosystem that fosters the promotion of resilient infrastructure through sustainable practices and green marketing. This integrative approach not only improves the resilience of infrastructure to environmental and social challenges, but also fosters a culture of sustainability at all levels of society. The transition to a clean energy future requires the participation of all sectors of society: government, business, communities and citizens, through support policies, investments, technological innovation and changes in consumption habits. This is the only way to move towards a more sustainable world (Júnior et al., 2023; Wu et al., 2023). **Figure 11** shows the findings obtained after the discussion of the results:
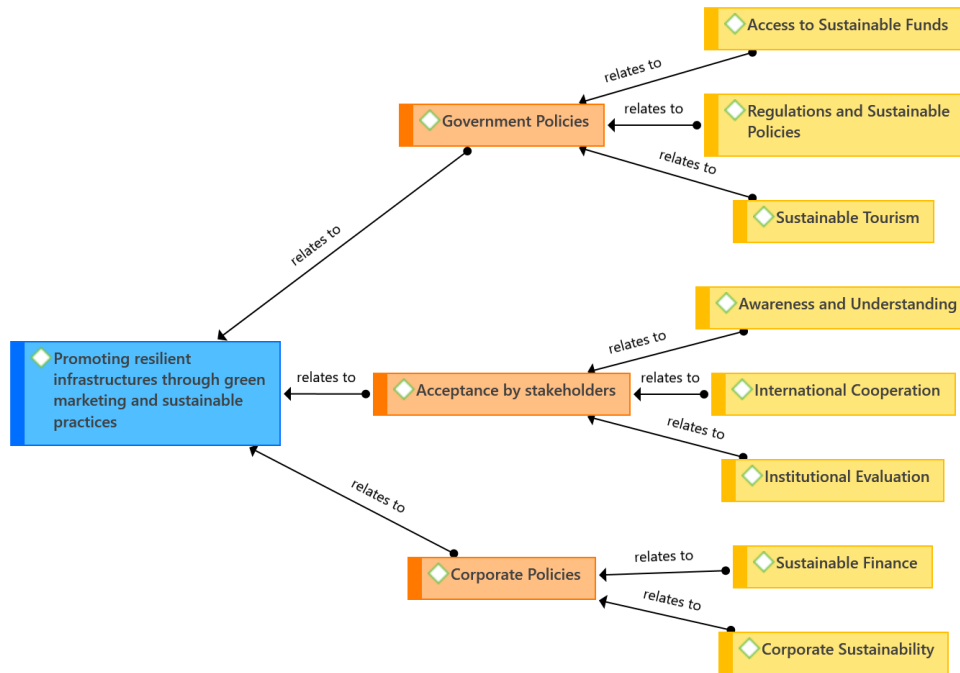

Figure 11. Core categories of adoption of sustainable practices and green marketing.
Note. Own elaboration with ATLAS.Ti. version 9 software.

4. Conclusion

The study of green marketing in the promotion of environmentally responsible and sustainable practices in the development of resilient infrastructure in Peru has revealed crucial insights for sustainable development and the creation of resilient infrastructure in the face of current environmental and social challenges. Through the research, key elements and effective practices have been identified, highlighting the importance of adopting sustainable actions driven by green marketing. These findings provide a comprehensive view on how to promote resilient and sustainable infrastructures.

In the field of green marketing, the relevance of communication strategies and the impact on the community is highlighted. Communication must not only be attractive and relevant, but also use innovative channels for meaningful interaction with consumers, promoting a shift towards more responsible choices. In addition, community impact seeks to generate broader societal benefits through initiatives that reduce environmental impact and encourage community awareness and participation. These strategies must be integrated to be effective, ensuring that the green marketing message reaches consumers and that individual actions translate into collective benefits. This lays a solid foundation for sustainable growth for companies in the construction sector, and is fundamental to moving towards a more sustainable future.

In terms of sustainable practices in the construction of resilient infrastructure, three fundamental pillars stand out: energy efficiency, waste management and adoption of clean technologies. Energy efficiency is achieved through the integration of innovative solutions such as clean technologies and solar energy, which are essential for effective resource management. Waste management focuses on the reduction, reuse, and recycling of materials, underscoring the importance of community engagement and policies that promote responsible waste management. The adoption of clean technologies facilitates a transition to more sustainable practices, being crucial in water management to promote its efficient use and the implementation of a circular economy. These practices not only address environmental challenges but also prepare infrastructures for future contingencies, ensuring resilient and sustainable construction methods in the long term.

Finally, the adoption of sustainable practices and green marketing in the promotion of resilient infrastructure is seen as an essential integrating element, from government policies to stakeholder support. Government policies provide a regulatory framework that incentivizes investment in sustainable and resilient projects, while corporate policies reflect a commitment to sustainability principles. Stakeholder support is critical to the success of these initiatives, promoting a culture of sustainability at all levels of society. This inclusive approach is vital to move towards a more sustainable and resilient future, creating a robust ecosystem that enhances the ability of infrastructure to address environmental and social challenges and promotes a sustainable culture globally.

Based on the findings, several future directions for research in the field of green marketing and sustainable practices in the promotion of resilient infrastructure are identified. First, there is a need to explore how green marketing strategies can be adapted and applied in other developing countries, assessing their effectiveness in different socioeconomic and regulatory environments. In addition, comparing the acceptance of these strategies in different cultural contexts can provide valuable insights to customize and optimize communication strategies. It is also important to investigate the synergy between green marketing and other sustainable development strategies, such as circular economy and corporate social responsibility, to amplify environmental, social and economic benefits.

Likewise, the impact of emerging technology, such as artificial intelligence and big data, on the optimization of sustainable strategies should be explored; the economic efficiency of green marketing should be evaluated to determine its return on investment and effect on business competitiveness; and consumer perception and

purchasing behavior should be studied to better adapt strategies to their expectations. At the same time, researching public-private collaboration models that promote sustainability, developing educational programs and environmental awareness campaigns to foster a culture of sustainability, analyzing the impact of green marketing on corporate reputation and customer loyalty, and conducting case studies on successful and unsuccessful experiences to identify key success factors and areas for improvement are essential directions. These initiatives will not only expand knowledge on the application of green marketing in different contexts, but will also contribute to the creation of a more robust and adaptable framework for the promotion of sustainable practices and infrastructure resilience globally.

5. Additional points

1) Analysis of study limitations:

Lack of Peru-specific empirical data. Many studies reviewed are based on international contexts which, while providing valuable information, may not be fully applicable to the Peruvian context due to cultural, economic and regulatory differences.

2) Innovative aspects of the research:

the systematic review employs an interdisciplinary approach, integrating knowledge from marketing, sustainability and infrastructure development. This integration allows for a more holistic and deeper understanding of the interactions between these fields and how they can jointly contribute to the promotion of environmentally responsible practices.

3) Suggest areas for future research:

Conducting empirical studies in Peru that evaluate the effectiveness of the green marketing strategies identified in this review. This could include case studies, surveys and experiments that provide concrete and contextually relevant data.

Conflict of interest: The authors declare no conflict of interest.

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