Article

The Evolution of Climate Change Reporting in Business Media: Longitudinal Analysis of a Business Newspaper

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Abstract: The agenda-setting and attitude-forming role of media has been proven and endorsed over time. Media has played an instrumental role in the way the issue of climate change is perceived by various stakeholders in society. Although studies on media coverage of climate issues have been gaining prominence in recent years, there is a gap when we consider the Global South. Moreover, although the business sector is a critical stakeholder in climate change policy and action, studies that focus on how business media projects and highlights climate change are relatively sparse. This vacuum is even more pronounced in developing countries. This research is an attempt to address this gap. We have conducted a longitudinal analysis of climate change reporting in a leading Indian business newspaper, using automated content analysis. Results provide us with valuable insights about how climate frames and climate themes have evolved over time in business media. Our findings suggest that while climate cooperation is a prominent topic in business media, however, it has been declining in recent years. On the other hand, the share of domestic news covering sector specific issues is increasing, mirroring India's change in stance. The insights derived will help in building consensus across stakeholders involving business decision-makers, media houses, policy makers, and civil society.

1. Introduction

According to the International Panel on Climate Change (IPCC), climate threats to society are expected to increasingly occur through extreme weather events impacting agriculture, health, infrastructure, and human security. As the third-largest emitter and with high climate vulnerability [1], India is a critical stakeholder in the global debate on climate action.

Although India is contributing to global climate goals, it is yet to achieve the policy traction required for meeting the Paris Agreement's long-term target of limiting temperature increase to 1.5 degrees [2]. More robust policy measures on phasing out coal, phasing in renewables, and promoting energy efficiency across industries and food production are considered relevant for India's low-carbon growth trajectory [3–5]. However, as a democracy addressing multiple developmental priorities, mainstreaming climate action and low-carbon growth development requires more robust citizen engagement and support. The argument for stronger public concentration is further reinforced by the Sustainable Development Goal 13, which explicitly calls for improving public understanding and awareness of climate change issues to promote collective action. In this context, the role of media, especially news media, as a narrator and shaper of public and policy discourse becomes pertinent.

Media has always been a potent medium for impacting public opinion and shaping attitudes toward significant societal issues. Several studies have established links

between media coverage and the evolution of climate change as a salient issue in the public mind [6,7]. Media influences public concern mainly by contributing to the perceived personal experience of climate change [8]. Although most of these studies are based on the West, studies which link media use and climate perceptions in the Indian context remain sparse.

India enjoys a well-developed press system and increasing trends in readership, supported by improved literacy rates. Digital disruption has had a tremendous impact on traditional, and even legacy media houses, in developed countries, with the newspaper sector in the United States witnessing a precipitous loss of 40% in the 2000s [9]. There is a trend of pluralization of material as social media and online platforms have witnessed explosive growth, with consumers becoming content creators, encapsulating diverse opinions [10]. Print circulation also declined in the emerging economies of Africa, the Middle East, and Latin America between 2011 and 2016 [9]; however, circulation trends in Asia has been countering the global scenario. Readership of newspapers increased by 40% in Asia, led by India and China (WAN-IFRA, 2017). Although China has a dominant state presence throughout its news media, it is surprising that India, where state-owned media is not as prominent, has more than 90,000 print media titles, while the number of privately held television news channels has expanded from 30 in 2006 to more than 100 in 2017 [11]. Having said that, there is a growing tendency in developing countries, including India, for consumers to access news on social media and online platforms [12,13]. Nevertheless, print media and newspapers in India have retained their prominent role of agenda setting and policy framing. Moreover, Thaker et al. (2017) also suggest that traditional media such as newspapers and television tend to be positively associated with climate change risk perceptions and policy support, in contrast with the new digital media which has weak links [14].

Despite the buoyant outlook for news readership, results from the empirical literature on climate change awareness are not so optimistic. Survey studies have established that understanding and awareness of climate change among the Indian public remains low [15–17].

Despite the evident knowledge gap, research on media coverage of climate change in poor and developing countries such as India remains grossly under researched. The existing literature focuses on English print media, mainly in the U.S., U.K., and Europe, catering to the general public [18–20]. Alternative segments within the print media, such as business and vernacular newspapers in non-English speaking countries, have received scant attention.

Business news merits exclusive investigation among these two categories because its audience may have a higher stake in the larger climate action narrative. For example, a recent report by the carbon majors project has found that the top 100 carbon-intensive industries contribute 62% of global emissions [21]. These top 100 companies are concentrated around private- and public sector-owned oil, gas, coal, and cement producers [22]. Beyond the top 100, sector-wise emissions, notably from industry, buildings, and transportation, contribute significantly to global emissions.

Business is one of the primary stakeholders in climate change policy. Historically, there have been several efforts to build consensus among business stakeholders and decision makers through global institutions such as the U.N., The World Business Council for Sustainable Development, and, more recently, the task force on Climate-Related Financial Disclosures. Although there is a shift in business organizations' position toward the climate change reality, transformative action has been elusive, barring a few notable exceptions. Multiple factors, such as individual and interpersonal characteristics and institutional and collective society, could affect the positions of business leaders and decision-makers in climate change. News media, especially business news media, can still influence individual factors such as the awareness and knowledge of climate science, risk perceptions, and the normative thinking around climate change [23].

Despite the potential role of the business media agenda-setting medium [24], the topic has received very little interest in the literature. Research gaps in the literature can be summarized along three major threads. First, is the significant skew in the research volume based on the G8 countries and the Global North. Studies that focus on the Global South are meager [25] despite the higher vulnerability of these regions to climate risks [26].

Second, are the shortcomings among the existing studies in the Indian context. Thaker (2017) provides a comprehensive overview of the few studies in the Indian context on media coverage of climate change [14]. Most of these studies suffer from shortcomings such as being restricted to relatively short periods and particular events [27,28] and often focus more on quantifying and estimating climate news coverage than analyzing content [29,30], or have analyzed news coverage based on predetermined frames [27,28,31]. In the Indian context, many studies have focused on the late 1990s to mid-2000s with 'climate justice' as the frame for analysis [25]. Furthermore, research on Indian media attention on climate change is confined to the analysis of *The Times of India* (TOI), *The Hindu*, and *Indian Express* [14,18,19,27]. The readership of these dailies does not represent the broad diversity of news consumers in India.

The third is the limited research volume on climate change issues covered by business newspapers as a distinct category. The few articles investigating climate change-related issues in business news do so indirectly by subsuming climate change within the construct of corporate social responsibility [32,33]. Direct investigations on climate change coverage, including the science and its uncertainty, are confined to leading newspapers such as *The Wall Street Journal* or the *Financial Times* [34,35]. In India, although Jogesh (2012) considers business newspapers, she consolidates them as part of a larger corpus that also includes English national dailies, thus overlooking distinctive patterns that may have emerged within business news content [27]. In the background of these research gaps, our work focuses on climate change news coverage by business newspapers as a category in the Indian context and explores the following research questions.

1. What has been the trend in climate coverage in the Indian business media?
2. What are the different climate frames used by the Indian business media?
3. How have the frames evolved with time?

The novelty of our work emerges from two main aspects. First, is the focus on reporting climate change in business media. We use a single business newspaper 'Economic Times', which is the leading business newspaper in India as a unit of analysis and cover 13 years from 2008 to 2021. Although focusing on a single newspaper as a case is typical in exploratory analyses of leading newspapers [35], longitudinal studies are sparse. Second, is using all the news available in the period as our data. In other words, we use the entire corpus of news available from the archives without sampling. Using natural language processing (NLP) enabled us to process a large corpus of articles to discover trends and themes in news coverage. The choice of NLP techniques and methods has been analyzed in detail in Section 4.

The rest of the article is structured as follows. In Section 2, we historically discuss how businesses have responded to the issue of climate change and justify the importance of communicating climate change to decision makers in the industry. In Section 3, we cover the existing literature on the role of newspapers as an agenda-setting medium in general and business newspapers. In Section 4, we introduce the data collection and analysis methods used in the article. Section 5 describes the results inducing the quantified, yearly news coverage and the discovery of themes related to climate change and its evolution over time. Finally, in Section 6, we discuss the results within the context of the existing literature focused on news media coverage content analysis. We further compare our results with mainstream newspaper analyses to highlight differences between both categories in the context of climate news coverage.

2. Background

The commercial sector has always been a significant stakeholder in the climate change discourse as a contributor toward global emissions, influencer of climate regulation and, finally, as an agent of climate action. Some of the earliest engagement of business action toward climate change was rooted in climate denialism. It formed a significant opposition to climate change-related regulation, using political and non-market means. An example would be the global climate coalition (GCC), a consortium of large corporations. In the wake of the Kyoto conference on climate change, the GCC launched an advertising campaign to promote climate skepticism and discredit scientific research [36]. The advertisements, among other things, strongly messaged the increase in fuel prices based on the theoretical idea of carbon taxes, thus severely undermining public support for serious climate action by governments [37].

Since the late 1990s, the stance of global businesses has evolved significantly. With the worldwide support garnered by the Kyoto Protocol (1997) and its subsequent ratification by countries the world over, companies have mainstreamed climate issues in their core operations and adopted evolving strategies to mitigate the impact of climate change.

Although several factors have influenced this gradual change in outlook, they can be consolidated into three broad categories. First, is the acknowledgment of scientific research on the threats posed by climate change and its anthropogenic nature. The Intergovernmental Panel on Climate Change (IPCC) has estimated that pathways that offer a 66% chance of limiting temperature rise within the 2 degrees C range would cost from 3% to 11% of world GDP by 2100. Without paying heed to climate change, unbridled growth could cost from 23% to 74% of global per capita GDP through climate-related disruptions such as lost agricultural production, extreme weather events, health hazards, and many other disruptions [38]. There is increasing cognizance among the business community on how the consequences of climate change can impact the supply chain, hamper production systems, and eventually impact aggregate demand. Second, is the increasing pressure from governmental and state actors to consider the 'social cost of carbon' by pricing carbon based on the detrimental consequences of emissions [38]. An outcome of this is the recent trend gaining traction among many businesses, that of 'internal carbon pricing', wherein companies proactively place a monetary value on their carbon emissions, even without any external carbon pricing mechanism. Over 60 national and regional governments, constituting over half of the global economy, have enforced policies relating to carbon pricing, and with over 184 countries ratifying the Paris Climate Accord, this number would most likely escalate. Governments have been pricing carbon through carbon taxes, cap and trade mechanisms, and indirect regulation that places a compliance cost on companies [39]. A survey revealed that in 2020 over 2000 companies worldwide, representing over USD 27 trillion in market capitalization, either used an internal carbon pricing mechanism or had one on the anvil to be launched within the next 2 years [40].

Finally, businesses recognize the strategic value of incorporating mitigating climate activities in the operating environment. Being climate-friendly creates 'a shared value' wherein companies could contribute to the economy and society by addressing socioeconomic problems within their business's scope. Sustainability as a strategy is particularly appealing to businesses in the face of the incumbent view that shareholder value can be created only at the expense of other stakeholders. Sustainable companies aim to create value for all stakeholders; they continually engage with them, thereby developing the agility and resilience to anticipate and react to social, economic, environmental, and regulatory changes. Sustainability can also foster and drive innovation, creating business opportunities, reducing waste, and enhancing financial performance.

2.1. The Indian Business Response to Climate Change

Emerging economies such as India are increasingly gaining attention in the climate change context because their high growth trajectory and substantial population size. India became the third-largest emitter in terms of absolute emissions in 2018 after China and the

United States. However, although there is a considerable gap between India and China in terms of total emissions, India's growth rates in terms of emissions are closer to China. Table 1 presents the emissions data for the top 10 emitters, country contributions to global emissions, and the compounded annual growth rates between 1990 and 2018.

Table 1. Global Emissions Statistics.

Country	2018 Absolute Emissions (MtCO$_2$e)	Share of Contributions	CAGR (1990–2018)
World	48,939.71	100%	1.40%
China	11,705.81	24%	4.80%
United States	5794.35	12%	0.10%
India	3346.63	7%	4.10%
European Union (27)	3333.16	7%	−0.80%
Russia	1992.08	4%	−1.20%

Source: Climate Watch Historical GHG Emissions. 2022. Washington, DC: World Resources Institute.

For India, the most significant source of emissions comes from its energy sector. Although agriculture was traditionally a large emitter as well, the share of agricultural emissions has reduced considerably as the country industrialized. Figure 1 shows the trends in sector-wise emissions, with energy being the dominant sector. Figure 2 shows the evolution of emissions within the energy sector. We see that electricity/heat is the chief source of energy emissions, followed by manufacturing and transportation. Although it is difficult to precisely attribute the source-based emissions to the business sector without end user data, we can qualitatively characterize them as about 30–50% of total emissions [41].
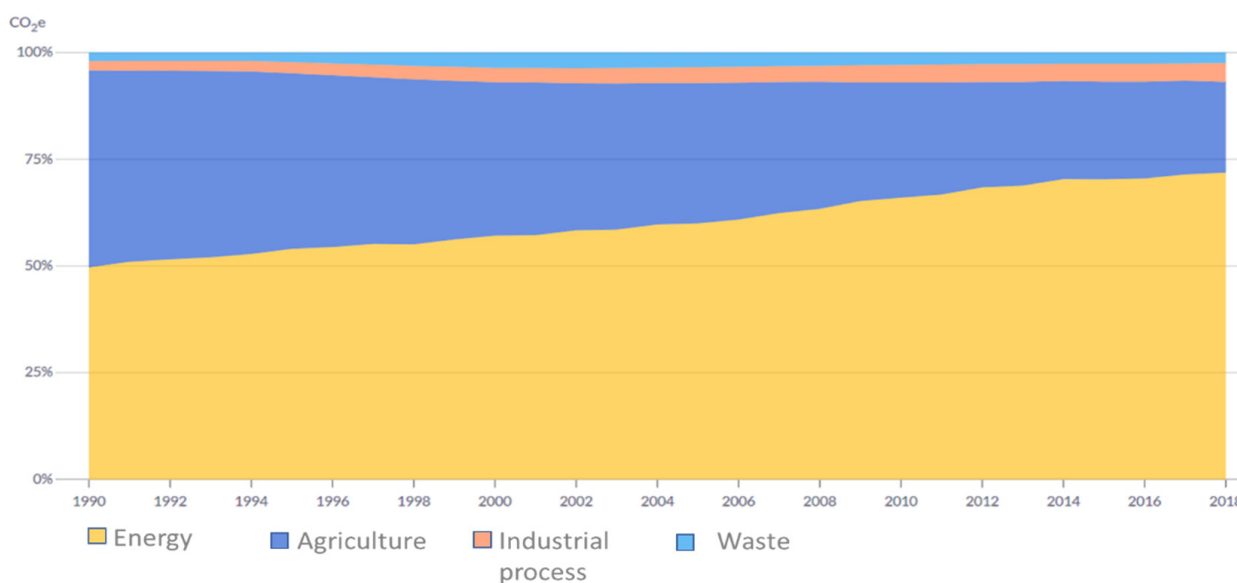

Figure 1. Emission trends by sector. Source: Climate Watch Historical GHG Emissions. 2022. Washington, DC: World Resources Institute. (https://www.climatewatchdata.org/ghg-emissions, accessed on 5 April 2020).

In the backdrop of rapidly growing emissions, being cognizant of how the private sector invests, operates, and influences regulation is highly relevant because their outcomes are likely to drive global emissions in the latter half of the century [4].
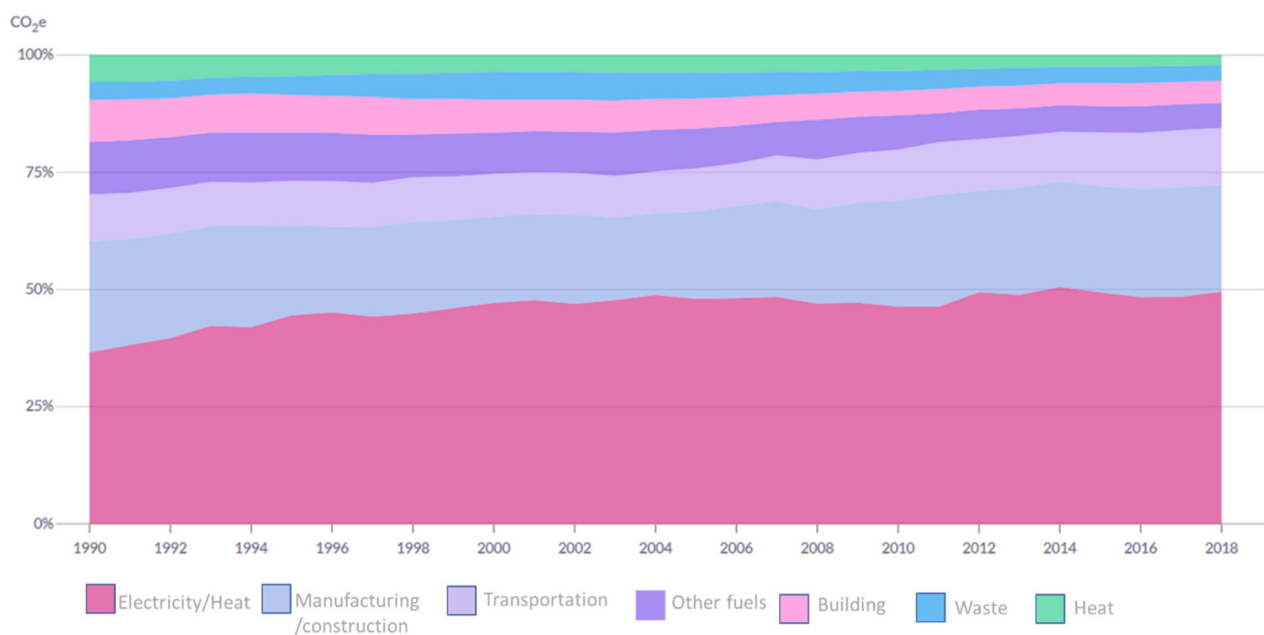
Figure 2. Emission trends within the energy sector. Source: Climate Watch Historical GHG Emissions. 2022. Washington, DC: World Resources Institute. (https://www.climatewatchdata.org/ghg-emissions, accessed on 5 April 2020).

Although the Indian business response has been slower to evolve as compared to its global peers, it has since caught up with the rest of the world. The earliest evidence of a formal response was when eight Indian CEOs were signatories to the open call from the World Economic Forum (WEF) urging political leaders to foster a climate deal and enable the private sector to move toward a climate-friendly transition. Another important development is the business sector's interest in internal carbon pricing mechanisms. This is particularly noteworthy, given the absence of any overarching regulation for an explicit carbon tax. Current tools for pricing emissions that resemble a carbon tax are more implicit or de facto, such as the 'Clean Environment Cess' implemented in 2010. Other carbon pricing instruments include the Perform, Achieve and Trade (PAT) scheme, which improves energy efficiency in energy-intensive sectors. The Renewable Energy Certificate (REC) scheme, which enables companies to meet clean energy obligations, is an example of carbon pricing levied by the government on the coal sector. In addition, energy efficiency standards and tradable renewable energy certificate schemes implemented by the government, as well as indirect taxes, could be considered as costs levied on carbon emissions [42]. Despite the lack of formal regulation on carbon pricing, a survey by the World Resources Institute (WRI) shows substantial interest in the Indian corporate sector toward voluntary adoption of internal carbon pricing. The survey revealed that 27% had already implemented or were looking to implement carbon pricing in the short term, whereas another 60% were actively exploring the idea. The key drivers for adoption were due to the business risk imposed by climate change [43].

Overall, it is clear that India's business response to climate change is still unfolding. Interestingly, the corporate response has not been against climate action as in the case of certain other countries. However, at the same time, there is no evidence of complete consensus either. Although it can be argued that organizations should consider their role in society and voluntarily mainstream sustainability, such an expectation would be impractical in reality. A more robust business case for sustainability is likely to evolve through regulation, positive market sentiment toward sustainable business practices, investors' perception of the adoption of sustainability principles, stronger advocacy, and stakeholder support across the stakeholder spectrum, including customers and employees of organizations. In the backdrop of such multi-stakeholder ecosystems that influence business action toward

climate change, the role of media is critical, and a deeper analysis of how climate change is framed in the media warrants special attention.

2.2. Indian Media Industry

India, poised to emerge as the most thriving newspaper market globally, is expected to witness a 2.7% CAGR in revenues between 2021 and 2026 from this sector. Future projections also indicate that it would be the only country in the world to experience growth in newspaper sales during this period, and by 2025, it will also leap ahead of China, replacing it as the biggest world market for print readership.

The Indian print media has seen tremendous dynamism and growth in the past two decades in terms of titles as well as readers. The industry is an intensely competitive space teeming with over 90,000 print titles, largely dominated by private players, and characterized by commercialization, corporatization, and professionalism [11]. In addition to the dailies in the English language, catering largely to the urban middle-income and upper-middle-income echelons, the vernacular print titles in regional languages enjoy a much larger readership in the hinterland. Although the print industry is mostly self-regulated, it broadly comes under the purview of the Ministry of Information and Broadcasting. The Press Council of India, a statutory, quasi-judicial, autonomous authority, is responsible for upholding the freedom of the press as well as maintaining and improving the standards of newspapers and news agencies in India.

Although the advent of digital media has unarguably unsettled the conventional print industry in general, its impact on climate journalism in India has largely remained unaddressed [9]. However, this research also revealed that climate change issues were covered by dedicated specialist journalists in many legacy media outlets such as *The Times of India*, *Hindustan Times*, and *Indian Express*, as well as business dailies such as *Mint*, *The Economic Times*, and *Business Standard*. Research has also indicated that entertainment often gets precedence in tune with the commercial aspirations of media houses in India, stifling other issues such as climate change [11]. A notable feature of most Indian business newspapers is that almost all are owned by prominent, legacy media houses, and the framework within which they operate is not very different from the mainstream newspapers [44].

3. Literature Review

The literature on climate coverage has emerged since the 1990s and has predominantly centered around agenda-setting and climate-framing themes.

3.1. Role of Media in Agenda Setting

Media, whether television, press, or online, can play an essential role in setting agendas, focusing public interest on specific topics, and providing a framework for discourse that could sometimes result in attitudinal shifts, thereby impacting governance and policy making [45]. Given climate change's multidimensional and complex nature, communication plays a vital role in galvanizing public opinion and putting it on the public agenda [46]. This role of agenda setting by the media can help bridge the gaps between groups dictated by gender, age, racial, or income differences, thereby facilitating community consensus building on social issues [47]. Other studies in the literature endorse the relationship between agenda setting by the media and consensus building. For example, Shaw and Martin (1992) found that increased exposure to news media helped reduce differences and build consensus across various socio-economic and demographic groups [48].

Agenda setting is essentially the news media identifying and reporting issues with differentiated importance. Naturally, the media in such a context plays a gatekeeping role by making two levels of decisions. The first level is about decisions on what content matters or the newsworthiness of the content. The second level is about decisions about how to frame the content, thus influencing how to think about the news, that is, preparing the content. Academic scholarship on agenda setting tends to focus on both the first and second levels. For instance, McCombs (1997) provides a more detailed framework for

the different ways media exercises agenda-setting abilities, especially in the context of issue selection [47]. This ranges from professional detachment to more engaging roles such as targeted involvement with campaigns, boosterism tantamount to cheering for local community developments, and a more proactive role in agenda setting. Although a proactive approach may be progressive because it encapsulates the different stakeholders' perspectives, including the government, it also comes with a clear ethical responsibility. Considering the ethical boundaries of news reporting, Mccombs further delineates the role of agenda setting for the transmission of salience and not for opinion formulation.

In the recent literature, agenda-setting research has tended to look beyond salience. It has focused more on the 'framing', which looks at how prominent issues are reported, and what is emphasized in the news media, thus bringing in concepts of 'priming' and 'agenda-melding'. These nuances understandably would significantly impact public opinion forming [49].

3.2. Framing in the Climate Context

The literature on climate media coverage also underscores the different frames in which climate change is presented. The most common theme is the politicization of climate reporting by the media and elite partisan influence in framing messages around climate change [7,50]. This line of inquiry further relates the politicization of climate reporting to climate skepticism and the polarization of opinion on climate action [51]. Another recurring theme in the media is the justice frame. Schmidt and Schäfer (2015) analyze the construction of environmental justice using five different perspectives comparing three countries: the U.S., Germany, and India. The authors find the U.S. most heterogeneous, with considerable support for the 'freedom' and 'market' perspectives. At the same time, India and Germany lean more toward 'Social and Economic' and International solidarity' [18]. On a similar note, Das (2020) considers 'equity' and 'harm avoidance' as the dimensions of environmental justice perspectives in media and concludes that Indian media leans more on the equity dimension than harm avoidance. The economic frame anchors on innovations across sectors such as energy and transportation and advocates the co-benefits arising from technological innovation and climate mitigation [52]. Liu (2017) also suggests that climate change, when linked with economic issues, prompts solution-thinking compared to science-based frames [53].

Studies have segregated newspapers based on their ideological or political leanings and their impact on their coverage of climate issues. Bohr (2020) has comprehensively documented the literature emphasizing the type of coverage [20]. Although news reporting was prominent, some researchers looked at opinion pieces and letters to the editor [51,54]. These may have included perspectives and unproven claims of climate change skeptics against scientifically accurate reporting.

The interesting take that climate concerns should trump journalistic norms of balanced reporting, which promoted the dissenters' perspectives, was highlighted by Boykoff et al. (2007) [46]. Since the 2000s, this 'balance-as-bias' trend seemed to wane, whereas the privilege of scientific perspectives over climate skeptics gained ground in conservative newspapers [55]. Although this in no way indicated the weakening of climate change dissenters' views, conventional media still framed climate issues in the 'warmers versus deniers' frame, and reporting seemed more in line with the scientific consensus [56]. Often outright denial of the adversities of climate change, especially by the capitalist free-market advocates, was now replaced by the criticism of the ensuing pro-environment regulation [57].

Studies have looked at ideologically diverse editorial perspectives of newspapers. However, the framing of the climate change risk based on ideological standpoints typically emerged over the responsibility of mitigation [54]. For instance, a study of four British tabloid newspapers usually consumed by the masses revealed that their coverage diverged substantially from the scientific consensus that assigns responsibility to humans for climate change [58]. The findings were not consistent with the trends documented in 'prestige press'

in the U.S. and U.K. Across geographies, it was generally found that liberal newspapers published substantially more on climate change issues. In contrast, opinions of climate change naysayers were more visible in the conservative print media [34,51].

An exciting study that covered a conservative, a business, and a progressive newspaper in South Korea suggested that although the conservative and the business newspapers supported capitalistic growth and continued the existing socio-economic structures, the progressive newspaper supported the active reduction in emissions while criticizing the technological sector. A Russia-based study that looked at climate coverage in about 65 newspapers over 35 years revealed that national-level variables, especially economic conditions, influenced climate coverage and the way it was framed, whereas the newspaper ownership structure and their underlying ideologies were relatively less important [59]. Contrary to the findings of most studies across developed and developing countries globally, scant divergence was observed across Russian newspapers based on contrasting ideologies, probably due to Russian media being highly controlled and centralized in the past decade. Han et al. (2017) have studied climate change framing in five mainstream Chinese newspapers [60]. Their results pointed out that party-sponsored newspapers tended toward the collaboration and cooperation frame for climate change mitigation instead of the general impression that Chinese media advocates that developed countries take more responsibility. Market-oriented newspapers used the human interest frame more, calling for proactive public action to mitigate climate change impacts. The other newspapers also adopted the human interest frame, suggesting that Chinese media is also getting influenced by Western values [61]. However, it should be stressed that half of the articles framed on the human and environmental impact were in a specialized newspaper, *Science and Technology Daily*, which is party-sponsored but with the least circulation among the five newspapers.

3.3. Business Media and Climate Change

The symbiotic relationship between business and climate concerns has been gradually mainstreamed quite compellingly in the Global North, as evidenced in widespread research. In contrast, research on the Global South countries remains sparse [9]. This study tries to address this research gap by focusing on climate issues covered in a prominent business daily in India, highlighting the concerns that garner maximum attention.

Surprisingly, relatively few studies have focused on the coverage of climate issues in business news media, given that they intensely impact each other in several ways. Pollach (2014) reported findings that strongly indicated the noticeable impact of news media on corporate environmental agendas incorporating critical issues such as carbon emissions, alternative energy sources, and carbon footprint, among others [62]. Other studies underscore the role of business news media as an intermediary impacting public perception of the corporate sector [63,64]. Finally, the influence of business media on senior decision-makers in the corporate sector has also been recognized in a study by Rickard et al. (2014) [23].

Finally, from a geographical coverage standpoint, the literature on climate change media coverage is well documented for developed countries such as the U.S. [25,46] and the U.K. [54,58], as well as Europe [65,66]. However, the focus on developing countries such as Mexico [67], Peru [68], Bangladesh [69], and India [19,27,69] is still in its nascent stage.

Based on the literature analysis, the gaps can be summarized below.

- The geographical distribution of research on climate media coverage is skewed toward the West. There has been minimal work on countries in Asia or Africa that are highly vulnerable to climate change.
- Because most of the work has focused on the West, current scholarship is driven by the ideological/political aspects of climate framing. There is little knowledge of climate framing in the context of developing countries.
- Finally, the extant literature has not covered business newspapers as a category despite the significant stake of business leadership in the context of climate change mitigation and policy.

4. Data and Methods

The study's objective was to investigate climate change themes in business newspapers and map the temporal evolution of such compositions. Therefore, we decided to focus only on business newspapers with extensive digital archives. Therefore, we chose India's most prominent business daily, the 'Economic Times,' as a single unit for the study. *The Economic Times* has the highest readership of about 4 million per month, more than the combined readership of other English business dailies. It is India's fourth largest newspaper among English dailies [70]. Second, *The Economic Times* is also one of the oldest business newspapers in India, circulating since its inception in 1961, with its digital archives available since the 2000s. Over 80% of *The Economic Times*' readers belong to the highest strata of the New Consumer Classification System in India (NCCS A). This corresponds to highly educated readers belonging to socio-economically well-to-do households, and about two thirds of them were below 30 years. This points to two things. First, the readers, given their characteristics, would be highly engaged with the business sector as employees or entrepreneurs. Second, their age and education levels also indicate that they may play a key role as stakeholders in climate-related policy and action [71].

Sample

We crawled all the news articles from the digital archives of *The Economic Times* between 2008 and 2021 based on the keyword search 'climate change'. We chose this time period because India's domestic climate action began in 2008 with the launch of the 'National Climate Change Plan'. Until then, India's stance on climate change was more outward looking and driven by climate justice considerations [31].

The initial corpus had a total of 9838 news articles along with metadata such as dates and authors. Our initial cleaning included removing video-based news articles with short stubs for text. The final dataset had 9774 articles with about 5 million words.

We then applied a preprocess commonly used in text mining. Preprocessing techniques are domain agnostic and essential for quantifying unstructured data and making them amenable to statistical processing algorithms. Standard preprocessing procedures include case conversion, tokenization, stopword removal, and the conversion of text into numeric vectors [72,73]. Removal of stopwords such as 'and', 'if', 'a', 'an', 'the', etc., was particularly essential because they appear very frequently through any text document but carry little information or contextual meaning. Filtering out stopwords improves the signal-to-noise ratio in unstructured text; therefore, improving the statistical significance of terms that are relevant to the context [74].

As a first step, we tokenized the corpus into a collection of individual words. Then we removed comments that were either numbers or stopwords. Our stopwords included all the commonly used terms in English, which do not render additional meaning such as 'and', 'in', 'for', 'at'. We used the standardized list of stopwords available as part of the NLTK library, a commonly used library for NLP. Finally, we filtered out all the words which were not nouns, verbs, adjectives, or adverbs using parts-of-speech (POS) tagging. After applying the processing techniques, our dataset now had 2.9 million words—a 43% reduction from the original corpus of 5 million words.

For the study, we used topic modeling, an approach that is typically used for summarizing large corpora of textual data. Topic models have been increasingly adopted by various social science disciplines, such as public policy, health care, and business management [75,76]. At their core, topic models are a family of unsupervised learning techniques that uncover more sophisticated structures in the text. Among topic models, Latent Dirichlet Analysis (LDA) has been popular in text mining studies, especially news analysis. The technique operates on the assumption that every document is generated by a complex underlying process that is unknown. Therefore, the objective of the LDA is to discover the parameters of the unknown process that is likely to have generated the corpus to the best possible approximation. Essentially, LDA considers a document as a mixture of topics following a finite distribution within each document, where each topic is further character-

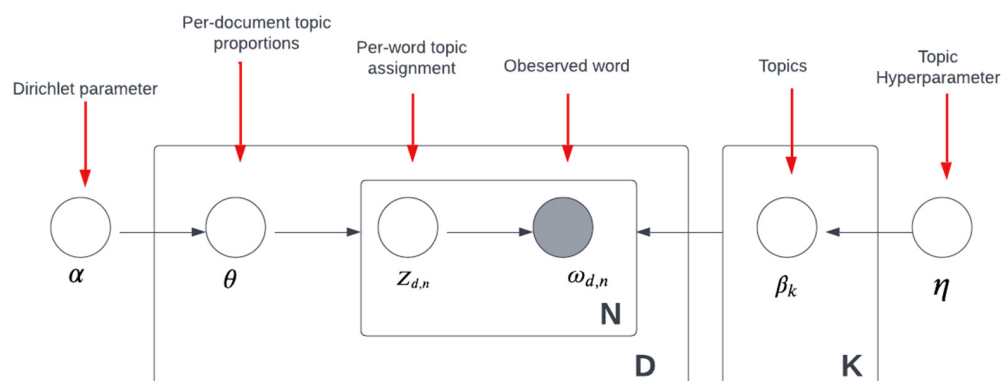ized by its distribution of words. The mathematical model behind LDA is represented in Figure 3 below.

Figure 3. Graphical representation of Latent Dirichlet Allocation. Where N—number of words in each document. k—number of topics a document belongs to (a fixed number). D—corpus, a collection of M documents. $z_{d,n}$—is the topic for the nth word in the dth document. θ—distribution of topics for each document. $β_k$—distribution of words, within each topic up to k. α, η—parameters of prior distributions over θ and β.

The most crucial user defined input to a topic model is k which determines the dimensionality of the topic space. A larger k may provide a detailed summary of the corpus but may result in additional topics which add little value. At the same time, a smaller value of k can lead to deficient topics in detail. Therefore, the choice of k is critical and commonly guided by metrics such as coherence, perplexity, harmonic mean, etc. Nevertheless, the validity of these criteria as a measure of the quality of topics is still a matter of debate. In our study, we decided to use human interpretability to measure the quality of topics instead of formal metrics. Therefore, after iteratively running the LDA model with different values of k, we set it at 20 because this gave us the most interpretable set of topics.

5. Results

The most important contribution of the topic model is the topic proportion θ generated for every document. When the θ is tracked over time, we get a temporal measurement of issue attention. However, the LDA output has to be processed further before mapping issue attention. We used the Gensim Python library for the LDA analysis and transformed the output into tabular data with the document content as rows and the topics as features. The topic features were populated with numbers ranging from 0 to 1 representing θ. We tagged each document by the topic that contributed the most to the content. For example lets assume, for k number of topics if a document held a proportion of 70% of topic 1, 5% of topic 3, and 2.5% of topic 4, and so on until topic k. We tagged topic 0 as the dominant topic. Details of topic proportion and some of the high-frequency words are displayed in Table 2 below.

Table 2. Distribution of topics with keywords and labels.

Topics	Keywords	Contribution
Agriculture and food	farmers, India, food, impact, security, climate change, agrculture, emissions, production, government, adaptation, crops, new, sector, income, minister, global, warming, management"	5.73%
Bilateral_relationships_multiple countries	country, economic, leader, trade, cooperation, investment, russia, africa, external, affairs, pacific, climate, change, dialogue, brazil, china, eu, partnership, strategic	5.75%

Table 2. *Cont.*

Topics	Keywords	Contribution
Climate negotiations_Summits	Climate, warming, negotiations, agreement, paris, binding, countries, global, developing, developed, action, covention, framework, round, India, China, eu, brazil, emissions, deal	7.78%
Climate_finance	countries, conference, India, finance, transfer, billion, usd, assistance, developed, developing, committed, green, technology, convention, framework, adaptation, mechanism, capacity, transfer, minister, un"	2.42%
Court_proceedings	government, environment, court, order, ministry, climate, change, national, committee, forests, pollution, green, tribunal, rivercoal, air, land, board, bench, report, clearance, control, centre	5.57%
Developing_countries	developing, nations, development, agenda, global, environment, emissions, energy, finance, emissions, action, plans, technology, achieve, capacity, building, efficiency, economy, finance, transfer	3.90%
Economic_growth	economy, india, global, financial, energy, bank, prices, demand, oil, policies, climate, warming, deal, trade, markets, crisis, inflation, growth, recovery, trade	3.23%
Energy and electricity	climate, change, solar, emissions, wind, power, generation, gw, mw, electricity, coal, capacity, greenhouse, warming, action, energy, sector, policy, support, paris	13.67%
Global warming_sea_levels	emissions, carbondioxide, warming, greenhouse, gases, celcius, temperature, degrees, sincrease, ice, sea, levels, ipcc, global, 1.5, celsius, atmosphere, antarctic, industrial	6.70%
Industry_engagement for climate	climate, risks, businesses, companies, enviroment, esg, disclosures, ministry, foundation, oppurtunities, assets, reporting, tcfd, director, award, social, governance, ceo	2.39%
Mixed	people, global, world, ministry, says, education, environments, campaign, voting, candidate, students, awareness, author, scientists	6.25%
National strategy and program for climate change	india, union, mission, plan, climate, action, 2030, reduce, carbon, intensity, countres, developing, ministry, environment, energy intensity, eission, gdp, forests	2.85%
Technology_innovation	technologies, data, engineers, researchers, study, analytics, pollution, development, strategies, footprints, plants, power, generation, electric, vehicle, coal	1.21%
US_China_ties	president, agreement, state, secretary, barack, trumo, biden, china, asia, relationship sea, military, cooperation, climate, energy, security, paris, accord	18.12%
Weather disasters	monsoon, weather, change, year, india, climate, glaciers, water, environement, meteorlogical, extreme, rainfall, increase, floods, temperature, drinking, water, supply, region	2.94%
Wildlife and ecosystems	climate, change, conservation, species, forest, india, tiger, biodiversity, wildlife, land, areas, birds, water, development, ecosystem, temperature, habitat, government	3.75%
World_leaders_call_for_action	climate, change, leaders, action, countries, emissions, energy, paris, global, carbon, agreements, china, modi, warming, greenhouse, celcius, summit	6.27%
Environmental pollution	environemnt, pollution, plastic, single, use, agriculture, ministry, waste, food, farmers, stubble, air, agriculture, health, water, quality, control, management, power, production	1.37%

In the next step, we manually labeled the topics based on the specific keywords and documents representative of the topic. During this process, we found specific topics to be repetitive. For example, we had three different topics that covered climate negotiations

and two different topics on energy-related news. In such cases, we merged topics to create unique categories. We also had discarded topics that had miscellaneous news which was irrelevant to our measurement. Once the labels were coded, the authors sampled ten topics randomly in every topic for further validation and checked if the assigned label was relevant for each of these documents. In order to further validate the topic labels, we asked an expert to manually label news articles from a sample dataset. The sample included randomly selected news articles from each topic. Based on the exercise, we estimated that the 'agriculture' topic had up to 15% of false positives. Some of these were recategorized into 'industry engagement' and 'bilateral ties'. Additionally, we found a substantial proportion of news related to pollution to 'environmental pollution'. The results of the validation round led to the creation of 'environmental pollution' as a separate category. Table 2 depicts the finalized topics and their distributions within the corpus

Each topic here corresponds to a particular issue related to climate change. After finalizing the topics, we further labeled them into overarching themes. The thematic mapping enabled us to compare with media frames used in the literature. Table 3 presents the individual topics as issues across six aggregated themes as frames and their contributions to the overall corpus.

Table 3. Distribution of themes.

Topics	Keywords	Contribution
Climate cooperation	Bilateral_relationships_multiple countries Climate negotiations_Summits US_China_ties World_leaders_call_for _action	40.49%
Climate_finance	Climate_finance Developing_countries	6.75%
Climate and development	Court_proceedings Economic_growth Environmental pollution	7.78%
Climate science	Global warming _sea_levels Technology_innovation Weather_disasters	11.59%
Sector specific	Agriculture and food Energy and electricity Wildlife and ecosystems	24.72%
Climate action	Industry_engagement for climate National srategy and program for climate change	5.59%

Another notable trend is that although Tables 1 and 2 describe the proportion of the corpus that can be attributed to issues and frames, they do not bring out the temporal variation in the news. Tracking news coverage by time provided us insights on the general trends in climate news coverage and patterns around issue attention. There has been an upward trend in climate coverage in *The Economic Times*. Between 2008 and 2021, the overall annualized growth rate in climate coverage is 600%. However, we also observed upward spikes in the quantity of news stories around the two COP events in 2016 and 2021, which may inflate the growth rates. Hence, to get a more conservative estimate, we excluded the Glasgow COP held in 2021. The annualized rate in this scenario was 140%, reflecting significant growth in news coverage in the climate change context.

Finally, Figures 4 and 5 also summarize the trends within the broad climate themes between 2008 and 2021. Figure 4 reports the number of articles per climate theme per year, whereas Figure 5 looks at the proportion of articles per year attributed to the different themes. When we consider the number of articles on climate themes shown in Figure 4, it is clear that the amount of coverage has increased across all the themes, barring climate

finance. In essence, climate finance-related coverage is low and gains some importance only around the COP events of 2016 and 2021. Before 2015, news coverage was dominated by climate cooperation and the international politics around it. However, post-Paris, based on Figures 3 and 4, we see a clear shift where the share of sector-specific news, direct science communication topics, and climate action is gradually increasing whereas the share of climate cooperation is declining. Sector-specific coverage warrants special notice because it is evolving into a dominant theme primarily fueled by news coverage on energy and electricity.
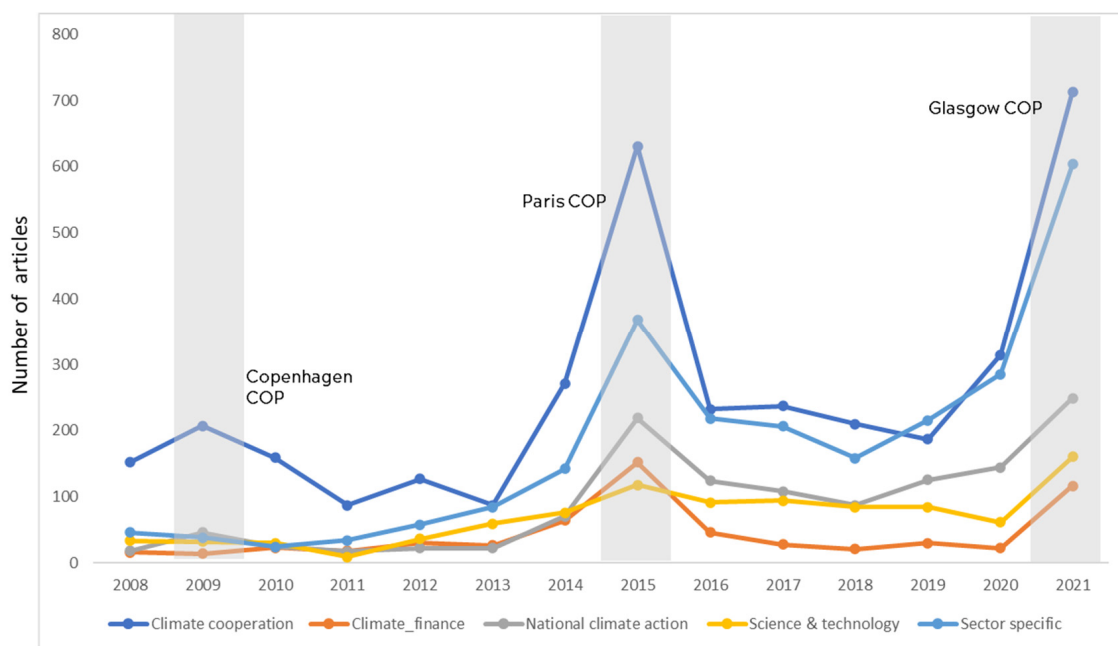

Figure 4. Count of articles within the five themes between 2008 and 2021.
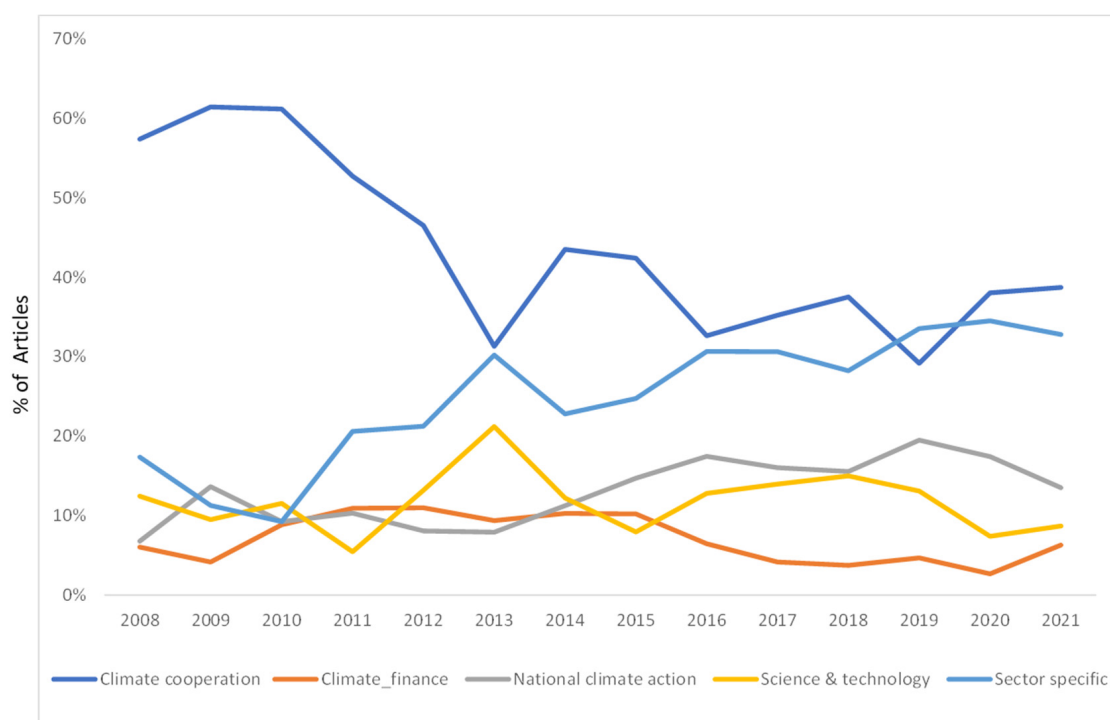

Figure 5. Distribution of articles (%) within the five themes in 2008–2021.

The results show that climate cooperation is the dominant topic, with almost half of the corpus dedicated to this topic. Within climate cooperation, we further see that news focusing on bilateral cooperation, especially with the United States and China, takes center stage. This is followed by news and discussions around negotiations for climate deals. This covers events such as the conference of parties (COP) and negotiations leading up to COPs. The topic also covers political leaders and government representatives' calls for global climate cooperation. The dominance of the climate cooperation themes reinforces the world view that climate change is a global collective action problem [77,78].

Second to climate cooperation is 'Sector specific responses', making up about 28% of the overall corpus. Within sector-specific coverage, we observe a wide variety of news content focusing on climate action and consequences. News about electricity emissions subsumes a considerable share of the overall theme and focuses on India's renewable energy transition. The content and the significantly higher coverage directly correlate with India's climate change strategy, which is pivoted on the idea of energy transition [27,52]. On the other hand, sectors such as agriculture focus more on the consequences of climate change, such as water scarcity, the impact of weather on yields, mitigation measures such as the development of weather-resistant crops, and agricultural insurance.

News stories covering topics within the theme 'Climate science' rank third among the topics and are related to climate-science communication. The theme has articles that directly discuss research on rising sea levels, glacier melting, and slow-onset events. Science aspects of climate have also been mentioned in reporting extreme weather and disasters in the local context. The substantially higher presence of climate science is particularly significant, given the world view that countries from the Global South have reported less on scientific aspects of climate science than the Global North [79]. The study by Hase et al. (2021) revealed that 6.53% of all Global North articles focused on climate science compared to 3.57% in the Global South. On the contrary, our study shows a sizable 10.8% of articles with emphasis on climate science, pointing to its increasing importance. Although a few studies have pointed to a lack of expertise in the arena of climate science in developing countries in general, India has been an exception with many governments as well as non-government players involved in climate science, as well as the related policy framework, right from the 1990s [80]. It is obvious that these well-developed capabilities would also be visible in the arena of climate journalism.

On the other hand, climate and development subsume topics directly in the nexus of economic growth and climate change. For example, the topic of court proceedings within the climate and development theme covers disputes regarding developmental infrastructure activities in climate-sensitive areas. Such disputes typically pertain to the development of mines, ports, and power projects and often in the context of forest clearance or disruption of sensitive ecosystems. A small aspect of the topic includes legal proceedings initiated by climate activists. The theme also contains topics labeled as 'economic growth'. Although these articles primarily focus on economic aspects such as inflation and growth, unemployment in national and international contexts, climate change and its consequences on output, sustainable growth concepts, and technological innovation for mitigation efforts are mentioned in larger macroeconomic discussions.

Climate finance includes news stories that report on finance required for mitigation efforts. A key aspect is the finance-related negotiations in various summits, such as the COPs and other multilateral forums. Other news stories track the climate discussion initiated by developing countries. Such news discusses actual aid, credit, investment flows, or calls for financial flows into developing countries to support global climate mitigation efforts.

Finally, 'climate action' comprises about 5% of the overall corpus. Within the topic, news coverage involves the direct government strategy to contribute to India's nationally determined contribution (NDC), tracking progress, and resource allocation for various schemes and programs for implementing climate action. Although the focus is mainly on the central government, a few state-level climate action engagements are also highlighted.

News stories under climate action also track the private sector in the Indian context. A substantial share of the news reports on the environment, social and governance (ESG) activities of private enterprises and the increasing demand for ESG activities by shareholders influencing the transition. A small proportion of the coverage can also be attributed to personnel appointments for corporate sustainability, finance commitments, and support provided by the private sector for the government's commitment to climate action, indicating a strategic shift in corporate commitment to climate change.

6. Discussion

A critical insight from the analysis is the increasing media attention on climate change over the last decade, even in the Indian business daily that we covered. Within the context of our study's results, climate news has increased on a year-on-year basis and confirms the findings of other prior studies. For example, Schmidt et al. (2013) recorded that in the second half of 2000, media attention increased by a factor of 2.9 compared to the late 1990s in India [29]. Our results show a much higher increase in coverage of climate issues, almost six times higher as compared to Schmidt et al. (2013). The higher media coverage can be considered as evidence of the growing importance of climate change in domestic affairs. Although media attention continues to increase sharply around international events such as COPs, as supported by an earlier study by Keller et al. (2020) [19], Our findings also provide evidence an increased coverage motivated by local factors. Another notable pattern is the decline in the share of climate news driven by international factors such as COPs, giving way to a higher share of domestic news across all the themes except 'climate cooperation'.

Our analysis confirms that the dominance of the climate cooperation themes reinforces the world view that climate change is a global collective action problem [77,78]. A more granular analysis of the sub-themes within climate cooperation aligns well with Schmidt and Schafer's (2015) well-contextualized frames [18]. Our findings corroborate their insights around global cooperation and economic growth being the central themes in the Indian media, thereby augmenting India's position as a 'globally responsible citizen' [18].

The most notable trend is the gradual shift in issue framing from exclusively projecting climate change news as an external issue to a more domestically aligned concern [63]. Themes related to energy are consistently found in other studies as well. For example, an earlier analysis by Jogesh (2012) also confirms that news related to climate action around energy ranks second to that of global politics in the Indian context [27]. Our findings are consistent with Keller (2020), who underscored the presence of energy-related themes in India based on mass-media English newspapers. However, our study attributes a significantly higher share of climate news to energy-related themes as compared to Keller et al., 2020 [19]. The substantially higher share underscored in our analysis might be due to the distinction between business media and mass media focus of Keller et al. (2020) [19]. Energy as a topic also consistently appears in country-level analyses of media coverage. For example, studies from Ireland, Greece, and Mexico report significant media attention to the energy theme, and it is linked to the central idea of energy independence, economic interests, and investments [52,81]. Agriculture also emerges as an essential sub-theme in our analysis, with news stories presenting both climate consequences, impact on food production, and mitigation efforts. However, within the context of the literature, we find that media attention on agriculture is sparse and possibly confined to developing countries where agriculture continues to be a dominant economic activity [69,81].

There could be several reasons for these shifts in attention as well as issue framing. Over the last decade, India's political stance has evolved from considering climate change as a 'risk-responsibility' issue to that of an equal stakeholder, thus promoting domestic sectoral changes. We, however, also have to acknowledge the strategic push for climate action at the national level that facilitated this transition. Therefore, although climate action may not have emerged as one of the most prominent themes in our research by itself, it is clearly visible as significantly impacting sectoral action in this direction. Action plans have continually been promoted as contributing to public health and energy security [17], which

has likely enabled mitigation efforts in sectors such as energy, industry, and agriculture in that order, thus integrating climate change into a wide variety of economic activities influencing media attention. Together, these findings suggest that for a developing country such as India, energy security continues to dominate the concerns around climate change. The second reason stems from the strong linkages between country vulnerabilities and media attention [29]. An increase in exposure to the negative consequences of climate change and its connection to disasters, natural hazards, and economic outcomes has made climate news worthy of attention in the Indian context.

Our analysis also shows that articles related to climate science have also enjoyed a steady increase in representation, albeit lesser than other subthemes. This is particularly notable given that countries from the Global South have reported less on scientific aspects of climate science than the Global North [79]. Increased climate science stories may also signal increased scientific capacity among Indian institutions to conduct and report climate change studies, increased journalistic exposure to such research, and increased awareness among the public and changing attitudes toward climate change in general. Although our study does not analyze the stance of the science-related news, other researchers highlight the dichotomy between the Global North and South in their attitudes toward climate change. Although media in the South is increasingly pro-climate, climate skepticism has remained at the center of climate science debates in the north [9,19,51].

Surprisingly, the appearance of climate finance as a separate topic within media literature is relatively sparse, even in a business newspaper. The scant references that do exist emerge from developing countries. For example, Pulver and Sainz-Santamaría (2017), in their analysis of Mexican media attention, highlight media debates on alternative investments for mitigation efforts [81]. Closer to home, Das (2020), in her account, defines climate finance as a separate frame and quantifies its contribution to about 14% of the news samples extracted from the three most influential Indian broadsheet papers. When compared to Das (2020), climate finance appears to be a comparatively minor topic in our research. Specifically, Das (2020) focussed on a restricted time span of 14 weeks each in 2015 and 2016 around the COP21 and COP22 meetings [82]. That probably explains a higher concentration of climate finance-related news stories as compared to our corpus, which covers a much larger time span and hence has a broader scope.

With climate cooperation as well as sector-specific responses prominently dominating climate themes, this study clearly highlights the prevalence of both introverted domestication, where climate change is viewed as a local issue, as well as extroverted domestication, which connects global as well as local facets of climate change [83,84]. The results of Keller et al. (2020) also endorse the presence of introverted as well as extroverted domestication frames in the Indian media coverage of climate issues.

Clearly, there are interesting parallels and contrasts to be drawn when we analyze the findings of the study in light of the mass news media. Although a direct comparison of the findings with business media would add to the narrative, the lack of literature in the area poses a problem. The few studies which analyze climate frames are centered on the U.S. These studies conclude that the American business media frames climate news in the context of politics and uncertain science or presents them using conflict frames [85]. This is in contrast to the diversity of frames that we find in our study. Furthermore, existing studies find that business media is less likely to cover economic losses of climate change, a striking difference from what we observe in our data [34].

7. Limitations and Future Research Agenda

One of the limitations of this research is probably the exclusive reliance on a single business newspaper, that is *The Economic Times*, for a perspective on the evolution of climate change reporting in Indian business media. This was due to the unavailability of long-term digital archives of other business newspapers, and a systematic study of the evolution of climate change reporting warranted that we cover a long period of time.

For our study, *The Economic Times* seemed to fit in quite well, as it was not only the largest circulating business newspaper in India, but its readers are considered to be educated and economically prosperous, as well as predominantly young. Although this risks it being classified as 'prestige press', the nature of our study requires it to be so. Our research looks at the issue-attention and agenda-setting role of business media, which is an important precursor to or a relatively accurate mirror of action from the business community. Although research on the agenda-setting role of business media has been rather limited, past studies have highlighted the role of media in corporate reputation as well as the public image of companies [24,62].

This study could be broadened to include other business newspapers in India, covering larger periods of time. Another line of inquiry could be based on a comparative analysis with mainstream media. Further, a separate area of research could be the trends in climate change reporting in local media, and in a country like India, climate coverage in regional languages. On similar lines, Bohr (2020) considered 52 U.S. newspapers that were geographically and ideologically diverse, looking beyond the 'prestige press' and highlighting how the climate change issue was often contextualized at the local level [20].

8. Conclusions

Although previous studies show that Indian media coverage was dominated by international summits and politics about climate change, our study shows that such international focus is on the decline. Instead, domestic sector-specific news is on the rise. In effect, it mirrors India's change in international stance on climate change, from external responsibility to an increasing focus on sector-specific concerns, particularly related to electricity and energy needs. India's energy transition also features prominently in Indian business news. Surprisingly, the theme of climate finance—an important issue in international politics on climate change—is absent in the coverage of climate change news of *The Economic Times.* To the extent that the Indian business media accurately reflect the concerns and aspirations of the Indian corporate sector, the analysis indicates climate change has clearly made its way as a domestic, cross-sectoral priority for Indian businesses. The significance of global cooperation as well as national sector-specific priorities in Indian business media also indicates a balanced and pragmatic approach to agenda setting, especially in the context of India business.

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