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From information to engagement in the Anthropocene: media's role in low-carbon city transformation in China

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Urban areas, with dense populations and concentrated consumption, are major contributors to CO₂ emissions, accelerating the progression of the Anthropocene. In this context, low-carbon city transformation is essential for sustainability and climate resilience. This transformation is a complex process requiring collaboration across sectors and stakeholders, with media serving as a crucial communication bridge connecting government, the public, and other actors. This study uses in-depth interviews combined with systems thinking and transdisciplinary insights to analyze media coverage and its role in China's low-carbon city transition. Basing on our cases, this study finds that (1) diverse media reporting raises public awareness of climate and low-carbon issues, but in-depth analysis and scientific interpretation remain limited due to a shortage of trained climate journalists. (2) Visual formats like videos and animations effectively capture public attention, while in-depth written reports, especially from state media, exert greater influence on policy and industrial transformation. (3) Beyond information dissemination, media facilitate dialog among government, businesses, NGOs, and citizens, promoting collective action in low-carbon city transformation. However, challenges such as climate anxiety, misinformation, and algorithm-driven information gaps undermine trust and engagement. This study highlights the media's vital role in raising awareness, influencing behavior, and connecting stakeholders, providing insights to support better policy decisions and climate communication strategies for sustainable urban futures.

KEYWORDS

China, climate change, qualitative research, science communication, stakeholder cooperation, the role of media

1 Introduction

In recent years, extreme weather events, including floods, heatwaves, and tornadoes, have become more frequent, intense, and prolonged (Luo et al., 2024). Data from the World Meteorological Organization (WMO) indicate that over two-thirds of the most severe heatwave events in Europe since 1950 have occurred after the year 2000 (World Meteorological Organization, 2025). As nature delivers more forceful and frequent warnings, there has been growing recognition of the Anthropocene concept (Jon, 2020). The Anthropocene, first introduced by Paul Crutzen and Eugene Stoermer in 2000, describes a geological era shaped by the planetary impacts of human activities (Zottola and de Majo, 2022; Belyalova and Yem, 2023; Malhi, 2017). A key feature of the Anthropocene is global urbanization, which reshapes the

interaction between human societies and natural environments, calling for a rethinking of urban development in the context of climate change and planetary health (Alberti, 2024).

Urban areas, characterized by high population densities and concentrated consumption, are responsible for more than two-thirds of global energy use and over 70% of carbon dioxide emissions (United Nations Climate Change, 2025), thereby accelerating the progression of the Anthropocene (Elmqvist et al., 2021). Under this background, low-carbon city transformation emerges as a vital pathway toward sustainability and climate resilience. This transformation entails improving energy efficiency, shifting to low-carbon industries, and promoting sustainable resource utilization to reduce dependency on non-renewable energy sources (De Jong et al., 2015). However, low-carbon city transition is inherently complex and dynamic, necessitating the coordinated interaction of policy, society, infrastructure, finance, and technology (Luque-Ayala et al., 2018; Li et al., 2024). Successful transition requires stakeholder collaboration and synergy across sectors and regions, as well as attention to local contexts and social equity. Evidence further suggests that low-carbon city policies can stimulate corporate green innovation by raising public awareness and strengthening transparency in environmental practices (Xia et al., 2024). Therefore, fostering public participation and awareness is not merely supportive but foundational to the success of sustainable urban transitions.

To enhance public engagement, media communication plays a crucial role in shaping how individuals understand, discuss, and engage with climate action (Wu et al., 2024). As many individuals have limited scientific literacy or technical knowledge of climate change, they often rely on media sources, such as television, newspapers, and digital platforms for information (Octavio and Setiawan, 2025). Media communication influences environmental beliefs and behaviors, with the public sphere functioning as a crucial arena for the exchange of diverse perspectives on climate and environmental issues (Pezzullo and Cox, 2025). As such, the media not only are channels for information but also could construct meanings around climate challenges and low-carbon policies (Junsheng et al., 2019; McNally, 2015; Bergillos, 2021). Beyond reporting events (Happer and Philo, 2013), media narratives affect public understanding, emotional engagement, and behavioral responses (Cooper and Nisbet, 2016). Moreover, the media act as a social bridge that connects scientists, policymakers, and the broader public through narrative framing (Boykoff, 2008), thereby promoting broader public engagement and stakeholder collaboration in low-carbon society transition (Moser, 2014).

China represents a particularly significant case due to the interlinked dynamics of climate change, the Anthropocene, and urban transformation. As the world's largest energy consumer and carbon dioxide emitter, China's urban areas account for approximately 85% of its total carbon emissions (Lin et al., 2023; Guo et al., 2025). To improve energy efficiency, China initiated the Low-Carbon City Pilot in 2010, with further roll outs in 2012 and 2017 that steadily expanded its scope and scale. Low-carbon city transformation has become an important strategy to peak CO₂ emissions by 2030 and achieve carbon neutrality before 2060. However, the transition faces some challenges such as a large population, regional disparities, and cultural differences (Li et al., 2025). While some cities have adopted digital technologies to promote green innovation and reduce emissions (Huang et al., 2024), cross-sectoral collaboration and the information gaps remain persistent difficulties (Hsu et al., 2024). These conditions reveal the importance of effective public communication to promote

inclusive governance and encourage collective action. In addition, in China, environmental and climate policies are implemented through a top-down approach (Luo et al., 2024), and media coverage of climate and low-carbon issues generally aligns closely with government policies (Wang and You, 2024). Unlike in Western media systems, where ownership structures are more diverse, most mainstream Chinese media, whether party-affiliated or market-oriented, are state-run (Wang and You, 2024; Zhang and Su, 2020). As climate change is a global challenge requiring international cooperation, it is crucial to understand how media in non-Western contexts contribute to public discourse, stakeholder interaction, and policy-making in climate governance. Therefore, this research will analyse how Chinese media report low-carbon transition and the differences in climate change reporting across various types of media in China.

Based on the above background and literature, this study is guided by the following research questions:

1. How does Chinese media report on climate change and low-carbon city transformation?
2. What are the differences in climate change reporting across various types of media in China?
3. What role does media coverage play in China's low-carbon city transformation?

Through exploring the above research question, this study has several contributions to the literature on low-carbon city transformation. First, it provides original empirical evidence on climate communication and low-carbon transition in China, contributing to the limited literature on non-Western contexts. By analyzing journalistic practices, the study re-examines the gap between policy implementation and public engagement in China's climate governance. Second, moving beyond prior studies that predominantly rely on quantitative content analysis, this research employs a qualitative approach through in-depth interviews with senior journalists. It examines how climate and low-carbon issues are selected, sourced, framed, and communicated, offering new insights into the media's role within urban transition systems. Finally, this study develops an integrated theoretical framework that combines transdisciplinary perspectives, systems thinking, framing analysis, and agenda-setting theory. Systems thinking provides a macro lens that frames low-carbon city transition as an interacting governance system, within which media serve as institutional communication actors. Transdisciplinary perspectives connect science communication, urban governance, and sustainability science to locate media within broader socio-ecological systems. Framing analysis examines how journalists construct meanings around low-carbon transition, while agenda-setting theory explains how issue salience varies across media types. This study uncovers the dynamic communication process and challenges that shape public engagement and stakeholder collaboration in the low-carbon transition.

2 Literature review and theoretical framework

Globally, scholars have increasingly explored how media shape urban transformation by influencing public discourse and stakeholder collaboration. Howarth (2017) found that narratives can help build public support for low-carbon transitions and increase experiential

engagement with climate change. [Lu and Lange \(2023\)](#) highlighted that visualization can enhance interactivity, immersion, and realism, contributing to a better understanding of sustainable urban transformation. In addition, [Abraham and Khatra \(2022\)](#) argued that cities themselves are inherently communicative spaces, characterized by dense media networks through which social, political, economic, and cultural messages circulate. Media technologies thus play a crucial role in shaping urban futures by facilitating information exchange, community building, public discourse, and policy influence that support urban governance.

Empirical studies further illustrate how media influence public perceptions of carbon reduction. [McNally \(2015\)](#) identified six dominant frames in Irish media coverage of carbon emissions, ranging from policy and economic narratives to calls for radical change, highlighting the marginalization of socially relevant perspectives. Examining Copenhagen, [Winter \(2019\)](#) found that the city's 'already green' image may discourage further individual environmental action. [Ter Mors et al. \(2023\)](#) revealed that Dutch national newspaper coverage of carbon capture and storage reflects a dynamic interplay between society and technology but often lacks comprehensive explanations. Similarly, [Donnison et al. \(2023\)](#) found UK media discussions of Bioenergy with carbon capture and storage underdeveloped relative to policy ambitions, emphasizing the media's crucial role in agenda-setting and its influence on public attitudes toward new energy technologies. Overall, existing studies show that media can influence public understanding and engagement in low-carbon transitions, framing sustainability narratives. Meanwhile, climate communication research has predominantly focused on Western contexts, examining media trust, climate attitudes, or cross-national comparisons ([Ejaz et al., 2024](#); [Mede et al., 2025](#); [Večkalov et al., 2024](#)), with limited empirical insights from low- and middle-income countries, including China ([Schäfer and Painter, 2021](#)). However, most existing research neglect how media function as institutional actors within urban governance systems that support communication among policymakers, businesses, and citizens. To address this gap, this study will examine media's role in the system of low-carbon city transformation.

Although some researchers have explored the Anthropocene through transdisciplinary frameworks ([Prescott, 2024](#); [Prescott et al., 2022](#)), limited studies have integrated transdisciplinary insights with system thinking to examine the role of media in China's low-carbon city transformation. The transition to low-carbon cities is not simply the sum of individual sectors, but a complex system comprising multiple interrelated elements, including energy, transportation, buildings, industry, governance, and residents' behavior ([Wu et al., 2016](#); [Liu et al., 2012](#); [Liu and Lo, 2025](#)). This transformation encompasses not only technological innovation, but also economic restructuring, behavioral change, and the reshaping of cultural values ([Connolly, 2018](#)). It constitutes a dynamic and long-term process influenced by interactions within the urban socio-economic–natural–governance ecosystem ([Zhu and Li, 2024](#)). However, these elements have often been studied in isolation or within disciplinary silos, resulting in a piecemeal understanding of how media facilitate communication and coordination among stakeholders in low-carbon city transformation ([Wan Rosely and Voulvoulis, 2023](#)). Currently, most studies on low-carbon cities in China focus on policy evaluation ([Liu and Qin, 2016](#); [Zhao et al., 2019](#); [He et al., 2024](#)), carbon emission calculation ([Li and Xing, 2024](#); [Xu et al., 2024](#); [Xiao et al., 2025](#)), and behavioral factors ([Wang G. et al., 2024](#); [Wang T. et al., 2024](#); [Xiang and Liu, 2024](#); [Yang et al., 2025](#); [Ren et al., 2024](#)), leaving the communicative dimension

underexplored. Although previous studies have examined Chinese media coverage of climate change ([Han et al., 2017](#); [Duan and Miller, 2021](#); [Pan et al., 2020](#)) and the dual carbon goals ([Wang G. et al., 2024](#); [Wang T. et al., 2024](#); [Wang et al., 2025](#)), few have explored how media function within urban governance systems. Specifically, the ways in which Chinese media frame low-carbon transitions, encourage public participation, and influence policy making remain underexplored. To fill this gap, this study takes China as a case study and applies systems thinking and a transdisciplinary perspectives to analyse how media contribute to public engagement and low-carbon city transformation.

The theoretical framework of this study is grounded in frame analysis and agenda-setting theory. According to Goffman's frame analysis, individuals interpret social reality through frames influenced by shared cultural norms ([Rettie, 2004](#)). In climate communication, news framing and the way information is selected and presented, affects how the public understands problems, assigns responsibility, and evaluates solutions ([Wolters et al., 2022](#)). Most climate news content is framed episodically (focusing on specific events) or thematically (emphasizing broader issues), and frames may shift in response to ethical concerns, public discourse, or scientific and economic factors ([Swain, 2017](#); [Guenther et al., 2023](#)). In addition, Agenda-setting theory suggests that consistent and prominent media coverage can increase the perceived importance of specific issues among the public and policymakers ([Su and Li, 2021](#); [McCombs and Shaw, 1972](#)). However, public attention to environmental issues typically follows a five-stage cycle: pre-problem (initial expert awareness but less public attention), alarmed discovery and enthusiasm, realization of costs, declining public interest as new issues arise, and post-problem, when concern decreases but some institutions remain engaged ([Telleria, 2023](#)). This study aims to explore how media shape public discourse by exploring the reporting practices of journalists, their topic selection processes, and the varied impacts of different media types in China.

3 Methodology

3.1 Semi-structured interviews

Given the limited research on the media's role in low-carbon city transitions and the predominance of quantitative approaches in environmental communication studies, which often emphasize reporting practices and the dissemination of climate change data and policies ([Bergillos, 2021](#)), there is a need for a deeper exploration of media actors' perspectives. Low-carbon urban transformation is a complex and systemic process requiring coordination among multiple stakeholders. To capture this complexity, this study adopts a qualitative approach, using semi-structured interviews with journalists to examine how Chinese media frame and influence sustainable urban transformation. This method is particularly suitable for exploring complex social processes, offering the flexibility needed to generate rich, in-depth insights into participants' perceptions and professional practices ([Lim, 2025](#)).

Semi-structured interviews align closely with this study's research questions, which explore how and why media practitioners report on climate change and low-carbon transformation ([Bentalha and Alla, 2024](#)). Their open-ended format allows participants to share their perspectives and experiences in their own words, while allowing the

interviewer to probe emerging themes (Knott et al., 2022; Osborne and Grant-Smith, 2021). This flexibility facilitates a deeper understanding of journalistic routines, topic selection, and report impact in climate change. As qualitative semi-structured interviews typically involve small, information-rich samples and prioritize interpretive insight over statistical inference (Hamilton and Finley, 2019), this study does not aim to establish causal relationships or achieve statistical generalization. Instead, it seeks to identify the communication patterns and professional practices through which media contribute to urban sustainability transitions.

These insights are valuable for analyzing media framing and agenda-setting in climate communication, as well as understanding systems thinking and cross-sectoral synergy in low-carbon city transitions. Unlike quantitative approaches that primarily rely on statistical correlations (Dehalwar and Sharma, 2024), this qualitative design captures interpretive meanings, communicative practices, and contextual dynamics that are often overlooked in previous studies. In this way, it reflects the social construction of low-carbon narratives and the role of media in the urban transition system. In line with qualitative research guidance, offering detailed descriptions of research procedures can strengthen the credibility and validity of the findings (Johnson et al., 2020). Therefore, this study outlines the sampling strategy (Section 3.2), participant characteristics (Section 3.3), data collection (Section 3.4), and data analysis (Section 3.5). To further ensure methodological transparency, potential limitations are discussed in Section 5.

3.2 Sampling

This study employed purposive and snowball sampling methods within qualitative research to recruit journalists who had published or produced content related to climate, environmental, and low-carbon reporting in China.

Purposive sampling was first used because it effectively identifies participants who can offer rich, relevant insights aligned with the study's goals (Ahmad and Wilkins, 2024). This approach supports a deeper exploration of the research questions while ensuring a degree of diversity is maintained within the sample (Andrade, 2021; Magnone and Yeziarski, 2024). To capture the complexity of low-carbon city transformation, which is influenced by both national policies and local governance (Zhao et al., 2023; Holtz et al., 2018), we included journalists from national, provincial, prefecture, and county level media organizations. Recognizing that organizational structures influence journalists' work (Russo, 1998; Soloski, 1989), this multi-level sampling strategy enabled exploration of the differences in climate change reporting across various media types in China. Furthermore, this research mainly recruited journalists from traditional media outlets such as television, newspapers, official media websites, and magazines. In China, traditional media remains a relatively highly trusted source of information (Meng and Xie, 2024), and most of these outlets have integrated print content with online platforms, mobile applications, and social media channels like Weibo, WeChat, and video services (Wang and Sparks, 2020). Basing on these criteria, participants were identified through online media platforms (e.g., WeChat, Weibo, official websites) by reviewing previous climate, environmental, and low-carbon reports, and contacting potential participants through our personal media network. Between

August 1 and September 16, 2022, we conducted an initial set of seven online interviews via video and voice calls, due to participants' geographical dispersion and pandemic-related travel restrictions.

After the initial recruitment, we used snowball sampling to reach additional participants. This method is commonly applied in qualitative research to access hard-to-reach or hidden populations (Zickar and Keith, 2023). Within the Chinese media system, specialized climate and low-carbon reporters are not listed in public directories, and professional networks often rely on informal referrals. Snowball sampling, therefore, provided effective access to eligible participants and increased the diversity of perspectives captured in the study. Current participants referred colleagues from their networks, thereby broadening the sample. We followed data saturation guidance in qualitative research, continuing interviews until no new themes or insights emerged (Saunders et al., 2018). Rather than being predetermined by statistical power calculations, sample adequacy in qualitative research is assessed in relation to informational richness, redundancy, and conceptual breadth (Vasileiou et al., 2018). According to previous studies, data saturation in qualitative studies applying grounded theory is generally achieved after 20 to 30 interviews, depending on the scope and complexity of the research context (Moser and Korstjens, 2018; Mason, 2017). In this study, data collection and analysis were conducted in parallel through an iterative process. Following an initial round of seven interviews, an additional 24 online interviews were conducted between December 15, 2023, and March 15, 2024. In the later stages of analysis, newly collected data largely repeated previously identified findings, with no substantial new insights emerging. Additional interviews served to confirm rather than extend the analysis, indicating that data saturation had been reached (Hennink and Kaiser, 2022). In total, 31 interviews were conducted, and this sample size was deemed sufficient to ensure analytical depth and methodological rigor.

3.3 Participants

This study includes 31 Participants totally. They are from 23 media institutions, including mainstream state media (15 participants from 8 organizations), market commercial outlets (7 participants from 6 organizations), and local media (9 participants from 9 organizations) including provincial TV stations, daily newspapers, and county-level media centers. To protect participant anonymity, institutional names and regional identifiers have been omitted. Interviewees' views are their own and do not represent their organizations.

Participants have between 2 and 24 years of professional experience, with nearly half having worked in journalism for more than a decade. Approximately 77% have a master's degree, reflecting a relatively high educational level. They are from various media types, including newspapers ($n = 17$), websites ($n = 7$), television ($n = 5$), and journals ($n = 2$). Most participants published their work across multiple platforms, including print editions, online portals, mobile applications, and social media channels such as WeChat, Weibo, and short-form video platforms.

In terms of specialization, the sample includes environmental journalists ($n = 3$), investigative journalists ($n = 5$), international correspondents ($n = 2$), social affairs journalists ($n = 12$), financial journalists ($n = 3$), technology journalist ($n = 1$), meteorological science

correspondents ($n = 2$), and project managers engaged in climate-related public communication ($n = 3$). This diverse sample provides a robust empirical basis for examining how media actors contribute to climate discourse and public engagement in low-carbon city transitions in China. Table 1 provides an overview of the participants' demographic characteristics.

3.4 Data collection

Semi-structured interviews were employed in this study as the main method of data collection, allowing flexibility in question order and the emergence of follow-up questions during the conversation (Kallio et al., 2016; Naz et al., 2022). Before the interviews, invitation letters were sent to potential participants, outlining the study's aims, interview topics, privacy and

confidentiality measures, and the procedures for data collection. Upon receiving consent, interviews were scheduled. Each interview began with a brief overview of the study, clarification of the interview process, and a reminder of participant anonymity. Participants were invited to provide their views and experiences, acknowledging that their opinions reflected individual rather than organizational positions.

Interviews began with background questions (e.g., education, role, media experience) before moving on to open-ended questions (Appendix 1) aligned with the study's objectives. We piloted the questions during the first three interviews and made adjustments based on participant feedback. The order and depth of questions were adjusted to suit the participant's background and the conversation's flow. Each interview lasted between 30 min and 2 h, depending on the depth of participant responses. With participants' consent, interviews were recorded using mobile phones. Important information was also noted during the interviews.

This study received ethical approval from the authors' institutional review board. To protect participant anonymity, all transcripts used numerical identifiers instead of names.

Although interviews offer in-depth insights into participants' experiences and perspectives, online information can serve as a valuable supplementary reference (Onwuegbuzie et al., 2010). To better understand our research questions and contextual background, we conducted keyword-based searches of previously published news reports on climate change, environmental issues, and the low-carbon transition. These materials were not treated as primary data for formal analysis; instead, they served as contextual references that supported the interpretation of interview narratives and helped validate participants' responses. By situating participants' accounts within the broader media landscape, this strategy enhanced the robustness of our qualitative findings.

3.5 Data analysis

All interviews were digitally recorded and fully transcribed into text. Following an inductive approach (Thomas, 2006) and grounded theory methodology (Corbin and Strauss, 2014), data collection and analysis proceeded simultaneously and iteratively (Ahmad and Wilkins, 2024) until data saturation was achieved (Hennink et al., 2017). After each interview, data were promptly organized and analyzed using Atlas.ti 22.2.0. All transcripts were reviewed twice to ensure data accuracy. Figure 1 shows the data analysis process of this study. The coding procedure followed three key phases in line with grounded theory:

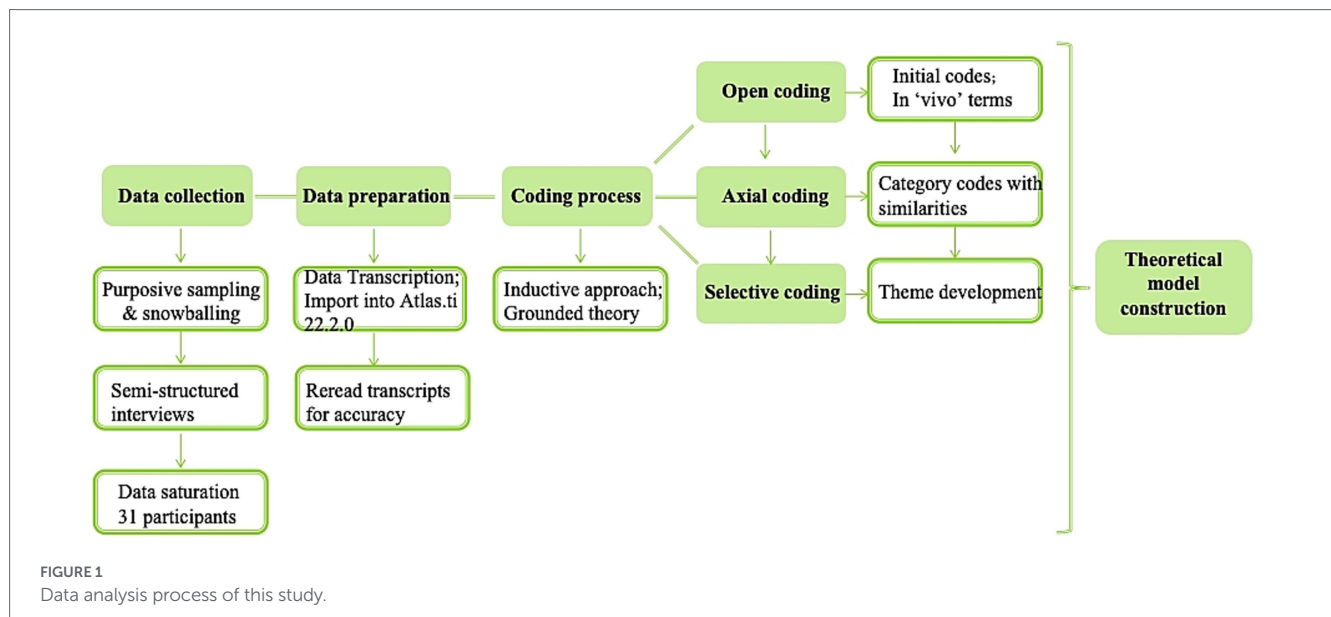
Open coding: Using an inductive strategy (Klauer and Phye, 2008), we examined transcripts line-by-line to generate preliminary codes, drawing on participants' own words ('*in vivo*' terms) (Bringer et al., 2006; Kuckartz, 2014). We extracted significant quotes and fragments, refining and merging codes as needed to avoid duplication (Gao et al., 2024).

Axial coding: We then grouped conceptually similar open codes into categories by identifying connections and relationships between them (Scott, 2004). These categories were reviewed, combined, or split further based on textual patterns and commonalities (Gasson and Waters, 2013).

Selective coding: Finally, we integrated the developed categories into broader themes aligned with our research questions (Mohajan and Mohajan, 2022). These themes included: (1) Media content and

TABLE 1 Summary of participants' demographic characteristics.

| Type | Details | | Frequency |
|--------------------------|---|----------------------------|-----------|
| Total participants | | | 31 |
| Gender | Female | | 16 |
| | Male | | 15 |
| Years of experience | 2–5 years | | 6 |
| | 6–10 years | | 12 |
| | 11–15 years | | 7 |
| | 16–20 years | | 3 |
| | 21–25 years | | 3 |
| Education level | Bachelor degree | | 7 |
| | Master degree | | 24 |
| Media affiliation | Mainstream state media | | 15 |
| | Market commercial media | | 7 |
| | Local media | Provincial TV station | 3 |
| | | Daily newspapers | 5 |
| | | Country level media centre | 1 |
| Media type | Newspapers | | 17 |
| | Websites | | 7 |
| | Television | | 5 |
| | Magazines | | 2 |
| Reporting specialization | Social affairs | | 12 |
| | Investigative journalism | | 5 |
| | Environmental journalism | | 3 |
| | Financial journalism | | 3 |
| | International reporting | | 2 |
| | Meteorological science communication | | 2 |
| | Technology reporting | | 1 |
| | Climate-related project management and public communication | | 3 |



framing in low-carbon (2) Reporting differences across media types and platforms (3) The role of media in low-carbon city transition.

To ensure analytic rigor, reflexive memo-writing was conducted throughout the analysis to minimize interpretive bias (Al-Eisawi, 2022). In addition, we conducted respondent validation by inviting participant feedback (Torrance, 2012). A peer researcher also reviewed the analysis to enhance validity and credibility (Birt et al., 2016). Finally, we thoroughly reviewed all documents, verified coding and categorization, extracted key information, and translated the content into English. The final analysis produced 94 codes, organized into 12 categories and three overarching themes (Figure 2).

4 Results

4.1 Media report contents in low-carbon

Media attention to climate change and low-carbon topics has grown since China introduced its 'dual carbon' goals of peaking CO₂ emissions by 2030 and reaching carbon neutrality by 2060. According to participants' experience and insights, the related coverage mainly focuses on the following areas:

4.1.1 Climate and environment

When reporting on climate and environmental issues, journalists tend to focus on phenomena such as glacier melt, habitat destruction, biodiversity loss, rising sea levels, floods, droughts, tornadoes, typhoons, heatwaves, wildfires, water pollution, and smog. Mass media commonly present these stories through visuals of extreme weather, info graphics, and expert interviews, disseminated via television, online platforms, and social media. Participants noted that such coverage often emphasizes the severity of these phenomena, while offering limited in-depth analysis of their scientific causes or potential solutions. This limitation is primarily due to the complexity of climate science, which requires expertise in meteorology, environmental

science, and data interpretation, skills that many journalists currently lack.

4.1.2 Policy and governance

In the area of low-carbon policies and urban governance, media coverage includes topics such as the 'dual carbon' goals related policies, carbon neutrality, subsidies, plastic restriction, smart cities, sponge cities, green parks, environmental supervision, desertification governance, controlling cyanobacterial blooms, hydropower development, and Yangtze River protection. These reports often highlight the background, objectives, and outcomes of policies, showcasing local governance transformation cases. Journalists often rely on official press releases or government briefings as primary sources to communicate high-level policy information to the public. However, participants noted that such coverage tends to overlook specific policy impacts, implementation challenges, and mechanisms for public engagement.

4.1.3 Social news and events

Media coverage of social news and major events related to climate change mainly focuses on the impacts of extreme weather, disaster recovery, vulnerable groups, industrial pollution and emissions, environmental information disclosure behavior, green washing, art performance, NGO activities, environmental public interest litigation, and climate change conferences. These reports are often timely, presented through special reports, event tracking, and in-depth interviews. After extreme weather events, public attention typically surges briefly, as these issues closely affect people's daily lives and often evoke emotional resonance. Participants believe that some media coverage of these topics is fragmented, overly driven by popularity and clicks, and lacks in-depth investigation. Moreover, due to information gaps and online misinformation, some people hold misunderstandings about low-carbon and climate change. Participants emphasize that media transparency and open information disclosure are crucial for building social trust.

| Themes | Categories | Codes |
|-------------------|-----------------------------------|--|
| Report contents | Climate and environment | Glacier melt, habitat destruction, biodiversity loss, rising sea levels, floods, droughts, tornadoes, typhoons, heatwaves, wildfires, water pollution, and smog |
| | Policy and governance | Dual carbon policy, carbon neutrality, subsidies, plastic restriction, smart cities, sponge cities, green parks, environmental supervision, desertification governance, controlling cyanobacterial blooms, hydro power development, and Yangtze River protection |
| | Social news and events | Impacts of extreme weather, disaster recovery, vulnerable groups, industrial pollution and emissions, environmental information disclosure behaviour, green washing, art performance, NGO activities, environmental public interest litigation, and climate change conferences |
| | Economy and industrial transition | Electric vehicles, low-carbon buildings, energy transition, climate finance, carbon finance, carbon credits, youth entrepreneurship, carbon-neutral factory, and ESG |
| | Culture and education | Expert lectures, youth environmental activities, community initiatives, and popular science education |
| | Health and lifestyle | Health risks of climate change, mental health impacts, low-carbon transportation, low-carbon diets, reuse and recycling, waste sorting, shared bicycles, low-carbon tourism, and carbon-neutral wedding |
| Report difference | Type of media institutions | Mainstream state media, market commercial media, local media |
| | Media platforms | Newspaper, television, websites |
| Media's roles | Information dissemination | Scientific knowledge, policies and regulations, uncertainty communication, interpretations of weather and climate, environmental and health risks, societal events, new technology and products |
| | Impacts on awareness and behavior | Understanding of climate risks, health awareness, civic responsibility, environmental values, behavioral changes in individuals and groups, energy conservation, environmental protection initiatives |
| | Facilitating social communication | Bridge connecting stakeholders, platforms for dialogue, storytelling, challenge sharing, explaining composite issues, emotional resonance, provides cases as references, industry impact, youth education, culture promotion, public engagement, transparency and accountability, social trust |
| | Mitigating negative impacts | Climate anxiety, climate news avoidance, misinformation, disinformation, keep media ethical standards |

FIGURE 2
The structure of categories and codes.

4.1.4 Economy and industrial transition

In the context of low-carbon economic and industrial transformation, media coverage focuses on topics such as electric vehicles, low-carbon buildings, energy transition, climate finance, carbon finance, carbon credits, youth entrepreneurship, carbon-neutral factory, and

ESG (Environmental, Social, and Governance). Most related coverage by mainstream financial media, normally framed around policy guidance, corporate case studies, or technological innovation. These reports require journalists to have strong knowledge of finance and industry. The information is normally used as a reference within the industry, while public engagement remains limited. Participants

believe that although more companies are exploring low-carbon transitions, there is still a need for more professional reporting that explains how to implement these changes.

4.1.5 Culture and education

Media coverage of climate change and low-carbon topics in cultural and educational contexts mainly features expert lectures, youth environmental activities, community initiatives, and popular science education. Some reports show experts' insights or suggestions, community swap event, or student visits to low-carbon enterprises. Although these reports are less frequent than those on low-carbon policies or climate disasters, they more effectively engage young people to raise low-carbon awareness and change behavior. According to participants, media should improve the appeal and interactivity of such coverage, using innovative formats to increase youth participation in climate action.

4.1.6 Health and lifestyle

Media coverage on health and lifestyle includes topics such as the health risks of climate change, mental health impacts, low-carbon transportation, low-carbon diets, reuse and recycling, waste sorting, shared bicycles, low-carbon tourism, and carbon-neutral weddings. Some reports highlight practical ways to adopt a low-carbon lifestyle, such as cycling, reducing packaging waste, and minimizing food waste. Others focus on the health effects of heatwaves and air pollution, like their impact on respiratory and mental health. Participants believe that such reports are generally more relatable to the public's daily life and easier to understand, contributing to improving low-carbon awareness.

Example quotes from participants are presented in Table 2, which illustrates the types of media report content related to low-carbon topics, categorized into climate and environment, policy and governance, social news and events, economy and industrial transition, culture and education, as well as health and lifestyle.

4.2 Reporting differences

4.2.1 Type of media institutions

Chinese mainstream media exhibit variations in discourse, thematic focus, and reporting practices due to differences in media positioning, scientific literacy, and audience profiles. According to participants, mainstream state media primarily focus on the promotion of national low-carbon policies, international climate cooperation, local governance in low-carbon transitions, science communication, and expert commentary. Their coverage tends to be broad, focusing on national-level narratives. Some state media also conduct in-depth investigations into environmental pollution, which can have significant policy influence. These outlets are highly trusted and benefit from strong institutional backing and platform resources. Market commercial media tend to focus more on low-carbon transition outcomes and specific industry information, such as carbon markets or energy transition. Compared to state media, they generally have greater flexibility and freedom in conducting in-depth reporting. Local media (including provincial TV stations, daily newspapers, and county-level media centers) focus more on regional economic development, residents' daily lives, local technological innovations, and government subsidies

TABLE 2 Example quotes from participants about media report content in low-carbon.

| Categories | Example of quotes |
|-----------------------------------|---|
| Climate and environment | Effective climate communication demands cross-disciplinary knowledge. Journalists need both a foundational knowledge and the ability to explain complex issues clearly. However, there is currently a shortage of climate journalists with these skills. P17 |
| Policy and governance | Policies need to be adapted to local contexts, and the low-carbon transition should consider social equity and inclusiveness in the process, not just outcomes. The media should focus more on the challenges encountered during the transition, rather than relying too heavily on official press releases or briefings. P25 |
| Social news and events | In terms of flooding, while some media report on the meteorological aspects, others also focus on the broader societal impacts, such as disaster conditions, post-disaster reconstruction, residents' self-rescue efforts, support from various sectors, and effects on agriculture. P7 The lifespan of these hot topics, from initial media exposure to peak coverage, typically lasts only about 5 days before public interest begins to fade. P15 |
| Economy and industrial transition | Public interest in electric vehicles is often driven more by government subsidies than by technological breakthroughs. However, technical innovation news is valuable references for professionals and industry stakeholders in tracking progress and shaping strategies. P13 |
| Culture and education | The media has a responsibility to focus on young people's low-carbon education, with videos and animations being especially effective in engaging them. P8 |
| Health and lifestyle | Climate change coverage should emphasize its direct impact on daily life, such as travel, lifestyle, health, and economic benefits, to better raise public awareness. P2 |

or policies that directly impact the community. They possess a deeper understanding of local contexts, particularly local culture and the challenges enterprises face in the low-carbon transition.

4.2.2 Media platforms

Traditional Chinese media, including TV, newspapers, and news websites, have gradually shifted toward an integrated model combining print, online platforms, mobile apps, and official social media accounts like Weibo and WeChat, driven by the growth of the internet and digital media. Most news content from mainstream outlets is now published simultaneously across multiple channels, rather than through a single medium. However, in climate communication and low-carbon topics reporting, different traditional media platforms have their characteristics. Newspapers are valued for their high credibility and rigor, often delivering key social events, policy interpretations, and high-quality content within limited space and periodic

publication. However, their capacity to respond promptly to sudden extreme weather events remains limited.

Television, with its strength in visual storytelling, excels at presenting weather phenomena, low-carbon public service messages, and climate change documentaries, combining visuals with trustworthiness. Recently, TV outlets have been exploring technological innovations in climate reporting by incorporating virtual studios and scenes, making news reports more vivid and enhancing public engagement.

Website platforms often combine images, posters, hand-drawn illustrations, H5 (HTML5 interactive content), animations, and videos to suit the fast-paced, fragmented nature of internet environment. They are effective in responding to environmental emergencies and promoting low-carbon awareness. Among these formats, video and animation stand out for public low-carbon education due to its intuitive and engaging style. Participants believe that timely release, appealing formats, and scientifically accurate content are key to capturing public attention.

Table 3 presents example quotes from participants on reporting differences, organized by type of media institutions and media platforms.

4.3 The role of media in low-carbon city transition

4.3.1 Information dissemination

In the process of the low-carbon transition, the media plays a vital role in informing the public about climate change and low-carbon developments. Its coverage spans scientific knowledge, policies and regulations, interpretations of the uncertainties posed by climate change, and reports on environmental and health risks. These information helps the public build a foundational understanding of complex climate issues. At the same time, the media provides timely updates during major societal events and disseminates information about low-carbon technologies and new products, thereby supporting the shift toward greener lifestyles.

4.3.2 Impacts on low-carbon awareness and behavior

Media coverage of climate change and the low-carbon transition not only raises public awareness but also influences individual behavior. As reporting on these topics grows, it increases understanding of climate risks, health, education, and civic responsibility. By embedding environmental and low-carbon beliefs into climate communication, media help shape societal norms around sustainability. Encouraging positive behavioral change at the individual level often creates a ripple effect, inspiring broader community participation. For example, consistent media advocacy for energy conservation and minimalist lifestyles can guide people to reduce carbon emissions in daily life. This further supports grassroots initiatives and community-level engagement. However, some participants believe that due to the cyclical nature of news, the behavioral impact is often short-term. Long-lasting change requires sustained media attention and coordinated efforts among stakeholders.

4.3.3 Facilitating social communication

Low-carbon city transformation is a complex, systemic process requiring coordination across sectors and governance levels. Participants believe that the media serve as a communication bridge

TABLE 3 Selected participant quotes on reporting differences.

| Categories | Example of quotes |
|----------------------------|--|
| Type of media institutions | When reporting on energy transition, state media may begin by analyzing a region's shift in energy structure, then expand to broader industry trends, interpreting them through the lens of national policy. Market-oriented outlets, such as financial media, concentrate more on low-carbon technologies and industrial low-carbon transformation trends. Local media tend to focus on specific topics, local public opinion, and the direct impact of these changes on the local economy and residents' daily lives. P27 |
| Media platforms | Newspaper: As text-based media, newspapers often rely on official websites, apps, and social media to supplement extreme weather coverage. These digital platforms enable faster updates and enrich content with photos and videos. P1 Television: TV has a unique advantage in producing and sharing short videos. For example, a typhoon news segment that incorporated Unreal Engine technology featured a host seemingly standing on a stormy street, with her umbrella being blown away. P4 Website: I once produced a low-carbon science animation that was released on March 23rd, World Meteorological Day, and it received over 50,000 views on its first day. Animation is an effective tool for explaining scientific concepts, such as the causes and process of a mudslide, which is easier for the public to understand. P30 |

connecting government, individuals, businesses, and other stakeholders to promote understanding and collaboration. First, the media provide platforms for dialog, public discussion, and engagement. By storytelling that show individual experiences, challenges, and coping strategies during the low-carbon transition, they translate complex social and environmental issues into accessible language, enhancing public understanding and emotional connection. Second, media coverage of low-carbon industries provides useful case references for business and government decisions, but may also unintentionally influence carbon markets, stock prices, and youth career choices. Third, through youth climate education, low-carbon culture promotion, and coverage of local governance, the media expand public involvement and help build broader networks for social action. Lastly, by emphasizing transparency and accountability in implementation and highlighting the experiences of vulnerable groups, the media support dynamic policy adjustments, build social trust, and foster a more inclusive, resilient low-carbon city transformation.

4.3.4 Mitigating negative impacts

While media is essential in promoting low-carbon city transitions, participants note that media communication also need to consider its potential negative impacts. Excessive climate-related content could lead to "climate anxiety," causing emotional distress and a sense of helplessness that may diminish public willingness to act. Similarly, constant exposure to negative news may cause "climate news avoidance," limiting public engagement and awareness. Online misinformation and

disinformation further obscure understanding, disrupt policy efforts, and erode trust in climate science. Moreover, algorithm-driven content filters can create information gaps, preventing timely and key messages from reaching target audiences. To address these challenges, media need to improve reporting quality, ensure accuracy, and keep media ethical standards to avoid amplifying fear or misleading.

Table 4 provides selected participant quotes on the media's roles in low-carbon city transitions, categorized into information dissemination, impacts on low-carbon awareness and behavior, facilitating social communication, and mitigating negative impacts.

5 Discussion

Combining transdisciplinary perspectives with systems thinking, this study employs semi-structured interviews within a qualitative framework to analyze media content, compare reporting differences across media types, and examine the role of media in China's low-carbon city transformation. Beyond identifying current patterns, the findings also suggest ways to strengthen media communication in advancing low-carbon transitions. Figure 3 shows the theoretical model mapping the links between media content, reporting variations, and the media's functions in this process. The sections that follow unpack three main insights from the analysis results.

First, based on our sample, this study finds that diverse media coverage of climate change and low-carbon issues helps raise public awareness, but is constrained by a lack of in-depth report and professional scientific interpretation. Spanning six thematic areas, we observe that climate, social, and health/lifestyle reporting predominantly use episodic frames to highlight specific events, aiming to raise risk awareness and prompt behavioral or policy responses. In contrast, policy, economic, and cultural/education reporting tends to adopt thematic frames that place developments in broader contexts, aiming to enhance policy transparency, foster technological innovation, and promote sustainable development. Together, these strands of coverage form a communication ecosystem that supports low-carbon city transformation. Previous research suggest that the influence of episodic versus thematic frames on attitudes varies with public emotional intensity: thematic frames are more persuasive when emotions are mild, whereas strong emotional arousal tends to amplify the impact of episodic frames (Aarøe, 2011). However, climate and low-carbon reporting remains limited in professional depth due to a shortage of trained climate journalists and an over reliance on official press releases as primary sources. As a result, some coverage lacks a scientific explanation of complex phenomena and overlooks the challenges stakeholders face in policy implementation (Kamboh et al., 2024). Enhancing interdisciplinary climate journalism training and supporting in-depth investigative reporting can improve coverage quality and increase social impact (National Academies of Sciences, Medicine, Committee on the Science of Science Communication and A Research Agenda, 2017; Tong, 2011). This will help promote an equitable transition and build social trust, which are important for sustainable low-carbon cities.

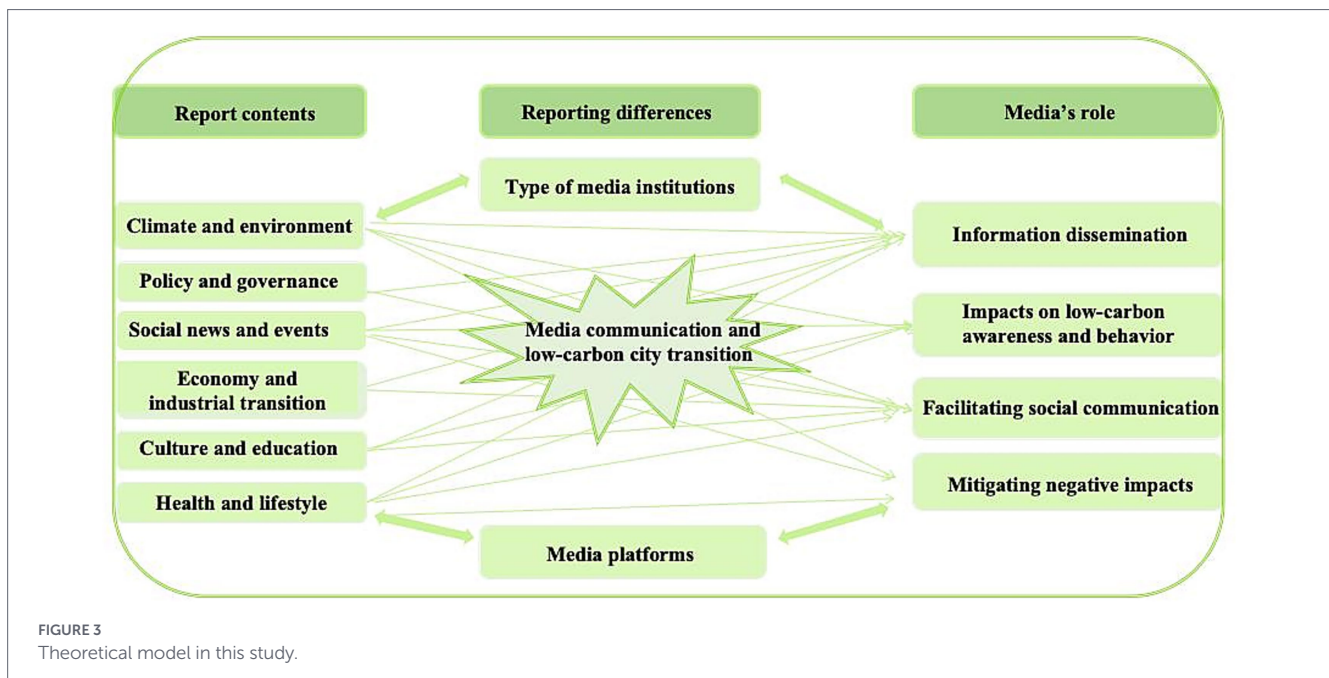
Secondly, differences in media types and platform formats shape both the focus of climate and low-carbon coverage and how audiences are engaged. Video and animation formats are particularly effective at attracting public attention, while in-depth written reports (especially from state media) tend to have greater influence on policy making and driving industry transformation. In China, state media prioritize national

TABLE 4 Example quotes from participants about media's roles in low-carbon city transition.

| Categories | Example of quotes |
|--|--|
| Information dissemination | Climate change and low-carbon reporting should integrate climate topics with areas like health, sports, entertainment, and agriculture. Some audiences perceive climate change as distant or irrelevant to their lives; therefore, linking scientific knowledge to everyday experiences is essential to make the issue more relatable and engaging. P28 |
| Impacts on low-carbon awareness and behavior | The shift toward low-carbon actions is a gradual process, more people are choosing new energy vehicles and shared bicycles. Individual choices often influence family, friends, and colleagues. It is important for media to consider how to encourage the public to maintain a long-term low-carbon lifestyle. P16 |
| Facilitating social communication | Cities are shaped not only by policies and businesses, but also by residents' values and choices. Media plays a key role in sharing climate information and exchange ideas. Effective communication is crucial for driving low-carbon transitions in high-emission sectors like real estate, aviation, and coal mining. To support climate action, media should also embrace cultural diversity and advocate for vulnerable communities. P18 |
| Mitigating negative impacts | Climate news often emphasizes broad, policy-oriented topics, and some topics are highly scientific and technical. Some individuals may perceive such information as disconnected from their daily life. As a result, they view climate issues or low-carbon transition as the responsibility of government or scientists, rather than a personal concern. P5 |

strategies and policy guidance, market commercial outlets emphasize industry and technological developments, and local media concentrate on local transitions, community practices, and daily life. Although traditional Chinese media content is widely repurposed across online and social platforms, each medium retains distinct characteristics in climate communication: newspapers provide credibility and analytical depth but lack timeliness; television uses visual storytelling and emerging technologies such as virtual studios to make reporting more vivid; and online news websites combine multimedia formats to respond quickly to environmental events and promote low-carbon awareness. These traits influence both the accessibility of information and the level of public participation (Gudowsky and Bechtold, 2013; Painter et al., 2024). Using advanced technologies in science communication can enhance the dissemination, understanding, and acceptance of complex research findings among different audiences (Jeyaraman et al., 2025). This study highlights that, across all platforms, ensuring truthfulness, accuracy, timeliness, and a commitment to the public interest is essential for strengthening urban adaptability and resilience in the face of climate change.

Third, in the transformation toward low-carbon cities, the media function as a vital social communication bridge connecting diverse stakeholders. Their role goes beyond disseminating information to



shaping low-carbon awareness and behavior, as well as facilitating dialog among government, businesses, NGOs, and the public. Most information on low-carbon policies, climate science, and related societal events is conveyed through media channels, helping the public to follow societal developments and gain a basic understanding of complex climate issues. Such information can strengthen environmental beliefs and, in line with the Theory of Planned Behavior (Ajzen, 1991), foster pro-environmental intentions and actions. The media also provide platforms for social dialog (Pattyn, 2000). Through storytelling that captures lived experiences and the challenges of transition, they can evoke emotional resonance, advance climate education, and cultivate a low-carbon culture. These narratives further provide reference cases for business strategies and government policy making. Sustained coverage, consistent with Agenda-Setting Theory (McCombs and Shaw, 1972), can influence not only what the public thinks about, but also the policy priority accorded to these issues. However, the media must also recognize potential risks in climate communication, such as climate anxiety, climate news avoidance, online misinformation, and algorithm-driven information gaps. These challenges can undermine public trust in climate science and reduce engagement in climate action (Damstra et al., 2023; Leiserowitz et al., 2013). To mitigate these, media should strengthen cross-cultural communication to adapt messages for diverse audiences (Aririguzoh, 2022), while upholding journalistic ethics to foster inclusive and equitable low-carbon city transitions.

Contributions

This study makes three major contributions. First, it addresses a research gap in the literature by enriching case-based research on climate change and low-carbon urban transformation in China. While existing scholarship has largely focused on climate journalism in the United States, the United Kingdom, and Europe, China remains comparatively under examined (Schäfer and Painter, 2021). By analyzing the role of media in China's low-carbon city transition, this study provides a detailed analysis of low-carbon coverage and assesses both the contributions and challenges of media engagement in this process.

Second, from a theoretical standpoint, the research moves beyond single-disciplinary approaches to low-carbon urban transformation or climate communication. It integrates transdisciplinary perspectives and systems thinking to investigate how media communication influences stakeholder actions and fosters collaboration during urban transitions. This framework provides a new insights for future studies on low-carbon city transformation and climate communication.

Third, from a practical perspective, the study draws on interviews with experienced journalists to review past media coverage, examine distinctions across platforms, and synthesize lessons learned. These insights offer actionable guidance for improving climate reporting quality, supporting climate journalists in their professional practice.

Limitations and future research

While this study offers theoretical and practical contributions to understanding the role of media in China's low-carbon city transition, several limitations should be acknowledged, which we suggest directions for future research.

First, the case analysis is limited to China. As environmental policies and media systems vary across countries, the findings primarily reflect the Chinese context in terms of media content, platform, and the role of media in low-carbon transition. Therefore, some conclusions may not be directly transferable to other national contexts. Future research could undertake cross-country comparisons to explore differences in climate change reporting and examine how the report influence public awareness and behavior in different countries.

Second, this research is based on interviews with 31 highly educated journalists, nearly half of whom have more than a decade of professional experience. This profile provided rich insights and in-depth perspectives, but the sample primarily consists of journalists from traditional media outlets. Therefore, the findings are based on this study's sample; this research may not fully represent Chinese media coverage on the low-carbon transition. The views expressed by

interviewees represent their personal perspectives rather than the positions of their respective organizations. Future studies could employ a mixed-methods design, integrating qualitative and quantitative analyses. For example, large-scale quantitative analysis could examine the relationship between media coverage and carbon emission reductions or behavioral change, systematically map patterns of media coverage related to low-carbon transitions, and assess differences across media platforms, cities, and governance contexts.

6 Conclusion

Low-carbon city transformation is a complex, dynamic process requiring collaboration across sectors, regions, and stakeholders. Within this process, the media act as a crucial communication bridge, connecting government, the public, and other stakeholders. This study uses in-depth semi-structured interviews, combined with systems thinking and transdisciplinary perspectives, to analyze media content, identify differences across media types and platforms, and explore the multifaceted roles of the media in China's low-carbon city transition.

Based on our samples, our findings show that while diverse media coverage on climate change and low-carbon topics helps raise public awareness, its professional depth is limited by a shortage of trained climate journalists and over reliance on official press releases. Reporting covers six main themes: climate and environment, policy and governance, social events, economic and industrial transformation, culture and education, and health and lifestyle. However, most reports lack scientific interpretation of complex phenomena and overlook practical challenges in policy implementation. In addition, media type and platform format also influence audience engagement: visual formats such as video and animation effectively capture attention, while in-depth written reports, particularly from state media, have greater influence on policy-making and industrial transformation. Beyond informing the public, the media facilitate dialog and understanding among government, businesses, NGOs, and citizens, promoting collaborative action in low-carbon transitions. At the same time, they face challenges such as climate anxiety, climate news avoidance, misinformation, and algorithm-driven information gaps, which can erode trust and reduce engagement. Addressing these issues requires improving journalists' scientific literacy, diversifying information sources, enhancing cross-sector collaboration, and adopting innovative storytelling techniques.

This study highlights the media's crucial role in raising awareness, impacting behavior, and connecting stakeholders, deepening people's understanding of communication in low-carbon city transitions. Its insights can help policy makers make better decisions and guide media professionals in improving climate coverage. The contributions foster more effective, inclusive, and science-based communication strategies to accelerate progress toward carbon neutrality and sustainable urban futures.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Faculty Niet-WMO Verplicht Research Ethics Committee, Maastricht University. Reference Number: FHML-REC/2023/090 (Approval date: October 23, 2023). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

YW: Formal analysis, Data curation, Methodology, Conceptualization, Writing – original draft, Investigation. PM: Supervision, Writing – review & editing, Methodology, Conceptualization. TK: Writing – review & editing, Methodology, Conceptualization, Supervision.

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Appendix 1

Interview invitation letter

Dear Sir/Madam,

This is to invite you to be our interview participants in the research titled: Public Awareness of low-carbon city Transformation in China.

I'm Yan Wu, a PhD candidate from Maastricht University, focusing on climate change, sustainability, and low-carbon city transition, supervised by Prof. Dr. Pim Martens and Prof. Dr. Thomas Krafft. I am funded by the China Scholarship Council (CSC) with grant No. 202008320395.

Coping with global climate change requires collective action. To achieve a low-carbon future, we would like to explore public low-carbon awareness on low-carbon city transformation. This interview is only for research purposes and will not be used for commercial activities. Your responses reflect your personal views and will remain anonymous.

Many thanks for your participation.

Interview questions

1. Current role in your organization. Please describe previous experience in low-carbon reporting.
2. Could you describe your understanding of a low-carbon lifestyle and climate change?
3. What are your views on the shift toward a low-carbon lifestyle and the transformation to low-carbon cities?
4. What are your thoughts on the gap between public low-carbon awareness and behavior?
5. What factors do you think that affect people's low-carbon awareness?
6. How do you select low-carbon or climate change news topics and interact with sources?
7. What factors influence media attention to and reporting on climate change?
8. What are the reporting differences between different platforms and media institutions?
9. What is your opinion on the application of technology in climate communication?
10. What is the media's role in climate communication and low-carbon city transformation?