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Climate Change and Urban Citizens: The Role of Media in Publicising the Conservation of Green Spaces and Mitigation of Air Pollution

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Abstract: Urbanisation has become a challenge as the urban population grows while cities' land areas, amenities, and green spaces have remained relatively unchanged or even declined. While urban areas are growing, the link between humans and nature is fading. Increasingly, cities are being affected by climate change impacts and so, the role of media in providing updated and correct knowledge to the public is becoming more valuable. Based on this theoretical ground, the research evaluated two printed Iranian newspapers' functionality in informing the public on Tehran climate based on two main themes of air pollution and greenery spaces, spanning seven years (2007–2014). The paper evaluated the tone, style, and outline of messages publicised by the press media to explore the following questions: Which types of news are dominantly conceptualised as the significant debates and concerns on Tehran's climatic issues? Who is mainly writing about Tehran's climatic issues? Is the public being informed effectively on the surrounding arguments and issues by reading newspapers? As such, five self-descriptive indicators were developed: 'Layout' (Title, Subject, Content), 'Message' (Public Awareness, Educating, Alarming), 'Contributor' (Columnist, Researcher, Authority), 'Spatiality' (Local, Provincial, National, International), and 'Allocated space' (10% to 100%). A text analysis of Persian newspapers using a Structured Query Language (SQL) was employed to extract data. It was found that the news articles mostly covered public awareness, followed by alarming messages on climate. The findings highlighted the critical role of researchers in generating scientific news while encouraging media for disseminating more educating messages on climate change in urban areas.

Keywords: Tehran; climate change; green space; air pollution; newspaper; SQL

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1. Introduction

Globally, rapid urbanisation has been a distinctive hallmark of the last two centuries [1]. By 2030, over 60% of the population will live in cities [2]. More importantly, 96% of urban growth will happen in the least developed countries [2], where they are already confronting numerous challenges.

Land-use change and transitions due to urbanisation are common in all countries' history in all continents. At the regional level, urban sprawl in the East and Southeast Asia regions has been enormous. A report found that urban land in this region has increased by about 22% in only ten years from 2000 to 2010 (Schneider et al. quoted by Daudey and [3]. In China, 70% of all built-up lands and over 50% of all new built-up lands developed between 1990 and 2010 were included in village landscapes [4]. Even in Europe, the urbanisation process was accelerated in the post-war period. At the country level, Italy experienced a land loss for urban use of 80 ha/day between the 1950s and 2000 [5]. During 1950–1960, the annual land uptake was 3.9% in the Helsinki metropolitan area [6].

Urbanisation has become a challenge as the urban population grows while cities' land areas, amenities, and green spaces have remained relatively unchanged or even declined. While urban areas are growing, the link between humans and nature is fading. Old,

extensive urban gardens and landscapes have been demolished in many cities. For instance, most of the new built-up areas in 34 Finland cities were previously different forests [6]. This disconnection with nature and declining green spaces is happening in cities that generate 70% of global carbon emissions [2]. The urban green spaces have lost biodiversity [7] and have become places for entertainment and festivals rather than aesthetical landmarks and biodiversity hotspots. Yet, due to the loss of natural habitats, wildlife remain in urban areas as inevitable locations for nesting, flying, breeding, and feeding [8].

Urbanisation and urban formation in Iran, like other developing countries, have been uneven, unplanned and mismatched to any patterns but primarily political willpower over the past. The total number of cities in Iran rose from 191 (1956) to 617 (1996) to 1139 (2001) [9]. A staggering number of cities were formed in Iran in 15 years (1996–2001), in which an average of one city was evolved every ten days [9]. Urban studies in Iran reveal that almost all these newly built cities were promoted directly from villages, of which around 54.39% (551 cities) have a population of less than 10,000 [9,10]. The public sees such promotion as a means to improve lives and to benefit from better facilities and services, while governments see this as an approach for decreasing villagers' immigration to larger cities [10]. As the capital city, Tehran has not been an exception to other cities in Iran. It was a village that changed gradually into a metropolitan. For instance, 2 towns and 132 villages were merged to form Tehran in just 10 years between 1956 and 1966 [11]. This rapid transition has dramatically changed Tehran's quality of life over the past [12].

However, how (effective) are urban daily issues disseminated in Tehran? This research paper will assess two mainstream newspapers published in Tehran regarding the representation of news on Tehran climatic change and mitigation issues. The paper indirectly evaluates the tone, style, and outline of messages publicised by the press media. It seeks answers to the following questions: Which types of news are dominantly conceptualised as the significant debates and concerns for Tehran's climatic issues? Who is mainly writing about Tehran's climatic issues: Are news presented by typical columnists or researchers and authorities? Is the public being informed effectively on the surrounding arguments and issues by reading newspapers?

This article opens the discussion on the public dissemination of urban issues, especially urban climate, through the lens of early efforts and documents at a global level. Debates will be narrowed by compiling recent achievements and manifestations of newspapers to publicise urban problems and their panaceas. The article will then focus on data compiled by two Iranian newspapers and a novel approach using a relational database system to extract information. The findings will be followed by comparing Iranian experiences with those of global findings. The final section will complement and suggest new avenues for future analyses.

2. Global Perspectives: Media and the Cities

2.1. Conveying Urban Challenges to the Public: A Historical Progression

Historically, air pollution was the first documented urban climate issue. The relationship between air and health was noted by Hippocrates as part of the book *Airs, waters and places* [13]. The earliest legislation called the "Smoke Abatement Act" that prohibited the use of coal was enacted in England in 1273 [13]. In the nineteenth century, Ildefonso Cerdà coined the modern urbanism idea and was the first to transform a data measurement approach about key urban statistics into a city science [14]. He is also regarded as the first scientist who indirectly explored urban climate issues by studying transportation, energy flux, and global characteristics about the quality of life in a city based on sunlight and ventilation [14].

At the same time, over the water channel, the British industrial cities were experiencing smoke pollution rising to unprecedented levels due to a more than tenfold increase in total coal consumption [15]. London was portrayed as a city of fog in international media and the British press from the mid-19th century [16]. Since then, the city's famous fog images

have also become an icon of air pollution in Chinese media to frame China's pollution problem [16].

Newspapers have become effective conduits to inform, publicise and warn the public about various urban living conditions over the past two centuries. The publication of the first Iranian newspaper in 1837 first became a symbol of a progressive state in the eyes of Qajar rulers, but then it became a threat to their existence [17]. Nevertheless, since then, the Iranian press has gradually become an urban emblem and covered a diverse range of urban issues, from politics to the environment. Newspapers have also acted as catalysts of science dissemination for urban citizens. As early as 1853–1856, for instance, newspapers effectively disseminated prevention and treatment information on the cholera pandemic in Portugal cities [18]. In the burgeoning Chinese press in the 1870s, two contrasting images of London were represented: London as a city renowned for its humid and foggy climate, and London as a city polluted by coal smoke [16]. This latter example depicts the ability of newspapers to transmit trans-oceanic sentiments, from the UK to China, when it took months for such news to be obtained, to justify the national urban issue.

With growing literacy and printing technologies, newspapers' style, tone, and functions have also been enhanced. These daily papers have been transformed into untamed beasts to play a more significant role in urban societies. The political, social, economic, and environmental acumen of authors and columnists has changed many unfavourable and unfair urban settings over the past. "The print media discourse not only mirrors the ongoing socio-cultural processes but also shapes them" ([19], p. 127).

Nowadays, concerning urban studies, the subjects, outlines, and views captured in press media, especially newspapers, have become more varied. Franco and Ortiz [20] evaluated the media's role in the dissemination of urban models for Medellín based on 405 news items published in 144 newspapers from 21 countries between 2004 and 2017. They showed that Medellín's urban model was highlighted as an inspirational source for other cities, from the most violent city to the most innovative in the world. Garz [21] investigated unemployment news' effects on economic perceptions based on several newspapers in Germany. It was shown that "the amount of reports decreases when competing newsworthy events occur at the time of the release of the monthly unemployment" ([21], p. 172.) Grabkowska [19] assessed urban space in Poland after 1989 as a benchmark year for restoring the press' freedom. Based on print media discourse, the study covered ten years (2006–2015) in two newspapers and two magazines and concluded that the issue had become a matter of public debate in Poland press media.

Among many news varieties, newspapers have captured urban environmental matters on various scales, from global (Rio Conference: [22]) to national (Australian Magpie bird: [23]) to local (a local zoo: [8]). Improvement in print technology has illustrated more alluring images and photos of animals, plants, landscapes, and dramatic urban calamities, while the internet expansion has enabled newspapers to reach out to the public more broadly and rapidly.

2.2. Analysing Urban News Articles

To assess the impacts and outcomes of the new human-based activities, conditions, and environments in urban studies, documents (governmental, official and publicly available), interviews, surveys, workshops, and expert panels, historical records, grey literature, journal archives, newspapers, websites, social network accounts, and blogs are used (e.g., [20,24–27]. These non-experimental data have increasingly become a part of growing research initiatives.

The abundance and accessibility of open digital resources and a transition from static to dynamic and streaming data (e.g., social media and social networking) have cleared the way for scholars to adapt their research and analysis methods to this new data-rich condition [28].

Besides, research is increasingly being contemplated on the combination of qualitative data types to resolve the problems. For instance, Rumson and Hallett [29] proposed to

utilise a diverse range of qualitative data (from interviews to social media and claims data) together with quantitative (environmental) data to facilitate the insurance of coastal flood risks.

Such qualitative documents are typically published and released in their local language, limiting the access of others to use these documents. These methods are categorised under the 'text analytics' methods that use technology to "turn text into numbers by adding structure to the text data to make the analysis possible" ([28], p. 6). Along with these diverse techniques, the content analysis of newspapers as a straightforward and normative way to explore (hidden) messages has also been in place for decades: from the early papers published over half of a century ago (e.g., [30]) to the latest ones (e.g., [31]).

3. Data and Methodology

3.1. Studied Variables

Cities have become major hubs for financial, educational, and health activities. As such, daily commutes, commodity trade, and housing are increasingly exerting unprecedented pressure on urban ecosystems and escalating climate change concerns. Cities are driving forces for global growth, but in the meantime, they must be transitioned to achieving sustainable development goals [2]. Terms, such as urban heat islands, urban flooding, and cities' emissions, reflect the severity of growing urban risks resulting from climate change, while green roofs and low-carbon transportation are becoming iconic representations of eco-cities and urban capacities for climate change adaptation (e.g., [32]).

There is a universal call for linking green infrastructure with air quality and human health [33]. Such an assertion magnifies the interlinkage/interaction between these two critical environmental variables (green spaces, air pollution) and between them and human health. Expansion of greenery spaces could reduce air pollution while potentially lessening risks and hazards for human beings. Notably, research highlights the impacts of each of these environmental variables on the health of the urban population separately (i.e., air pollution and human diseases, greenery spaces, and longevity). Therefore, we used two critical variables ('air pollution' and 'green space') for the evaluation of climate mitigation and adaptation strategies in Tehran.

3.2. Data Type

The study covers the Tehran province, which includes the Greater Tehran city and surrounding small towns. Based on the content analysis of news articles, it considers two mainstream newspapers published in Tehran: *Hamshahri* and *IRAN*, spanning seven years (2007–2014). The literal translation of '*Hamshahri*' is 'fellow citizen'. These newspapers release information in Persian with more or less the same coverage and style [8].

3.3. Database

Our database was part of a larger data collection that was used to investigate and assess three newspapers to publicise the public on environmental issues in Iran (6600 entries: [34]). In that study, all news articles were read twice and classified under several groups, including water, wildlife, etc. Each news article was considered only for one group and so, we did not assume multiple groups for one article. We developed these self-descriptive indicators that cover five major themes: 'Layout' (Title, Subject, Content), 'Message' (Public Awareness, Educating, Alarming), 'Contributor' (Columnist, Researcher, Authority), 'Spatiality' (Local, Provincial, National, International), and 'Allocated space' (10% to 100%).

Here, we re-employed our search algorithms to extract only those topics concerning green spaces and air pollution in Tehran. As such, our dataset comprised a spreadsheet file containing those relevant words on Tehran extracted from two newspapers. They were classified in rows ('records') under the subjective columns ('fields'). Rows included each news article and columns included selected self-descriptive indicators.

3.4. Data Analysis

This research employs text analysis of Persian newspapers using a Structured Query Language (SQL) as a rare technical novelty in assessing news articles. This computational model of analysis makes the possibility to cross-check and extract hidden messages and words among the texts. There is also a shortage of such rigorous cross-disciplinary studies in urban climatic studies, and thus, this research will add a new dimension to the international literature. We found only one article by Klein et al. [35], who analysed web-based documents to evaluate the private sector's role and citizens' climate change adaptation of 402 cities globally.

For content analysis of newspapers, we employed a relational database management system (RDBMS) composed of algorithms that allow us to manipulate data based on a series of rules, constraints, and filters [36]. Here, we exported the prepared database, as described above, into a SQL-based database management system. Based on the rules and algorithms of SQL, we made various queries.

4. Results

4.1. Distribution of News on Environmental Topics

As is shown in Figure 1, half of the environmental news on Tehran was published to cover two topics: air pollution and green space, followed by wildlife and waste management.

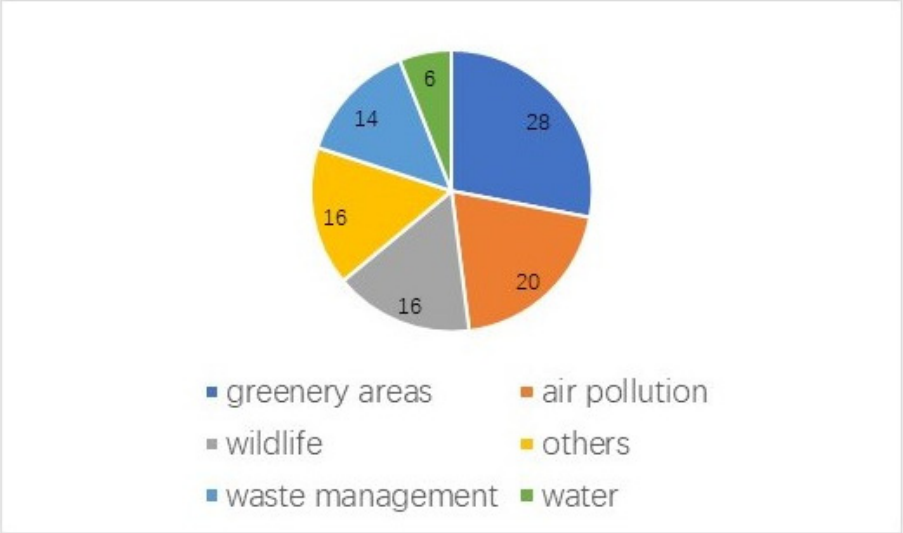

Figure 1. The share (%) of environmental news covering Tehran in two newspapers.

4.2. Analytics of Individual Indicators

As mentioned earlier, we considered two proxies (sub-themes) for assessing climate news: air pollution and green spaces. Table 1 summarises two news articles to provide international readers with the typical style and content of news articles. The news sub-themes and features have been expanded for analytical purposes in this research only.

Table 1. Typical news articles on Tehran with climate subject (translated to English).

Title of News Article	Newspaper	Sub-Theme	News Features
Increasing the level of UV in Tehran between 10 a.m. to 4 p.m.	IRAN	Air pollution	Contributor: Columnist Message: Alarming Spatiality: Local Allocated space: 0.1 page
Tehran has become greener	Hamshahri	Green spaces	Contributor: Authority Message: Public awareness Spatiality: Local Allocated space: 0.3 page

Each individual indicator was analysed further. The allocated spaces for Tehran climate news varied between 10% or less to a full page. Only 10% of articles were allocated a full page, while 47% were allocated 10% or less. Most news was related to public awareness (79%) followed by alarming (21%) messages. Those alarming news covered the air pollution issues of Tehran. Regardless of the message type, the majority of news was written by authorities, followed by columnists. Authority was defined as a person with a high-ranking decision-making post in a relevant organisation. Researchers were involved in 5% of the news articles. Except for one translated international news, other news articles were related to Tehran.

4.3. Combined Indicators

Using SQL-based algorithms, we could extract relationships between two or more indicators in combined (e.g., Contributor AND Message AND Spatiality AND Allocated space), which would not be achievable without running SQL codes. Such an approach assisted us to explore hidden and unrelated aspects of news articles of two newspapers embedded among all entries. For instance, one of the news articles published in the IRAN newspaper was on 'air pollution' (Subject). Using SQL codes, we found out that this news article was written by an authority (Contributor) and as alarming (Message) news and was allocated 10% of a newspaper's full page (Allocated space). In this instance, we combined four different indicators to extract information.

Table 2 reveals a few queries by crossing two or more indicators that otherwise would have been difficult, if not impossible, to do without using SQL-based algorithms. We have mentioned only a few queries here, but it could be continued to generate more queries.

Table 2. A few representatives of the crossing of two or more indicators.

Description	SQL-Based Coding Variables	% of News Articles	Number of Combined Indicators
Those news articles with air pollution subject written by authorities	*air_poll* AND *auth*	42%	2
Those news articles with air pollution subject, covered a full page of a newspaper and written by authorities	*air_poll* AND *spa_1* AND *auth*	5%	3
Those news articles with air pollution subject, covered a full page of a newspaper, written by authorities, with a public awareness message	*air_poll* AND *spa_1* AND *auth* AND *P_A*	5%	4

The overall findings of our cross-examinations of two or more indicators revealed that 'authorities', rather than 'researchers', mostly wrote news articles related to the Tehran climate. In one instance, an authority from Tehran Municipality reported the extent and costs of a project to expand a particular green space area. In another news article, an authority

from the Tehran Air Quality Control Bureau reported the high level of toxic gases exhausted from commuting cars across the city. Such news articles were short and did not cover more than half a page of a newspaper. Moreso, they were not presented analytically or scientifically and had no educational message.

5. Discussion

In this section, the results of the quantitative analysis of newspapers' features are investigated while two themes of air pollution and greenery space are discussed further. Then, the findings will be linked to brief historical changes in Tehran. The final part will emphasise global approaches and strategies to deal with a growing population and urban challenges.

5.1. Climate News Encapsulated by News Articles

We return to our earlier questions and decode their answers separately here:

Q1. Which types of news are dominantly conceptualised as the significant debates and concerns on Tehran's climatic issues?

Air pollution and green spaces were two critical topics in the news, followed by wildlife and waste management. We used these two dominant issues as our proxies to assess climate-related responses in Tehran. Two top environmental challenges that were prioritised here (air pollution and green spaces) conform to the actual situation in Tehran. We will discuss these challenges in detail in the following sections.

Q2. Who is mainly writing about Tehran's climatic issues: Are news presented by typical columnists or researchers and authorities?

We showed that authorities wrote most news while researchers did not show high interest and the columnists were in between these two groups. Typically, as stated elsewhere [34], Iranian researchers are not interested in presenting their scientific findings or writing articles in Iranian newspapers, as universities do not consider these outputs as credible points for academic promotions.

Q3. Is the public being informed effectively on the surrounding arguments and issues by reading newspapers?

We revealed that a tiny proportion of pages were presenting climate news for Tehran during our study timeframe. The public cannot be benefitted from such short and incomplete news articles. It was not just climate issues that were not covered well. Other hazardous issues have the same fate. According to the comprehensive seismic studies, as a severe probable scenario for Tehran, an earthquake hazard is imminent as the city lies on significant seismic faults. Since years ago, these seismic activities have been monitored by the Earthquake Hazard Management and Prevention programme of Tehran Municipality, concerning the technical investigation and training of the public on earthquake incidents [37]. Although such news articles were not considered in our research, we curiously looked at the news subjects from our original file. Surprisingly, only one news article on the Japan earthquake was published, while no newspaper covered Tehran's probable earthquake scenario.

5.2. Tehran and Climate Challenges and Actions

As the capital city, Tehran faces multi-dimension and multi-layer social and environmental problems. As such, the relocation of the capital from Tehran has been proposed. Many areas of concern, such as earthquakes, flooding, crimes, etc., are out of the scope of this paper to be assessed. Because of the over-withdrawing of groundwater resources, the city faces land subsidence at the rate of several centimetres per year [38]. This overexploitation of water resources results from unforeseen urban planning, unprecedented population growth, and agricultural expansion of Tehran's suburbs. However, the underground water issue can also be partly related to the overall climate change pattern observed in Iran as the country is experiencing more frequent drought events (e.g., [39]).

5.2.1. Air Pollution

Data show that the air quality index in Tehran recorded the highest level for 2016 (208.49 ± 42.13) and the lowest for 2011 (134.13 ± 46.80) during the period 2011–2016 [40]. Thus, noting air pollution as the second top news in our seven-year research period (2007–2014) is not a surprise. Tehran is constrained by several natural factors, including topography, low and infrequent winds, and rainfall. However, the number of vehicles and motorcycles is also rising in this city. These can collectively make air pollution more noticeable. During this particular timeframe (2007–2014), Tehran's air pollution worsened. In almost 1000 days, between 2010 and 2012, Tehran experienced spotless air only for 20 days (2%) [41]. One specific news article revealed the high UV index of 8 at 1:00 pm, which is usually one of the traffic rush hours in Tehran.

Since the end of the timeframe of our research (2014), however, the air quality of Tehran has not been improved. The total clean air figure was only slightly improved (5%) for the five years between 2014 and 2018, including 29 days in 2018 [37]. One specific reason was the low quality of vehicle fuels produced in domestic refineries, although experts also blame the inefficiency of internally manufactured car engines. In our research, several news articles referred to these shortcomings and highlighted the poor quality of both car engines and fuels. One problematic factor could be polluting vehicles (light and heavy duty) running across Tehran. According to the laws, each vehicle must obtain a "technical inspection certificate of air pollution" annually. An annual Municipality report [37] indicates that nearly half of the vehicles tested in 2018 could not pass the test. In November–December 2019, the high concentrations, as high as 146 micrograms per cubic metre, of hazardous airborne particles were again recorded, exceeding the World Health Organization's advised maximum level of 50 micrograms [42]. Such a high level of toxic smog forced schools and universities to close, whereas the young and elderly and people with respiratory illnesses were warned to stay indoors [42]. For the first time, theses school closures were extended for five consecutive days in one week. This worsening air pollution, in late 2019, once again launched public media queries on the effectiveness of the existing laws on air pollution in Iran.

A news article published by the Iran Student News Agency website criticised the ignorance and lack of competence of the responsible organisations and reminded them of their clear accountabilities regarding the observance of two laws concerning air pollution [43]. The first one, The Prevention of Air Pollution Law, was approved by the Parliament in May 2005 and included 36 Articles [44]. This law explicitly asked nine governmental ministries and organisations, plus the Department of Environment, to reduce air pollution actively. It also warned factories, mines, power plants, refineries, restaurants, hotels, bakeries, and vehicles to prevent polluting the air and considered both cash and imprisonment penalties for those cases disregarding the law [44]. About 12 years later, in 2017, the second law, the Clean Air Law, was approved by the Parliament and included 34 Articles [44]. This later law was drafted better in terms of technicality in which polluting sources and the accountable organisations were defined as broader and more detailed. For instance, Article 11 (Paragraph 3) of the Clean Air Law delineated the establishment of online air monitoring systems in all medium- and large-scale manufacturing units that transmit updated air pollution data to a monitoring centre [44]. Perhaps it can be seen as the first-ever law considering such detailed technicality in Iran's legislative system. Both laws asked to set up an emergency air pollution committee to evaluate the public health situation during severe air pollution. Uncontrollable vehicle traffic jams have caused many plans to be launched in Tehran, although some have been aborted and failed due to the number of vehicles rising while no streets are widened or adapted. In summary, there are no shortages of technical laws and regulations in the country, but how these are being obeyed and implemented. As a whole, Iran lost an equivalent of 2.48% of its GDP (2013) due to air pollution [45].

5.2.2. Green Space

In our research, almost one-third of the news was related to green spaces (Figure 1). News articles covered various topics, including a few news articles that described the "Tehran Birds Garden". This type of news article was promoted by Hamshahri newspaper as the official newspaper of the Tehran Municipality. This tourist compendium is located inside a forested area in the northern part of Tehran. The garden is regarded as the first in terms of the area size (17 ha) and diversity of bird species (168 species) [46]. Development of such garden-style and forested thematic parks and entertainment resorts across Tehran has been the aim of the "Tehran Beautification Plan" over the past decades.

Concerning urban green spaces at the national level, a technical law on preserving urban green spaces was ratified by the Iranian parliament as early as the 1970s. The first law, the Law on Preservation and Expansion of Green Spaces and Prevention of Tree Cutting, including 12 Articles and 9 paragraphs, was passed by the Iranian parliament in August 1973 [44]. It explicitly prevented the cutting of all types of tree species with a diameter larger than 50 centimetres without permission from the then Ministry of Agriculture and Natural Resources. For urban areas, in particular, the law enforced the municipalities to monitor the content of the law precisely and prepare a detailed database for collating information on all trees existing in their constituencies [44].

After the Iran-Iraq war, a turning point occurred regarding Tehran city planning and management. A new Western-educated mayor was selected. Along with other envisaged developmental activities, a series of Western-style beautification plans were launched to mask the war's ugly side and promote the new post-war era's spirit. An effective measure regarding parks and green spaces was to remove iron fences around the parks, pave the sidewalks, dye the park furniture, etc. (Figure 2). "The construction of three-and-a-half times as many parks as existed previously has had a similarly profound aesthetic, symbolic and social impact" ([47], p. 25). Tehran municipality's ambitious and costly renewals and developmental plans have been funded mainly by levying new fees on commercial construction and taxes on fixed properties [47]. Such parks have been a relief for those residents living in tiny flats affected by anxiety and lack of green spaces (Figure 2).

Figure 2. Modern Tehran urban life: a view of two different parks in the city north (**top-left**) and in the city centre surrounded by high-rise buildings (**top-right**); the symbolic first railway wagon used as a way of transport between Tehran and Ray city about one hundred years ago, located in one of Tehran's parks (**bottom-left**); inside of a typical small apartment in the city centre: Sources (**bottom-right**): Author.

The current average per capita green spaces ratio for Tehran is about 16 square metres [37]. Noticeable size area gaps, varying from 2.58 to 58.67 square metres (SD ± 13.27), exist among Tehran's municipality districts ([37]; Figure 3). It reveals a per capita difference of 23 times between the lowest and largest areas. The total area for inside and surrounding parks and forested areas in Tehran is estimated as 59 million m^2 of which the lowest share (3.3%) belongs to locations with over 100,000 m^2 and the highest share (39%) to locations with 1000–5000 m^2 green spaces [37].

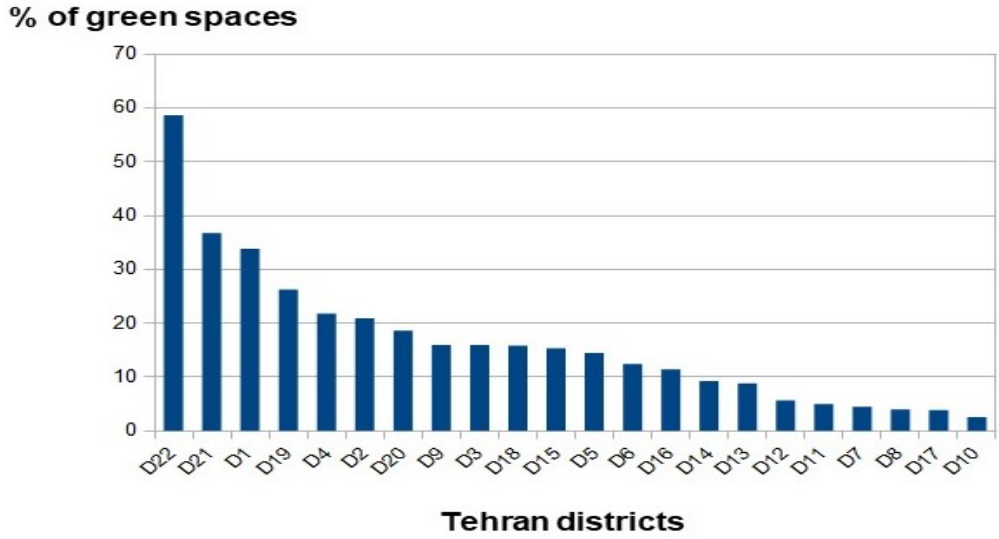

Figure 3. Distribution of per capita green spaces across Tehran districts.

5.3. Tehran Landscape Transition: From Garden to Garbage to Garage

Looking back to the recent centurial history of Tehran, one notices a massive expansion from just a tiny and insignificant village to a metropolitan city by the early 21st century: "from a pre-capitalist city in the 18th [. . .] to a dependent capitalist city after the 1950s" ([48], p. 167). An American geologist and petroleum advisor to the then Government of Iran in 1927, passing through Tehran in late 1927, described Tehran as a city encompassing beautiful gardens and a 200,000 population, surrounded by several villages in the north [49]. Those described villages surrounding Tehran have been converted into luxurious and expensive streets and houses are located within Tehran's municipality districts. Those inner-city gardens have been converted into ugly, high-rising buildings or highways, and the stated 200,000 population has reached 9 million. Tehran's story is a case study of "the tensions of modernity and globalisation" ([50], p. 57).

During our research timeframe (2007–2014), the Tehran population rose from 7.8 million to 8.5 million, with an annual average of 1.05% growth [51]. Population statistics for the past centuries in Iran are speculative and generally based on records written by foreign missionaries and travellers. Existing unofficial records put 150,000 as the population for Tehran in 1850 [48]. Compared with the Tehran population of about 9 million in 2018 [37], it suggests a population increase by a factor of 60 in about 170 years. Considering the city's official census reported about 4.5 million in 1976 [48], it has revealed that the Tehran population doubled in the recent four decades. Tehran's size area has also been enlarged by a factor of 70 in 124 years from 19.5 km^2 in 1894 to 1335 km^2 in 2018 (including suburbs and buffer zones) [11,37]. Notably, most of the expansion has occurred in the last four decades, as Tehran's area was just 250 km^2 in 1976 [52].

It is true that the capital city primarily reflects the legitimacy and polity of the states [53], and this notion has been with Tehran over the past centuries. Iranian monarchs had significant impacts and influences on the city form by interventions to "destroy and rebuild, demonstrate and glorify, and impose and create" ([11], p. 333). During 1925–1941, Reza Shah dictated secularisation, nationalisation, modernisation, and Westernisation to

make an impression on the world [11,52,54]. During that period, the Tehran population was doubled even though neither the quality nor quantity of utilities (e.g., water) had been improved noticeably [54]. As a transitional capitalist city in the 1920–1950 period [48], the city was modernised hastily and based upon Turkish, French, and German models. Even the idea of establishing the first Municipal Corporation (the Municipalities Act of 1913) was borrowed from the West [11]. Following surging oil revenues, the *first* major known rural-urban migrations in Iran were started in pursuit of new job opportunities and relatively improved medical health services in urban centres [54]. Since then, more populations have moved to Tehran and created significant problems.

Contemporary Tehran has seen alterations while its citizens' expectations and needs have arisen. Municipalities across the country, including Tehran, are vital stakeholders in making the cities cope with climate change by planting plant species tolerant of rising temperatures or expanding green spaces [55]. Moreover, Tehran City Council is an entity with members elected by local citizens and monitors Tehran Municipality's annual executive plans and budget. In the past, Tehran has lost much of its gardens [12]. Therefore, the Tehran City Council has urged Tehran Municipality to allocate a specific budget for purchasing those last remaining green lots and gardens from individuals or organisations. In 2018, the Council approved 209 Regulations and Acts, of which one-third were related to Tehran gardens and green spaces [37]. There were three major large-scale Acts among these approved Regulations and Acts: issuing identification certificates for individual gardens and forested lands, the amendment to the Act of Preservation and Expansion of Green Spaces and levying fees for the relocation/removing of trees in Tehran. Other Acts were related to the remaining individual gardens and forested properties across 22 Tehran districts [37].

5.4. Urban Policies Worldwide

Over the last century, with rising population growth, urban sprawl, and the mass production/manufacturing of commodities (including private cars), cities have also become sources of pollution, more importantly, air pollution (e.g., [13]). Acute health issues and morbidities due to air pollution incidences in cities of developed countries have launched public actions for imposing health rules, coal-burning restrictions, and better-quality transportation systems in large cities. Notably, the Great Smoke of London in 1952 gradually paved the way for the Clean Air Act in 1956 that restricted coal-burning [56].

Local governments and municipalities struggle to keep constant pressures in balance given their limited financial resources, waste disposal, housing, increasing climate change impacts (notably across coastal cities) and unprecedented global incidents (e.g., the recent COVID-19 pandemic) (e.g., [57]). In the meantime, the public is raising its voice by forming urban climate movements (e.g., Extinction Rebellion) to pressure policymakers on climate change through direct action [2]. Thus, the only possible cheaper solution to mitigate climate change impacts in the cities could be public engagement (e.g., [57]) and public awareness [58]. These so-called adaptive capacities [58] could be feasible via the mediation of media to reduce consumption, mitigate the impacts and increase the adaptability of urban citizens to changes.

Diverse strategies for the protection and expansion of green spaces are widely implemented across the world. Municipalities turn to nature to mitigate pressing environmental, economic, and societal challenges [59]. As such, nature-based solutions, inspired by nature, are recommended and implemented in urban areas (e.g., [59–61]).

6. Conclusions

Media are vital and influential conduits for transferring updated knowledge and news to the public. Nevertheless, a little effort has been made to use such powerful change instruments to publicise urban citizens on various climatic issues that affect their life, especially in developing countries. We presented Iran's case as a representative of this research.

As rare research to link urban climate studies with SQL-based data analysis, we employed quantitative and qualitative datasets and information to evaluate major printed newspapers' functionality in informing the public. We revealed the subjects, tones, outlines, and views captured by two Iranian newspapers. Findings were diverse but equally relevant to contemporary Tehran. These parameters reflect the actual situations regarding social, cultural, economic, and environmental issues in Tehran.

We demonstrated attempts to increase green spaces and highlighted news articles that address these efforts in Tehran. Such actions could become mitigation strategies to reduce air pollution. Nevertheless, the effective link between the public and on-the-ground attempts was missing, and the approaches the newspapers were taking were inadequate. There were no educating messages for addressing the growing concerns of climate change impacts on Tehran. The role of the researchers in generating scientific news on Tehran climate challenges and actions was not appropriate and was substituted by authorities' short and informing news articles.

While cities are increasingly becoming potential sources of climate warming and air pollution, they could also become a part of the solution to overcome these challenges. More research is needed to capture the role of the media in assessing urban climate; however, this paper provided a novel scientific ground for similar data-driven research on other cities and their features by integrating data analysis techniques and qualitative explanations.

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