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Article

Factors and Strategies for Environmental Justice in Organized Urban Green Space Development

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Abstract
Increased demand for land for economic and residential purposes has engendered tensions among different land users in Indian cities. Consequently, the development and management of environmentally just and organized green spaces involve major challenges. In this article, using the context of three Indian cities (Bhubaneswar, Cuttack, and Kolkata), the factors that contribute to environmentally unjust development and management of organized green spaces were examined and various strategies that would lead to environmental justice were evaluated. A survey research method was used to collect data, followed by factor analysis and ordinal regression modelling. Findings suggest that factors under five principal components contributed to environmental injustice, including: community features and infrastructure related to organized green space; the economics of development and management of organized green space; linking green space to environment and health; spatial development, land use, and accessibility; and land availability and governance of the supply of green space. Strategies such as community-led, green space development and management; fair and equitable distribution of green spaces; improvement of accessibility; connecting green spaces to benefits of health; and mandatory linkage of built infrastructure with the provision of green spaces would ensure environmental justice.

Keywords
accessibility; economy; environmental justice; green space; India; land use

Issue
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1. Introduction

Organized green space is one of the essential uses of land for sustainable cities. However, increasing population leads to higher demands for land for economic, residential, transportation, and civic purposes which cause significant tensions among different land uses in Indian cities. Consequently, it is possible that land allocation for organized green spaces has been undermined. Furthermore, compromising of land use policies has been observed (Anand & Deb, 2017) and the challenges of insufficient green spaces and their differential development and management have been experienced (Mohapatra & Mohamed, 2015). For instance, in some cases, organized green spaces that were allocated for public purposes have allegedly been used for developing residential buildings or commercial activity centres. Similarly, in many residential areas of large and medium cities in India, organized green spaces have been found to be scarce, although, generally, some cities might have one or two large central green spaces. Further, since the value of land has increased significantly in most cities in recent decades, provision of adequate, organized green spaces, according to the norms for residential areas, specifically where most of the socially and economically disadvantaged sections of society live, has been found to be meagre (Praharaj, 2019). In addition, large construction activities have encroached on green spaces (Mishra, 2016; Praharaj, 2019). To add to the challenges, although provision has been made for organized green spaces in the planning of land use, sometimes, due emphasis has not been given to their development, management,

operation, and maintenance, leading to their misuse and degeneration (Mishra, 2016; Mohapatra & Mohamed, 2015; Praharaj, 2019).

It has been argued that this undermining of the provision of adequate and equitable development and management of organized green spaces leads to environmental injustice (Jennings et al., 2012; Kronenberg et al., 2020). Environmental justice is compromised in terms of inappropriate land use, skewed allocation of green space, and the occurrence of land, air, water, and solid-waste pollution, specifically in the areas occupied by the disadvantaged sections of society (Jennings et al., 2012; Venter et al., 2020). Essentially, this leads to a lack of social inclusiveness, as a large segment of the population remains bereft of organized green spaces (Ramirez-Andreotta, 2019).

Although according to the concept of environmental justice the differential exposure to environmental burdens and access to environmental benefits experienced by different socio-economic groups is highlighted (Schweitzer & Stephenson, 2007), the reality is broader and more complex (Jennings et al., 2012). Environmental injustice stems from claims that environmental burdens, such as landfills, toxic-emitting facilities, and other environmental hazards, are disproportionately located near socially disadvantaged groups (Bullard, 2000; Jennings et al., 2012). While unequal access to urban green spaces was not considered generally in research about traditional environmental justice, recent conceptualizations have been expanded to include issues such as equitable access to urban parks and other natural resources because of their association with economic, psychological, and cultural benefits (Leonard & Pelling, 2010; Rigolon et al., 2018).

Environmental justice encompasses distributive, procedural, and interactional (recognition) justice. Distributive justice is focused on the fair allocation of, or access to, benefits for all social groups. Procedural justice advocates the fair integration of all affected groups into decision-making processes. Interactional justice recognizes the interests of all stakeholders in a safe, fair, and non-discriminatory environment (Kronenberg et al., 2020; Low, 2013). Concerning environmental justice in green space development and management, several issues in different contexts have been identified and investigated. The issues range from unequal distribution to the design and placement of green spaces in different social areas in the Global North (Jennings et al., 2012; Kabisch et al., 2016). Similarly, in the Global South, issues included inadequacy of green spaces, unequal distribution, and lack of participation in decision making and recognition of people's needs, aspirations, values, etc. (Mohammed et al., 2021; Mohapatra & Mohamed, 2015; Nero, 2017; Venter et al., 2020).

In the Indian context, lack of adequate green spaces, their inequitable distribution (Kaur et al., 2021), and lack of inclusion of different social strata in development and management are observed (Mohapatra & Mohamed, 2015). Conjoined with the inequitable distribution and lack of access, specifically in under-privileged areas, an increase in land values and limited supply of land has led to tension between the use of land for green spaces and more lucrative residential projects and commercial activities (Zerah, 2007). Furthermore, the lower priority given to management, maintenance, and operation of green spaces in the budgets of developmental authorities reduces their quality. The combined effect of inadequate availability, access, and poor condition of the green spaces reduces the propensity of people to use them. This offers an opportunity to the pressure groups advocating the use of land or the transformation of green spaces for commercial purposes. Moreover, despite being within a democratic and participatory decision-making framework, factors such as the hegemony of political leaders, bureaucrats, and market forces predominate in the development and management process. Participation and recognition of people in the process of city development (Das, 2017), specifically green space development and management, are marginal. Thus, all three types of environmental injustice (distributional, procedural, and interactional) exist with regard to green spaces in Indian cities.

Consequently, there is a need to develop and manage environmentally just, organized green spaces in Indian cities. To achieve this aim, it is necessary to explore what factors influence the creation of such unjust scenarios and how the scenarios can be improved. Although several studies have been conducted around the world, such studies in the Indian context are limited, resulting in a significant knowledge gap. In this context, although several arguments and concerns have been raised (Praharaj, 2019; Riyan, 2019), very few scholarly research studies were found. For example, Mohapatra and Mohamed (2015) examined and discussed the urban processes for the planning and provision of urban open spaces and their impacts on cities. In another study, Mohapatra and Mohamed (2013) explored the association between recreational use and attachment to neighbourhood open space. Kaur et al. (2021) observed that there is an unequal distribution of green spaces among different social strata and argued for consideration of environmental justice in green spaces in the cities. Similarly, Singh et al. (2010) discussed the lessons learned from urban forests and open green spaces in a city of India.

Therefore, the objectives of this study were to examine the factors that contribute to environmentally unjust development and management of green spaces and to evaluate various strategies that would lead to the development of environmentally just, organized green spaces in Indian cities. For this purpose, the following research questions were examined:

1. What is the current status of organized green spaces in terms of actual allocation in relation to the recommended provisions made in different planning and development guidelines in Indian cities?

2. What are the perceptions of people towards the provision, development, and management of organized green spaces in Indian cities?
3. What are the principal components and factors that contribute to the development of environmentally unjust, organized green spaces in Indian cities?
4. What strategic interventions would create environmentally just, organized open spaces in Indian cities?

2. Literature Review

2.1. Concept of Environmental Justice

Environmental justice pertains to the fair treatment and meaningful involvement of all people, regardless of race, colour, national origin, or income, concerning the development, implementation, and enforcement of environmental laws, regulations, and policies. The challenges of environmental justice emanate from the existence of inequity in the distribution of environmental burdens in society (Schlosberg & Carruthers, 2010). In other words, the challenges of environmental justice are another form of social injustice where some communities incur more environmental risks than others (Dominelli, 2014; Seymour, 2012). However, the focus of environmental injustice has been expanded from inequity to a variety of issues that range from the generally unequal nature of environmental protection to the realm of distributional, procedural, and interactional injustices (Kronenberg et al., 2020; Low, 2013). For instance, the role of people's participation and engagement in the planning and decision-making, the needs, values, and aspirations of people, as well as universal access to health and safety, which are essential elements of social inclusivity, form a part of the discourse (Kubanza et al., 2016; Schlosberg, 2007; Seymour, 2012).

2.2. Environmental Justice in Organized Urban Green Space Development

Open green spaces include spaces that are characterized by vegetation and/or bodies of water, which contribute to biodiversity and multiple ecosystems. The green spaces that are systematically and legally planned, provided, and managed by public authorities in urban areas and form an integral part of urban land uses are defined as organized urban green spaces. Examples include parks at different levels of settlements, urban gardens, playgrounds, stadiums, bodies of water, green buffer zones (including green walls), plantations (including street-side trees), natural conservation areas, etc. (Grunewald et al., 2018).

The ecosystem services provided by organized green space for a sustainable built environment range from improving the environment, helping to reduce pollution, enhancing aesthetic value, providing health benefits, creating places for outdoor activities, to creating social cohesion. They also assist in flood control, groundwater recharging, preventing pollution, etc. (Rigolon et al., 2018; Wolcha et al., 2014). A sustainable relationship between green spaces and buildings, roads, and other public spaces would ensure sustainable urban development (Grunewald et al., 2018). However, in recent decades, a steady increase in settlement and transportation areas has been experienced to meet the demands of an increase in urban populations and activities, specifically in the Global South, including India. These changes in urban settlements have occurred at the expense of urban green spaces, compromising the health, safety, and ecosystems of the cities (Mahmoud & Gan, 2018).

Evidence from the literature from the Global South suggests that fair allocation, equitable development, and management of organized green spaces have been undermined (Ju et al., 2021; Mohammed et al., 2021; Nero, 2017). For example, in South Africa and Latin America, an inverse relationship between low-income areas or socio-economic status and the amount and condition of public green space has been observed (Jennings et al., 2012; Ju et al., 2021; Shackleton & Blair, 2013). Tendencies of differential availability of, access to, and quality of green spaces have been observed in India, Eastern Asia, and some African countries, such as Nigeria and Ghana (Mohammed et al., 2021; Mohapatra & Mohamed, 2015; Nero, 2017; Ye et al., 2018). In other words, disparities in the green space development according to socioeconomic status were observed across the Global South. Furthermore, the participation of people in decision-making was limited (Mohapatra & Mohamed, 2015). Also, due recognition is not given to people's needs, values, and preferences for a safe, fair, and non-discriminatory environment (Rigolon et al., 2018; Venter et al., 2020). Therefore, all three types of environmental injustice in organized green space exist in some form specifically in the Global South, although distributional injustice is largely highlighted. Therefore, all three types of environmental justice need to be addressed to develop environmentally just green spaces in cities of the Global South.

3. Study Context and Research Methods

3.1. Study Context

Three important cities in the eastern region of India—Bhubaneswar and Cuttack in the Odisha State, and Kolkata in West Bengal State—were chosen for this study because they provide regional and locational homogeneity and cultural similarity. These cities encompass significant commercial, industrial, and educational centres. Moreover, because of the emergence of a significant number of higher education institutions, specifically in professional domains, as well as ICT industries in all three cities, a significant, young, and active population is found in these cities. Concurrently, they offer structural, morphological, and functional heterogeneity. While

Bhubaneswar and Cuttack are medium-sized cities in the Indian context (tier 2; Ministry of Housing and Urban Affairs, n.d.), Kolkata is a mega-city (Torkington, 2016). Also, Bhubaneswar and Kolkata are sprawling cities, but Cuttack is compact. Functionally, Bhubaneswar and Kolkata are provincial capitals, whereas Cuttack is an old commercial centre in the region.

Large numbers of daytime visitors to the cities are experienced because of the significant, regional-level commercial activities that take place. The large, active age group of the population demands organized green spaces in the cities for various activities such as relaxation, health, and fitness, and rest during idle periods. Organized green spaces are located in the cities to some extent. Each city has some kind of central park located in an important centre. Similarly, smaller parks and children's playgrounds are found in some neighbourhoods (Bhubaneswar Development Authority, 2021; Cuttack Development Authority, 2021; Mohapatra & Mohamed, 2015). Although free access is provided to most of the green spaces, some of the large parks and gardens only offer paid access. However, skewed distribution of organized green spaces has been observed in the cities (Bhubaneswar Development Authority, 2021; Cuttack Development Authority, 2021; Mohapatra & Mohamed, 2015). Also, a majority of the green spaces are degenerating as a result of poor management and maintenance. It has been alleged that some of these had been used for other, more profitable land uses such as residential and commercial purposes. Therefore, these cities were considered to be important candidates for this study.

3.2. Data Collection

Data were collected from the study areas by means of surveys. Firstly, a survey was conducted among the households of the three cities to explore the respondents' perceptions of the provision, development, and management of organized green spaces, as well as the factors that influence environmental justice. Secondly, a Delphi survey was carried out to explore and evaluate the influence of strategic measures to improve environmental justice concerning organized green spaces.

3.2.1. Households Survey

The households survey was conducted by using a pretested questionnaire that consisted of two sections. The first section contained questions about the respondents' perceptions of various attributes related to the current provision, development, and management of organized green spaces. For this purpose, 11 attributes, which are used to evaluate the provision, distribution, adequacy, accessibility, and usage of green spaces by development authorities were chosen. These attributes were selected and included in the questionnaire based on discussions with the stakeholders responsible for planning, development, and management of urban green spaces, and experts. The second section included questions about the respondents' perceptions of various plausible factors that influence environmental justice in organized green spaces. In this section, the questions were asked on two levels. Firstly, respondents were asked whether a particular factor influences environmental justice. Secondly, respondents were asked to rate how influential each factor was on a scale of 1 (very low) to 5 (very high). However, the second level question was considered relevant and asked if the answer to the first level question was affirmative (see Appendix 1 in the Supplementary File).

A total of 670 questionnaires was administered, of which 610 completed responses were returned, giving a response rate of 91.04%. The survey was conducted by using a random sampling method and a semi-structured interviewing process. Interviews were conducted with households in various residential areas based on their willingness and availability to participate in the survey (see Table B in Appendix 3 in the Supplementary File). The areas were selected to represent geographical location, population, socio-economic and environmental heterogeneity, and availability of different types of organized green spaces. Care was taken to avoid bias towards any race, gender, or age of the respondents. Skewness to one group of respondents was avoided by deploying a proportional distribution of questionnaires among different groups of respondents.

The response rate of samples collected from Bhubaneswar, Cuttack, and Kolkata were 244 (90.37%), 162 (92.57%), and 204 (86.68%) respectively. The overall sample size was adequate (>385) at a confidence level of 95%, a confidence interval of 5%, and a worst-case percentage of 50%. Also, the sample size for respective cities was found to be adequate at a confidence interval ranging between 6.27% and 7.70% (Cochran, 1977; see Table A in Appendix 3 in the Supplementary File).

3.2.2. The Delphi Survey

A Delphi survey was carried out to explore and evaluate the influence of strategic measures to improve environmental justice concerning organized green spaces. For this purpose, 30 specialists were chosen based on their expertise, professional engagement, and experience in the development of cities, land-use allocation, and development of organized green spaces. The experts included: six architects, three landscape planners, seven urban planners, three entrepreneurs (real estate developers), two social activists, three civil engineers engaged in city development, two legal professionals, and four academics related to the field of study. The survey was conducted in two stages. In the first stage, the experts were asked to identify a set of strategies that could improve environmental justice. In the second stage, the experts were asked to rate the influence of the proposed strategies for improving environmental justice (see Appendix 2 in the Supplementary File).

The reasons for adopting the Delphi survey were two-fold. Firstly, not much structured, statistical data was available and expert opinion was relied upon to develop strategic interventions for this study through a rigorous analytical process. Secondly, a Delphi survey provides a structured communication process that enables a group of experts to address a complex problem effectively and which can provide more accurate answers to a question, based on triangulation and convergence of the opinions of various experts in an aggregated manner, compared with the opinions of individual experts or traditional/statistical groups in which judgements of non-interacting individuals are aggregated (Hsu & Sandford, 2007).

For both the households and Delphi surveys, a Likert scale ranging between 1 and 5 (1 = very low, 2 = low, 3 = fair, 4 = high, and 5 = very high) was used to measure the responses from the participants. In addition, secondary data about the norms and standards, as well as allocation of organized green spaces were obtained from the reports of various organizations related to the development of green spaces in the cities studied.

3.3. Data Analysis

Descriptive and inferential statistics, factor analysis, and an ordinal regression model estimation were used to quantitatively analyze the data. For this purpose, IBM SPSS 27, 2020 software was used. Also, qualitative narrative analyses of the opinions of experts were conducted.

Descriptive and inferential statistics, which included a perception index (PI), standard deviation (SD), and z-test, were used to assess the respondents' perceptions of the current provision, development, and management of green spaces in the cities. The mean Likert scale scores obtained from the responses were taken to represent the PI values. These values were calculated by assigning uniform weights to the response categories which remain unchanged for all items (Chakrabartty, 2014; Dithebe et al., 2019). The SD values were used to observe the consistency in the responses and the z-test results were used to establish the statistical significance of the attributes assessed. The z-test was used as the preliminary analysis of data and showed the Kurtosis values ranging between −0.873 and +0.911, and skewness ranging between −0.436 and +0.783 for all parameters (which are within the range −2 and +2), indicating normality (Hair et al., 2010; Kline, 2011). A PI greater than or equal to three and a p-value less than or equal to 0.05 indicate the performance of an attribute as being fair. Similarly, a PI greater than or equal to four and a p-value less than or equal to 0.05 indicate the performance as high. However, a PI less than three and a p-value greater than 0.05 imply the performance to be less than fair.

Factor analyses were conducted using principal component analysis to identify and examine the components and related factors that influence environmental justice. The factors which received affirmative responses from the majority of respondents of having plausible influences on environmental justice were used for factor analysis. Principal component analysis was used because it can simplify the complexity in high-dimensional data without compromising the trends and patterns (Velliangiri et al., 2019). Before the analyses were conducted, the adequacy of the sample size and validity and robustness of the model were checked using Kaiser-Meyer-Olkin (KMO) measure and Bartlett's tests. The principal components were extracted by using a scree plot. The results were interpreted according to communalities, total variance, and varimax rotation values, specifically to interpret the components and various factors under the components.

Ordinal regression model estimation was performed to evaluate the strategies to improve environmental justice. Also, a narrative analysis of experts' opinions was conducted to supplement the findings from the model estimation. Before the model estimation was done, the model was validated using model fitting information, the goodness of fit, and the test of parallel lines. The model fitting information indicates how well the model fits the data. The goodness of fit test indicates how well the data fits a distribution from a population with a normal distribution. The test of parallel lines is used to assess whether the assumption that the parameters are the same for all categories is reasonable (Williams & Quiroz, 2020). These are specific tests to check the validity and robustness of ordinal regression models, which rest on the ChiSquare test (non-parametric), thus avoiding the concerns for the non-normality of the data.

4. Results

4.1. Current Provision of Organized Green Space in the Selected Cities

According to the land-use regulation of Bhubaneswar Comprehensive Development Plan (2010–2030), 5 to 10% of the land should have been provided for organized green spaces. However, land for green spaces constituted only approximately 1.86% (Bhubaneswar Development Authority, 2010; Mohapatra & Mohamed, 2015). A similar trend was observed in Cuttack, in which land for green spaces varied between less than 0.5 and 2.0% in different zones, and, in Kolkata, the allocation ranged between 3 and 7% (Table 1). Thus, currently, the provision of organized green spaces in all three cities was significantly lower than the minimum recommended and appeared to have contributed to environmental injustice.

4.2. Respondents' Perceptions of the Provision, Development, and Management of Organized Green Space

The current scenario was assessed based on the perceptions of the respondents (Table 2). The results have been

Table 1. Provision of organized green space in the selected cities.

City	Green Space Allocation (% of Total Land)	Urban Development Plan Formulation and Implementation Land-Use Regulation (% of Total Land)	Remarks
Bhubaneswar	1.86	12–14 *	
Cuttack	<0.5–2.0	12–14	Varies between different zones of the city region
Kolkata	3–7	14–16	Varies between different municipal corporations in the metropolitan area

Note: * 5%–10% as per the *Comprehensive Development Plan (2010–2030) Guidelines* (Bhubaneswar Development Authority, 2010).

presented on an aggregate basis because similar trends of responses to all the aspects were observed across the three cities. According to respondents, although there has been a general allocation of land for organized green spaces, it was not adequate. Further, although these spaces had been developed to a certain extent, they were not fairly and equitably distributed throughout the cities. Similarly, low importance had been given to environmental considerations such as improving airflow, reducing air and noise pollution, urban groundwater management, creating buffer zones, etc. The management, governance, operation, and maintenance of these places were perceived to be less than fair. Furthermore, although these spaces were quite accessible to all classes of society, their usage by all classes of society was less than fair. Also, these spaces lacked adequate amenities and facilities. Many of these spaces, specifically those which were poorly managed and maintained, were misused, e.g., used for dumping wastes and encroached upon for unauthorized activities. Overall, inadequate provision, unfair and inequitable distribution, poor accessibility and usage, lack of concern for the environment, and misuse of organized green spaces were the major concerns.

4.3. Components and Factors That Influence Organized Green Space Development and Management for Environmental Justice and Social Inclusivity

An exploratory analysis of the principal components and factors was conducted to examine the ones which influence environmental justice in the study areas. A KMO measure of 0.934, significance value p = 0.000 (<0.05; Table 3), and communalities of all the factors greater than 0.5, except in two factors (creation of activities in the organized green spaces and management of microclimate; Table 4), indicated the adequacy and factorability of the sample. Further, the correlation coefficients among the factors were found to range between 0.009 and 0.7, showing that the chances of over-estimation

Table 2. Respondents' perceptions of the provision, development, and management of organized green space.

Attributes	PI	SD	Z-Test (p-value)
General allocation of land	3.38	0.92	0.000
Adequate allocation of land	2.81	0.90	0.998
Development of organized open space	3.22	0.88	0.000
Fair and equitable distribution in different areas of the city	2.58	0.79	0.998
Provision of organized green space in accordance with environmental considerations	2.87	0.80	0.999
Accessible to all classes of society	3.25	0.89	0.000
Usage by all classes of society	2.91	0.81	0.998
Availability of adequate and relevant amenities	2.95	0.81	0.902
Misuse of organized green spaces (e.g., poorly managed and maintained, used for dumping of wastes or encroachments)	3.47	0.96	0.000
Management and governance	2.80	0.95	0.999
Operation and maintenance	2.69	0.81	0.997

Table 3. Factor analysis validation parameters (KMO sampling adequacy and Bartlett's test of sphericity).

KMO Measure of Sampling Adequacy		0.934
Bartlett's Test of Sphericity	Approx. Chi-Square	36,004.967
	Degree of Freedom	703
	Significance	0.000

Table 4. Communalities indicating adequacy and factorability of the sample used for factor analysis.

Factor ID	Factors	Initial	Extraction
F1	Demographic characteristics	1.000	0.841
F2	Social receptiveness	1.000	0.971
F3	Crime/fear of crime	1.000	0.655
F4	Community feeling towards the availability and use of green spaces	1.000	0.643
F5	Infrastructure and services for green spaces	1.000	0.902
F6	Propensity to use open spaces	1.000	0.977
F7	Socio-economic inequality	1.000	0.878
F8	Preference for outdoor activities	1.000	0.715
F9	Community engagement and participation	1.000	0.845
F10	Unequal distribution of green spaces	1.000	0.642
F11	Demand for land for real estate	1.000	0.965
F12	Land value	1.000	0.924
F13	The economic return of the land	1.000	0.856
F14	Cost of development of organized open spaces	1.000	0.805
F15	Cost of management and maintenance of open spaces	1.000	0.768
F16	Cost of infrastructure development	1.000	0.879
F17	User fees	1.000	0.936
F18	Employment opportunities through the creation of commercial activities	1.000	0.812
F19	Aesthetics and beautification	1.000	0.740
F20	Creation of public congregation areas	1.000	0.812
F21	Providing space for recreation for different age and gender categories	1.000	0.946
F22	Providing space for outdoor and sporting activities	1.000	0.854
F23	Creation of urban forests and national parks	1.000	0.871
F24	Creation of urban gardens, neighbourhood parks, and children's playgrounds	1.000	0.786
F25	Reduction of pollution	1.000	0.968
F26	Creation of central parks	1.000	0.769
F27	Complementing different land use	1.000	0.936
F28	Solid-waste management	1.000	0.763
F29	Sustainable built environment	1.000	0.865
F30	Creation of urban activities	1.000	0.465
F31	Urban groundwater management	1.000	0.416
F32	Creation of buffer zones	1.000	0.810
F33	Management of micro-climate	1.000	0.280
F34	Accessibility of green spaces (vehicular, pedestrian, and digital)	1.000	0.792
F35	Creation of a healthy environment (space for airflow)	1.000	0.557
F36	The hegemony of political leaders and governing authorities for green space development and pressure on planners	1.000	0.877
F37	Availability of land	1.000	0.706
F38	Standards and norms for urban land use and urban activities	1.000	0.663

and co-linearity were limited (Pallant, 2010). Therefore, the factor analysis was found to be adequate and used for further analyses (Tucker & MacCallum, 1997).

Five components with eigenvalues of more than one were extracted using a scree plot (Figure 1). The total variance explained by each component extracted is shown in Table 5, with a cumulative variance percentage of 78.67%.

The factors under the five components that influence the environmental justice of organized green spaces were interpreted using varimax rotation (Table 6). The five principal components extracted and labelled were: (a) community features and infrastructure related to organized green space; (b) economics of development and management of organized green space; (c) linking green space to environment and health; (d) spatial development, land use, and accessibility; and (e) land availability and governance of supply of green space.

The community features of social structure, demographic characteristics, feelings, behaviour, engagement, etc. (Gavrilidis et al., 2019) were found to be the most important components that influenced environmental justice. However, the community features were linked to the availability of green space infrastructure (Gavrilidis et al., 2019; Kronenberg et al., 2020). So, they were being considered together as one component. Ten factors, which included factors F1 to F10 listed in Table 6, loaded onto this component. The second most predominant component was the economics of development and management of organized green space. The influential factors which loaded onto this component included F11 to F18 (Table 6), which contributed to the economics of just supply, creation, and development of green spaces. Linking organized green space to environment and health was found to be the third most important component. Eight factors, ranging from F18 to F26,

Table 5. Total variance explained showing eigenvalues and loadings used to extract principal comments.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.24	37.47	37.47	14.24	37.47	37.47	8.74	23.00	23.00
2	7.23	19.02	56.49	7.23	19.02	56.49	8.35	21.98	44.98
3	4.57	12.03	68.52	4.57	12.03	68.52	6.76	17.78	62.77
4	2.09	5.49	74.02	2.09	5.49	74.02	3.75	9.87	72.63
5	1.76	4.63	78.65	1.76	4.63	78.63	2.29	6.02	78.67

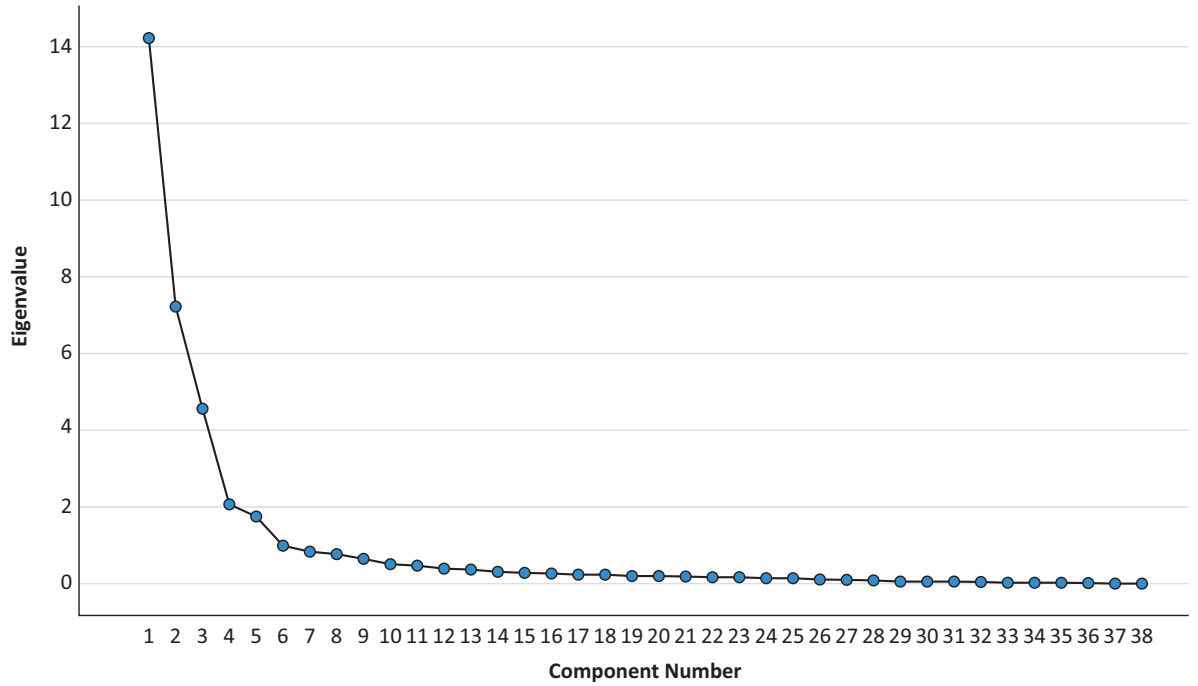

Figure 1. Scree plot with eigenvalues used for extracting components. Note: The components having an eigenvalue greater than one are retained as principal components.

Table 6. Rotated component matrix showing the factor loadings for each factor under different components.

		Component				
Factor ID	Factors	1	2	3	4	5
F2	Social receptiveness	0.938	0.071	0.183	0.073	−0.001
F3	Crime/fear of crime	0.959	0.059	0.219	0.077	0.009
F4	Community feeling towards the availability and use of green spaces	0.954	0.064	0.218	0.076	0.017
F6	Propensity to use open spaces	0.942	0.048	0.202	0.073	0.008
F7	Socio-economic inequality	0.904	0.026	0.207	0.054	0.037
F10	Unequal distribution of green spaces	0.879	0.060	0.170	0.070	0.036
F9	Community engagement and participation	0.871	0.072	0.148	0.068	0.047
F5	Infrastructure and services for green spaces	0.846	0.125	0.174	0.072	−0.023
F1	Demographic characteristics	0.835	0.053	0.189	0.061	−0.030
F8	Preference for outdoor activities	0.823	0.045	0.146	0.063	−0.018
F11	Demand for land for real estate	0.051	0.966	0.153	0.081	0.077
F12	Land value	0.056	0.963	0.154	0.078	0.067
F14	Cost of development of organized open spaces	0.048	0.953	0.147	0.088	0.072
F17	User/entrance fees	0.045	0.951	0.128	0.098	0.060
F15	Cost of management and maintenance of open spaces	0.102	0.915	0.099	0.071	0.090
F18	Employment opportunities through the creation of commercial activities	0.043	0.915	0.177	0.068	0.043
F13	Economic return of the land	0.114	0.876	0.109	0.039	0.105
F16	Cost of infrastructure development	0.059	0.873	0.113	0.059	0.055
F19	Aesthetics and beautification	0.342	0.143	0.868	0.106	−0.034
F22	Providing space for outdoor and sporting activities	0.348	0.181	0.844	0.108	−0.041
F20	Creation of public congregation areas	0.166	0.098	0.839	0.312	0.039
F24	Creation of urban gardens, neighbourhood parks, and children's playgrounds	0.338	0.166	0.836	0.114	−0.036
F21	Providing recreation space for different age and gender categories	0.204	0.160	0.823	0.363	0.031
F23	Creation of urban forest and national parks	0.158	0.128	0.823	0.303	0.047
F26	Creation of central parks	0.185	0.186	0.802	0.312	0.032
F25	Reduction of pollution	0.304	0.152	0.798	0.096	−0.032
F29	Sustainable built environment	0.024	−0.020	0.205	0.774	−0.013
F28	Solid-waste management	0.148	0.112	0.518	0.732	0.076
F34	Accessibility of green spaces (vehicular, pedestrian, and digital)	0.129	0.137	0.334	0.716	0.058
F27	Complementing different land use	0.142	0.141	0.415	0.706	0.066
F32	Creation of buffer zone	−0.014	−0.006	0.124	0.664	−0.089
F35	Creation of healthy environment (space for airflow)	0.155	0.235	0.372	0.570	0.115
F30	Creation of urban activities	0.058	0.060	−0.026	0.521	−0.012
F31	Urban groundwater management	0.078	0.770	0.018	0.027	0.233
F33	Management of micro-climate	0.026	0.639	0.067	0.042	0.032
F37	Availability of land	0.023	0.204	0.004	0.032	0.902
F38	Standards and norms for urban land use and urban activities	−0.011	0.084	0.001	0.043	0.872
F36	The hegemony of political leaders and governing authorities for green space development and pressure on planners	0.015	0.281	0.006	−0.051	0.749

Notes: The extraction method consisted of principal component analysis. Rotation: Varimax with Kaiser normalization, converged in seven iterations.

loaded onto this component (Table 6). Essentially these factors improved the environmental health and aesthetic value of the city as well as enabled people to use these spaces for their health benefits. Five factors—F27, F28, F29, F32, and F34 (Table 6)—loaded onto the fourth component (spatial development, land use, and accessibility). Although, in theory, organized green spaces have been given importance, in practice, they have been undermined as regards complementing different land uses and creating a sustainable built environment. Availability and supply of land for organized green spaces were found to be a challenge. Therefore, factors F36, F37, and F38 (Table 6), which influenced the development and management of organized green spaces, loaded onto the fifth component. It is necessary to address the factors under these five components to create environmentally just, organized green spaces in Indian cities.

4.4. Strategies for Improving Environmental Justice in Organized Green Space Development and Management

To improve environmental justice in the cities of India, six strategies were evaluated and compared with the current scenario. The current scenario under consideration was the allocation and development of uses of land in the current system, where adequate consideration had not been given to organized green space. The strategies were based on the evaluation of the ordinal regression model estimation and narrative analyses of experts' opinions. Tables 7 and 8 show the ordinal regression model validation and model parameter estimates, and significance of the strategies, respectively. The results in Table 7 indicated that the model validation parameters were acceptable and model estimation could be done. Five out of the six strategies were found to be statistically significant and likely to contribute to improving environmentally just, organized green space in Indian cities (Table 8).

The model parameter estimates suggested that community-led, green space development and management was the most important strategy (Table 8). Further, according to three experts (3, 8, and 12): "At the community level, when provided with responsibilities, they create rules, regulations, and procedures for the management, operation, and maintenance of the facilities. They remain vigilant for any misuse."

Ensuring a fair distribution of green spaces among different social areas was found to be the second most important strategy (Table 8). In this context, seven experts (1, 4, 14, 17, 18, 22, and 28) advocated that: "While planning and making land uses, fair distribution of green spaces among different social areas would improve their availability, access, and use," which is likely to improve environmental justice.

Mandatory linkage of built infrastructure with the provision of organized green spaces was the third most important strategy (Table 8). This strategy was expected

Table 7. Model validation parameters of ordinal regression model estimation.

Model Validation Parameters	Chi-Square	Significance	Remark
Model fitting information	67.166	0.000 (≤0.05)	Accepted
Goodness of fit	19.809	0.344 (>0.05)	Accepted
Test of parallel lines	19.809	0.344 (>0.05)	Accepted

Table 8. Strategies for improving environmental justice and social inclusivity in the development and management of organized green space.

Strategies	Parameter Estimate (B)	Exp (B)	Wald	Significance
Community-led, green space development and management	4.143	62.99	40.171	0.000
Ensuring a fair distribution of green spaces among different social areas	3.299	27.08	33.050	0.000
Improved accessibility including digital accessibility for green space use	1.796	6.03	11.704	0.001
Connecting green spaces to health benefits	2.417	11.21	19.271	0.000
Mandatory linkage of built infrastructure with provision of green spaces	2.871	17.65	25.765	0.000
Linking green space with micro-climate and environment	0.966	2.62	3.212	0.073 *
Current scenario for green space land-use allocation	0	1	—	—

Note: * Statistically not significant.

to attract people to these spaces and improve their use. Moreover, according to several experts (2, 5, 12, 16, and 23): "Built infrastructure and civic facilities, specifically recreational facilities, sporting elements, lavatories, food, and water facilities, etc., within or near the public parks or gardens, encourage people to visit the green spaces and use them frequently." In other words, it would contribute to environmental justice.

Connecting green spaces to health benefits was the fourth most important strategy that could improve environmental justice (Table 8). According to the majority of the experts, when the green spaces are linked to benefits of health and relevant elements, such as walking or jogging tracks, open gymnasium equipment for exercising and sporting activities are provided, and a fresh and aesthetic environment is created, people from all classes, ages, and gender are likely to visit these spaces.

Although to a relatively lesser extent, compared with the first four strategies, improved vehicular and pedestrian accessibility, including digital accessibility for green space use, was found to be significant (Table 8). According to several experts (3, 9, 11, 19, 24, and 27):

> Lack of accessibility both by vehicles and pedestrians including inadequate parking facilities acts as a barrier to attract people. Also, people may not have sufficient and real-time information about the activities and operation of the organized green spaces. The lesser use of such spaces leads to their degeneration creating environmental and social problems such as criminal activities.

5. Discussion

It has been argued that the development and management of organized green spaces in Indian cities have been undermined and the challenges of environmental injustice have been experienced. Five principal components and associated factors were found to influence environmental justice in the development and management of organized green spaces (Table 6). The most important component—community aspects, infrastructure, and the aligned factors—implied that, in addition to inadequate availability of organized green spaces, unequal distribution, poor infrastructure and services, socio-economic inequality, and crime were the major deterrents to the use of these spaces (Shackleton & Blair, 2013), which could contribute to environmental injustice (Gavrilidis et al., 2019). Concurrently, demographic characteristics, the receptiveness of society, the propensity of people towards the use of green spaces, their preference for outdoor activities, and community engagement and participation in making green spaces accessible require due consideration (Rigolon et al., 2018; Shackleton & Blair, 2013).

While the lack of green space infrastructural factors creates procedural and distributional injustice, community factors might lead to interactional injustice. Furthermore, since land is scarce and the cost of land is high, there is a high demand to use the land for activities that would offer a higher return. Also, owing to the limited availability of funds, the costs relegate the development of organized green spaces to lower priorities. So, the economics of development and management of organized green spaces play a crucial role in attaining environmental justice. The pressure for the use of green spaces for more commercially viable purposes because of the economic aspects related to development might lead to distributional injustice and should be recognized (Onose et al., 2020).

Factors (F18–F26; Table 6) that link green space to the environment and health are related to planning and regulations. Since these factors directly influence the community, their participation and opinions are important (Liu et al., 2017; Shackleton & Blair, 2013). Lack of consideration for a majority of these factors, except perhaps for the sporadic creation of urban gardens or parks in central locations, was found to contribute to both procedural and interactional environmental injustice.

Spatial development, land use, and accessibility were also observed to be crucial components for environmental justice. Land use and built environment dictate the provision of civic facilities and vehicular and pedestrian access. For example, in the absence of buffer zones and an adequate solid waste management system, environmental challenges are experienced. Despite the provision for these in planning guidelines and regulations, non-adherence causes procedural injustice. Furthermore, digital accessibility to organized green spaces through information, often real-time, could assist people to access and use these spaces. The lack of consideration of these factors, as argued by Kronenberg et al. (2020), could contribute to all three types of environmental injustice. Moreover, the scarce availability of land combined with the hegemony of pressure groups, compromising of the norms and standards, and improper allocation of land can also lead to all three types of environmental injustice (Onose et al., 2020; Zupan & Büdenbender, 2019). The study shows that the factors under the five principal components are essential for attaining all three types of environmental justice in India, which could be applied in similar contexts of the Global South. Consequently, emphasis on distributional justice as it is currently highlighted in many studies may be insufficient to ensure organized green space development in cities of the Global South (Mabon, 2020).

To create environmentally just, organized green spaces, five strategies could play significant roles (Table 8). The most prominent was the community-led, development and management of organized green spaces. Implementing this strategy is likely to require the demands and aspirations of the people to be considered while improving belongingness and ownership in alignment with the theories of environmental justice. This strategy could contribute to equitable and just distribution, access, and public satisfaction (Rigolon et al.,

2018; Shackleton & Blair, 2013). Also, it might break the hegemony of pressure groups for green spaces to be used for commercial purposes. Any environmental challenges, including solid-waste dumping, could also be eliminated by the vigilance of people, thereby improving the environment.

A strategy of ensuring a fair distribution of green spaces among different social areas would address the skewed development of green space among various social areas and, specifically, areas where disadvantaged sections of society live, which is prevalent in the Global South. Similarly, the strategy of mandatory linkage of built infrastructure with the provision of organized green spaces would eliminate the concerns of lack of adequate infrastructures, such as recreational facilities, sporting elements, civic elements, drainage systems, security systems, etc. Moreover, elements that would introduce health benefits in organized green spaces would attract people from all strata of society (Liu et al., 2017). The amalgamation of people from all groups of society, a healthy environment, and the enhanced use of these spaces is likely to contribute to the improvement of environmental justice (Kronenberg et al., 2020).

Both physical and digital access was found to be important. So, creating adequate vehicular and pedestrian access and parking facilities, as well as provision of real-time information, would assist in attracting people. Also, the use of real-time information through digital accessibility might enable policing and security agencies to monitor various unscrupulous activities remotely and take warranted actions, which can discourage criminal activities, thus improving the usage of these places (Das, 2021). It is argued thus that the combined effect of these strategies could improve the environmental justice of organized green spaces in Indian cities as well as cities that have similar contexts in the Global South.

6. Conclusion

Using the context of three cities of India, the principal components and factors influencing environmental justice were explored in this study, and a set of strategies was evaluated that could improve environmental justice in organized green spaces. However, the study is based on stakeholders' perception data in the absence of structured statistical data from three cities from one region of India, which is the limitation of the study. Further interlinkage among components and factors therein were not considered which is considered as the future scope of the research.

The findings revealed that environmental justice challenges are experienced in organized green spaces in Indian cities. Five important components, including community aspects and infrastructure; the economics of development and management of organized green space; linking green space to environment and health; spatial development, land use, and accessibility; and land availability and governance of supply of green space and associated factors were found to influence environmental justice and require redress. To overcome these concerns, five strategies were found to be significant: these include community-led, green space development and management; fair and equitable distribution of green spaces among different social areas; mandatory linkage of built infrastructure with provision of green spaces; connecting green spaces to benefits of health; and improvement of accessibility including digital accessibility for green space use. These strategies are likely to improve equitable availability of organized green spaces, participation, belongingness, and ownership of the community, and compatibility with the environment. They could also diminish the hegemony and motivation of pressure groups for the use of such spaces for commercial activities.

Consequently, the contributions of the factors under the five principal components should be addressed as relevant for creating environmentally just urban green spaces. Strategic interventions that could address the contributory factors by enabling both participation and recognition in addition to equitable distribution and access should be adopted. The proposed strategies should be effected in combination for plausible improvement of all three types of environmental justice in organized green spaces in India and similar contexts in the Global South.

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Conflict of Interests

The author declares no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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