

Review

Green Cities for Environmental Citizenship: A Systematic Literature Review of Empirical Research from 31 Green Cities of the World

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Abstract: During the last decade, many cities worldwide have implemented various green policies; in this way, they have gradually transformed into “green cities”. The emergence of green cities may provide a promising venue to address cities’ environmental degradation and citizens’ disengagement with current socio-environmental issues, thus giving rise to the notion of Environmental Citizenship (EC). Despite these assumptions, empirical research on the topic is currently emerging. In this study, we examine citizens’ engagement in green cities and its interrelatedness with EC through a systematic literature review. The selected empirical studies ($n = 25$) were published in peer-reviewed journals during the timespan of the last 12 years (2010–2021). In total, 31 green cities were analyzed in the 25 selected empirical studies. Thematic and frequency analysis revealed that green cities encourage citizens’ engagement with the implemented green policies, while also advancing citizens’ EC. Furthermore, correlational analysis between citizens’ engagement and the Education for Environmental Citizenship (EEC) model revealed that citizens’ engagement with the implemented green policies fosters citizens’ knowledge, skills, attitudes, values, and behaviors, fueling the undertaking of various EC actions. Importantly, green cities have also proved successful in achieving EC’s outcomes leading to sustainability.

Keywords: green cities; environmental citizenship (EC); citizens’ engagement; green policies; systematic literature review



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1. Introduction

The 20th century was marked by rapid and often unregulated urban growth, resulting in the emergence of compacted cities with a lot of environmental problems [1]. Living in densely populated cities tends to amplify the pressures that urban settlements place on the environment. The emergence of various environmental problems in cities, such as atmospheric pollution [2] or water pollution [3], which have been directly or indirectly caused by the irrational exploitation of the environment and its resources, is therefore not surprising [4].

These poor ecological conditions necessitate the adoption of a new environmental worldview from the citizens [5]. Importantly, this environmental crisis urges the need for citizens to take action, in order to address or, at least, mitigate the environmental problems, which are especially sharpened in many big cities worldwide. Actively engaged citizens may contribute to the development and successful implementation of green policies in their cities; several green policies aim for instance, at the environmental and social transformation

of the cities [6]. For example, green cities are argued to reduce waste and emissions while enhancing the efficiency with which energy, water, and land are used [7,8]. Toward this direction, as attempts to mainstream green infrastructure and nature-based solutions techniques have progressed, the idea of a “green city” has also gradually emerged [9]. The “green city” refers to a strategy for improving urbanized regions’ sustainability. It is a strategy for city planning that focuses on the ecosystem goods and services that green infrastructure could provide. This strategy combines an amalgam of ideas such as the city interacting with nature, restoring urban ecosystems, and minimizing natural resource and energy use [10]. Green infrastructure encourages physical activity, mental and psychological relaxation, oxygen for breathing, and the removal of air pollutants, all of which speed up human life events [11]. Green cities also focus on ecological innovations along with economic achievements and democratic transparency, which taken together result in a living environment that is socially inclusive [12]. All in all, according to Pace et al. (2016), three important dimensions have been identified to characterize a “green city”: (a) environmental quality, (b) human well-being, as well as (c) political and social actions that aim at the first two dimensions [10].

However, Elelman and Feldman (2018) have argued that citizens are not encouraged enough to actively get involved in socio-environmental issues in green cities [13]. Aiming to achieve citizens’ active engagement, green cities should enable the development of a trust-based ecosystem between citizens and the environment [14]. In addition, stimulating conditions should be developed to harness citizens’ engagement so as to maximize the intended environmental outcomes [6,15]. Citizens’ engagement with green policies in cities could be encouraged, for instance, by setting a combination of social and environmental goals, grounded on Environmental Citizenship (EC), which extends beyond immediate personal interests to include broader communal values [16]. Schild (2018) also pinpoints that citizens’ engagement with socio-environmental issues is closely connected to citizens’ EC [17].

Despite the assumptions that green cities encourage their citizens’ engagement in the implementation of various green policies and, as such, may empower their Environmental Citizenship (EC), empirical research on the topic is currently emerging. This by no means implies that there is a lack of empirical research, but rather that available studies are thinly spread and fragmented. This study presents a Systematic Literature Review (SLR) to synthesize the available empirical research on citizens’ engagement with the implemented green policies of green cities as well as on citizens’ EC in relation to their involvement in applied green policies. In its essence, this SLR first seeks to answer how green cities encourage citizens’ engagement with the implemented green policies. Secondly, it examines how citizens’ engagement with the implemented green policies contributes to the empowerment of citizens’ EC.

2. Theoretical Framework

2.1. The Concept of a “Green City”

The concept of a “Green city” is one of the latest breakthroughs of the diverse efforts and research conducted to address the problems caused by the dispersed model of city development. For Kronsell (2013) a green city is seen as an urban structural model, which ensures the quality of the environment and the quality of life via the implementation of various green policies [18]. The primary goal of implementing green city policies is therefore to improve community life quality and protect the environment, by adopting inclusive and participatory decision-making processes [18].

However, the existence of a wide range of green policies as well as the wide spectrum of environmental and other urban-related challenges within a city has also led to the development of various definitions and approaches for what “green cities” are and what they entail. Some of them incorporate socioeconomic, environmental, and infrastructure components, while yet others primarily concentrate on the environmental aspects [19]. Still others also include policies, resilience, ICT technologies, and strategies like disaster risk plan-

ning, etc. [19]. Some researchers have translated the green city concept, into frameworks and indicators assessing environmental and/or sustainability performance [19]. These frameworks aim to support city policymakers in setting environmental or sustainability priorities, as well as areas of action such as green transport, energy efficiency, and resources management [19]. Pace and colleagues (2016) have defined the green city as “... a city that takes responsible political and societal action in order to achieve high environmental quality, which by itself contributes to human well-being” [10] (p. 6). This definition is also adopted in this study as a working definition.

Green cities mainly address key environmental issues, which may also have an influence on social and economic aspects [20]. Green cities aim to achieve a low environmental impact, be resilient against natural disasters, have a low risk of severe infectious disease outbreaks [21], decrease chemical and physical hazards, advance urban environments for all, reduce environmental costs being transferred to places outside the city, and assure progress toward a green economy [22]. In addition, green cities adopt sustainability policies and policies related to transportation, water, climate change, energy efficiency and renewable resources, and pollution and waste management, e.g., Refs. [23–25], resulting in healthier living conditions. Overall, green cities encompass regional or local policies and regulations, as well as various urban settings, and are grounded on the involvement of several stakeholders (e.g., organizations or citizens), especially in terms of social or community issues [26]. Focusing on the latter, citizens’ engagement in green cities is of vital importance [26].

2.2. Citizens’ Engagement in Green Cities

Green cities are perceived as the answer to how cities could become more sustainable, less dispersed, and more habitable. For this to occur, people are considered sources of progress for the city’s social realm and implementers of various green policies. For instance, the literature proposes that public engagement at the decision and implementation levels of green policies is crucial for the effective implementation of such policies [27]. Citizens’ willingness to participate in the green modernization processes is, therefore, critical to all green advancements [28].

Citizens’ engagement entails citizens assisting in the development and implementation of all policies aimed at improving the community’s quality of life, rather than simply identifying the source of a problem [29]. According to Barney (2006), citizens’ engagement has four functions: (a) to apply democratic procedures in policy development, (b) to let citizens increase their awareness with the purpose of diminishing misinformed oppositions, (c) to inform the city administration as to how citizens might react to (green or less green) policies, and (d) to help optimize civil communication strategies related to specific projects and policies [30]. Citizens’ engagement can be therefore deployed to enable valuable participation in public discussions and decision-making, as well as for achieving policy implementation by a larger population of citizens [30]. In this study, drawing on Adler and Goggin (2005), we define citizens’ engagement in a green city as citizens’ active participation in city life with the purpose of contributing to the sustainability of the city [31]. We also posit that citizens’ engagement in the development of green cities is strongly related to the notion of Environmental Citizenship (EC), which is presented in the next section.

2.3. Environmental Citizenship (EC)

Environmental Citizenship (EC) is a broad concept that encompasses pro-environmental activity as well as citizens’ engagement toward environmental protection and socio-environmental transformation. Despite the significance of EC, it is only recently that the concept has gained the traction it deserves and was defined by more than 150 experts in a comprehensive and holistic way by the European Network for Environmental Citizenship [32]. The following excerpt describes the given definition of EC:

“Environmental Citizenship is defined as the responsible pro-environmental behavior of citizens who act and participate in society as agents of change in the private and public

sphere on a local, national and global scale, through individual and collective actions in the direction of solving contemporary environmental problems, preventing the creation of new environmental problems, achieving sustainability and developing a healthy relationship with nature.” [32].

Building on this conceptualization, Hadjichambis and Hadjichambi (2020) have introduced the Education for Environmental Citizenship (EEC) model, which seeks to provide citizens with a set of competencies and convert them into “environmental change agents” [32]. In this way, EEC is to educate and inspire citizens to appreciate the value and significance of civic engagement as well as the significance of addressing today’s socio-ecological concerns. More specifically, the EEC model consists of three major components: (a) the competencies that an environmental citizen should be equipped with (green cycle); (b) the possible actions that could be undertaken by environmental citizens (in different dimensions, spheres, and scales); and (c) the environmental outcomes of these actions on the environment and the society (orange arrows) (Figure 1).

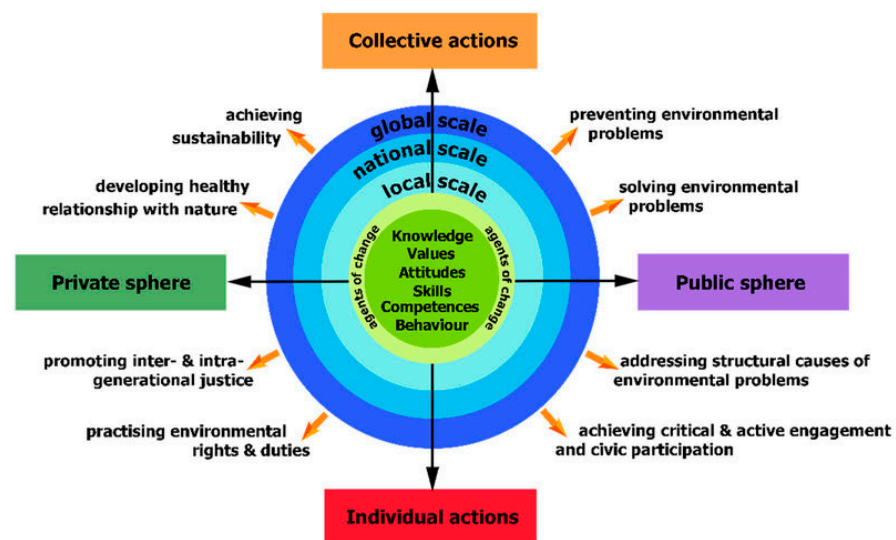


Figure 1. The EEC model (Adopted from Hadjichambis and Paraskeva-Hadjichambi, 2020).

EC Competences-EC Actions-EEC Outcomes

The EC Competences (illustrated by the green cycle in Figure 1) refer to the needed knowledge, attitudes, skills, values, and behaviors of environmental citizens in relation to socio-ecological issues to be responsible and actively engage in civic and social life, so acting as “environmental agents of change”. Also, citizens’ EC actions are categorized on (a) individual or collective dimensions, (b) private or public spheres, as well as (c) local, national, or global scales. Finally, citizens who possess the EC competences are required to act in a variety of dimensions, on a variety of spheres and scales, in order to achieve specific environmental outcomes and bring about social and environmental change. These environmental outcomes are: (a) the solution of current environmental problems, (b) the prevention of the creation of new environmental problems, (c) the addressing of the structural causes of environmental problems, (d) the development of a healthy relationship with nature, (e) the practice of environmental rights and duties, (f) the achievement of critical and active engagement and civic participation, (g) the promotion of inter-/intra-generational justice, and (h) the achievement of sustainability.

3. Rationale and Research Questions

Taking into account the theoretical framework underpinning this study, it seems that interesting relationships may exist between “green cities”, “citizens’ engagement”, and “environmental citizenship”. Despite this fact, these relationships have remained unstudied so far, due to the emerging and fragmented nature of these research areas. The

present review study aims to systematically examine citizens' engagement in green cities for Environmental Citizenship (EC). More specifically, we focus on the following four research questions:

- RQ1: What are the main green policies adopted by green cities?
- RQ2: Which opportunities do green cities offer for citizens' engagement?
- RQ3: How do green cities contribute to citizens' EC?
- RQ4: How can green cities further support the development of citizens' EC?

4. Methodology

4.1. Data Collection

This Systematic Literature Review (SLR) focuses on the analysis of empirical research in the intersection of "green cities", "citizens' engagement", and "environmental citizenship" published in peer-reviewed academic journals from 2010 to 2021, in the English language. For defining this research corpus, the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) methodology for systematic literature reviews was followed, which is a well-recognized approach [33]. Based on the PRISMA standards [33], three steps were taken: (a) Identification, (b) Screening, and (c) Eligibility (Figure 2).

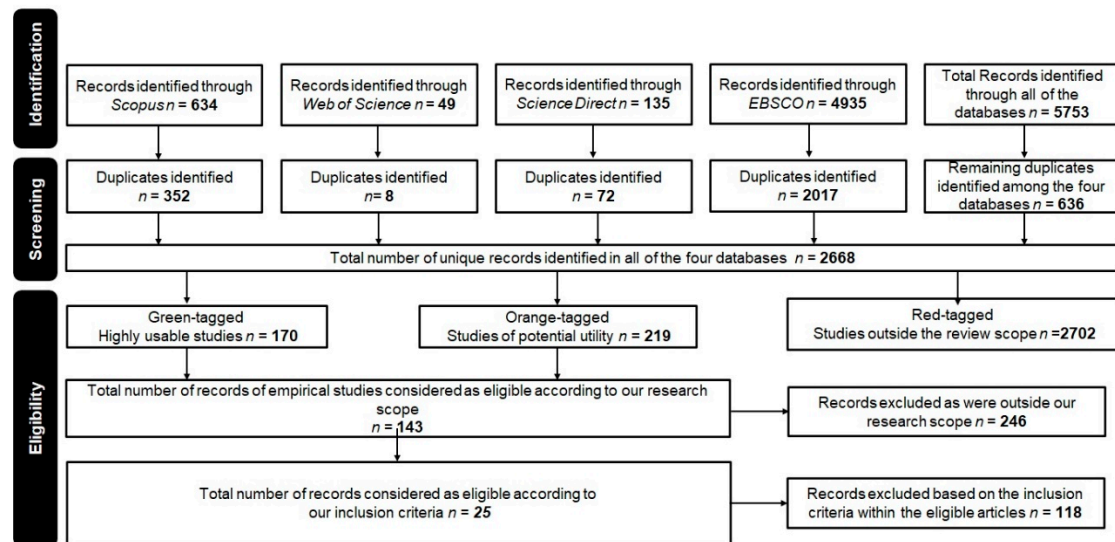


Figure 2. The PRISMA Methodology Followed for Article Retrieval.

The identification step included the retrieval of studies from four electronic databases: Scopus, Web of Science, Education Research Complete (via EBSCO), and ScienceDirect. Within each database, we used the terms "City", "Green city", "Sustainable City", "Environmental city", and "Ecological city", which were combined with the terms "Citizen", "Citizenship", "Environmental citizen", "Environmental citizenship", "Sustainable citizen", "Sustainable citizenship", "Green citizen", "Green citizenship", "Ecological citizen", and "Ecological citizenship", to create meaningful search strings. For instance, we combined "Green city" AND "Citizen". In total, 48 search strings were deployed. To ensure that the journal articles retrieved were restricted in the context of citizens' engagement with the implemented green policies taking place in green cities, we looked for the above search strings within the title, the abstract, and the keywords of the retrieved articles. The literature search resulted in a total number of 5753 journal articles retrieved in March 2022.

During the screening step, we removed the duplicates within and among the four databases resulting in a total of 2668 peer-reviewed journal articles, on which we further elaborated. Based on their titles, these articles were classified into three categories. "Green", "orange", or "red" colors were tagged on to the three categories according to the alignment with the scope of this review. In particular, green-tagging was used for highly relevant

studies, while red-tagging was employed for studies that were out of our research scope. Papers with potential relevance were tagged with orange color. For the orange-tagged studies, it was not straightforwardly apparent if they were indeed aligned with our research scope. Color tagging was carried out by two of the authors. After reaching an agreement on which papers should be marked with green, red, or orange colors, we further elaborated on the full texts of the orange-tagged papers to explore whether they were reporting on citizens' engagement with green policies/practices taking place in green cities. The screening process ended up with 170 green-tagged articles.

In the eligibility step, after the thorough study of the resulting peer-reviewed journal articles, they were further categorized according to their research methods into (a) empirical papers ($n = 143$), and (b) review papers or other theoretical papers ($n = 27$), which were not providing any empirical data for 31 green cities around the world. Finally, the full texts of the 143 empirical articles were thoroughly examined according to three main inclusion criteria: The study should (a) explicitly state and describe the undertaken green policies and practices contributing to the emergence of the green city, (b) evaluate and report on the contribution of the green policies and practices of a green city to Environmental Citizenship (EC) outcomes or/and to the development of citizens' EC competences or/and the empowerment of EC actions, and (c) clearly report on both the green policies and their evaluation in relation to EC as an integral part of the research study rather than simply mentioned without being a part of the research conducted. The implementation of these inclusion criteria resulted in a corpus of 25 empirical studies referring to green policies and practices in 31 green cities which involve citizens. These empirical studies were further analyzed for the purposes of our SLR and they are presented in Appendix A of this study.

4.2. Coding Schemes and Typologies

Initially, a template was drafted to capture general information about the green cities identified in the reviewed studies, such as (a) the name of the city; (b) its geographical coverage; (c) the degree of urbanization; (d) the year or the range of years of the green policies and practices implementation; and (e) the green city index deployed. Next, to address our research questions, a coding scheme was developed, which comprised of three matrices.

In Matrix A (in Appendix A), a comprehensive typology was developed for capturing the green policy and practices implemented in the green cities. For this purpose, a Green City typology created by Hadjichambis (2018) was adopted to capture cities' green policies and practices in Cyprus (hereafter the "Green Cities typology" of CYCERE). The Green Cities typology of CYCERE was built upon the European Green Capital Awards initiative of the European Commission and was deployed in the context of the "Green Cities and Green Communities of Cyprus National Awards". Hadjichambi's initial typology (2018) was further validated using the literature review we conducted. For this purpose, the reviews and theoretical articles derived through our PRISMA methodology were deployed, and we were particularly focused on described models, frameworks, and other typologies about green cities. During this process, it was confirmed that most of the categories comprising the Green Cities typology were also reported in these studies. However, some additional categories were also identified (e.g., "Green Economy and Sustainable Food Systems"), which were added to our typology, thus enriching the initial coding scheme.

Matrix B was developed following a bottom-up approach. Toward this end, we deployed the data collected from our reviewed empirical articles in relation to citizens' engagement in green policies and practices implemented in cities. The empirical studies were analyzed using the thematic analysis method [33]. According to this bottom-up coding approach, themes and categories were mapped. Overall, this process led to a comprehensive typology including seven themes, which were further divided into forty categories. (CYCERE stands for Cyprus Centre for Environmental Research and Education; For more information, please consult European Commission's website https://ec.europa.eu/environment/european-green-capital-award_en (accessed on 15 January 2016). For

more information, please consult CYCERE's website <http://kykpee.org/en/greencitycy/> (accessed on 15 January 2016)).

For Matrix C, a top-down approach was adopted using an already validated typology about Environmental Citizenship (EC) and Education for Environmental Citizenship (EEC) [30]. This typology gave the opportunity to tap into the potential of a green city to foster citizens' environmental citizenship. More specifically, this matrix comprised three categories to capture citizens' EC: (a) EC competences (Knowledge, Skills, Attitudes, Values, and Behaviors), (b) EC actions on different dimensions (individual/collective), spheres (private/public) and scales (local, national, global), and (c) EEC outcomes of environmental citizenship.

Table S1 in Supplementary Materials presents the three matrices (Matrix A, B, C), providing the definition and source of each theme and category, as well as indicative excerpts.

4.3. Data Analysis

Data analysis was initially deployed to address our RQ1 (What are the main green policies adopted by the green cities?), RQ2 (Which opportunities do green cities offer for citizens' engagement?), and RQ3 (How do green cities contribute to citizens' Environmental Citizenship?). More specifically, a descriptive analysis was conducted to identify the extent to which the categories of all typologies (Matrix A, B, and C), were promoted in the green cities. The unit of our analysis was the green cities; to this end, we coded and calculated the frequency (in percentages) of each category per typology as this occurred in the 31 green cities included in our reviewed corpus ($n = 25$ reviewed studies). For instance, the category "Partnership between the Public and Private Sectors" was reported in 20 out of the 31 reviewed green cities; therefore, this category covered 64.5% of the reviewed green cities.

To address RQ4 (How can green cities further support the development of citizens' EC?) a bivariate correlations analysis was first performed using the Statistical Package for the Social Sciences (SPSS V.28.0). In particular, computations were performed to detect potential correlations among (a) Citizens' engagement (Matrix B) and EC (Matrix C), and (b) the Implemented Green Policies (Matrix A) and EC (Matrix C). To conduct this correlation analysis, Spearman's Rank-Order correlation coefficient was used, which is considered a non-parametric statistic to look at the strength of association between two factors. The significance level was set at $p < 0.01$, and the correlation strength was determined by the coefficient range, with 0.80–1.0 indicating a very strong correlation, 0.60–0.79 indicating a strong correlation, 0.40–0.59 indicating a moderate correlation, 0.20–0.39 indicating a weak correlation, and 0.00–0.19 indicating a very weak correlation (Evans, 1996). In the second step, a K-means cluster analysis was employed to divide the components into two homogeneous groups by accounting for the number of connections they had with the EC components [34]. K-means cluster analysis, to put it simply, employs Euclidean distance to categorize data over numerous iterations into a number of pre-defined groups. This procedure continues until cluster means do not fluctuate more than a predetermined cut-off value or the iteration limit is reached. By doing this, a cut-off point was established for categorizing the EC components into (a) "Keystone Components" (KCs), or components with the most connections, and (b) "Peripheral Components" (PCs), or components with fewer connections than the rest of the EC components.

5. Findings

5.1. Overview—General Characteristics of the Green Cities

The 25 reviewed studies reported on 31 green cities (i.e., six of the reviewed studies reported more than one green city), which have initiated green policies/practices and involved citizens to successfully implement them. Most of these green cities were located in Europe (20 green cities) or in Asia (10 cities green cities), one was found in America, and none in Africa or in Oceania (Figure 3). Some cities were also reported twice or

three times (e.g., Stockholm, Freiburg, London, Rotterdam). Supplementary Table S2 in Supplementary Materials provides an overview of the green cities reported, their countries, and the frequency with which they were reported. Finally, these green cities may range from mid-sized ones (e.g., 140,000 inhabitants) to large cities (e.g., 12,000,000 inhabitants).

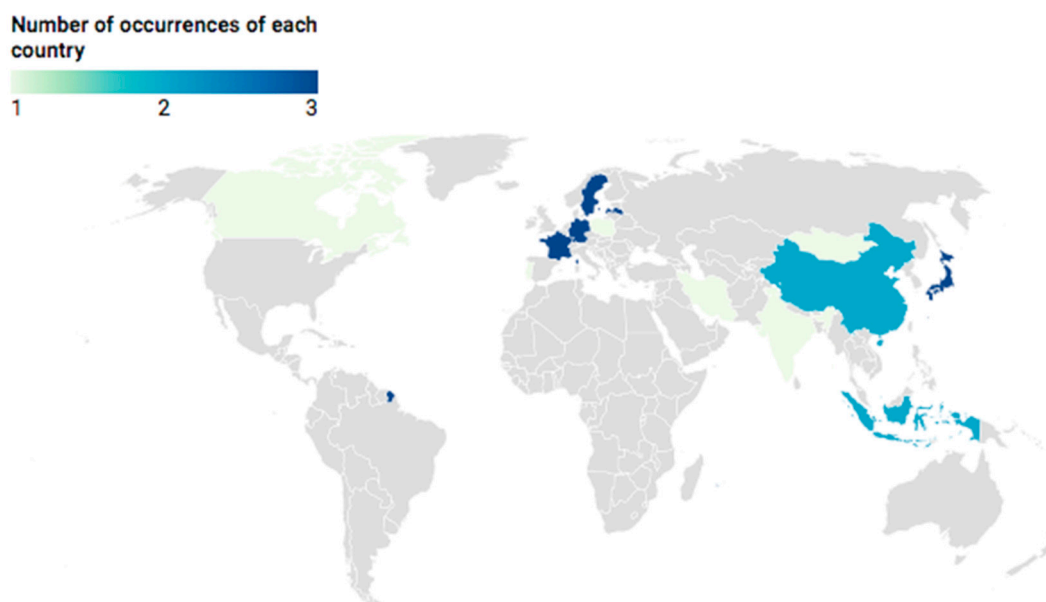


Figure 3. Green Cities in Several Countries and Occurrences of Each Country.

5.2. Implemented Green Policies

Our analysis revealed that green cities implement a range of green policies (Table 1). About half of the reviewed green cities implemented policies in relation to “Green Areas and Biodiversity (GAB)” ($n = 15$ green cities, 48.4%) or to “Green Economy (GE)” ($n = 14$ green cities, 45.2%). Green policies such as “Practices to tackle Climate Change (PCC)” and “Water Resources Management (WRM)” were applied by eight ($n = 8$, 25.8%) green cities, whereas green policies such as “Sustainable Build Environment (SBE)”, “Solid Waste Management (SWM)”, and “Sustainable Trafficking and Transportation (STT)” were implemented by seven ($n = 7$, 22.5%) green cities.

Table 1. Absolute Number and Percentage of the Implemented Green Policies.

Implemented Green Policies	N	%
Green Areas and Biodiversity (GAB)	$n = 15$	48.4%
Green Economy (GE)	$n = 14$	45.2%
Green Service Industry (GE-GSI)	$n = 5$	16.1%
Circular Economy (GE-CE)	$n = 5$	16.1%
Green Service Industry (e.g., green commerce) (GE-GSI)	$n = 2$	6.5%
Green Jobs (GE-GJ)	$n = 2$	6.5%
Goods Consumption (GE-GC)	$n = 1$	3.3%
Sustainable Energy Consumption (SEC)	$n = 11$	35.5%
Practices to tackle Climate Change (PCC)	$n = 8$	25.8%
Water Resources Management (WRM)	$n = 8$	25.8%
Sustainable Build Environment (SBE)	$n = 7$	22.5%
Solid Waste Management (SWM)	$n = 7$	22.5%

Table 1. Cont.

Implemented Green Policies	N	%
Sustainable Trafficking and Transportation (STT)	<i>n</i> = 7	22.5%
Sustainable Tourism (ST)	<i>n</i> = 5	16.1%
Ambient Air Quality (AAQ)	<i>n</i> = 5	16.1%
Liquid Waste Management (LWM)	<i>n</i> = 3	9.7%
Sustainable Food Systems (SFS)	<i>n</i> = 2	6.5%
Culture and the Environment (CE)	<i>n</i> = 1	3.3%
Quality of the Acoustic Environment (QAE)	<i>n</i> = 1	3.3%

The rest of the green policies were performed by just a few green cities. More specifically, the green policies regarding “Sustainable Tourism (ST)” and “Ambient Air Quality (AAQ)” were applied only by five (*n* = 5, 16.1%) green cities. The green policies of “Liquid Waste Management (LWM)” were implemented only by three (*n* = 3, 9.7%) green cities, while “Sustainable Food Systems (SFS)” were implemented only by two (*n* = 2, 6.5%) green cities respectively. Finally, green policies related to “Culture and the Environment (CE)” and “Quality of the Acoustic Environment (QAE)” were implemented by only one (*n* = 1, 3.2%) green city.

5.3. Citizens’ Engagement in Green Cities

To address RQ2, a content analysis was conducted as an inductive approach to capture the dimensions underpinning citizens’ engagement in green cities. Figure 4 shows the themes that the thematic analysis resulted in. Table 2 shows the categories for each theme and the results of the frequency analysis.

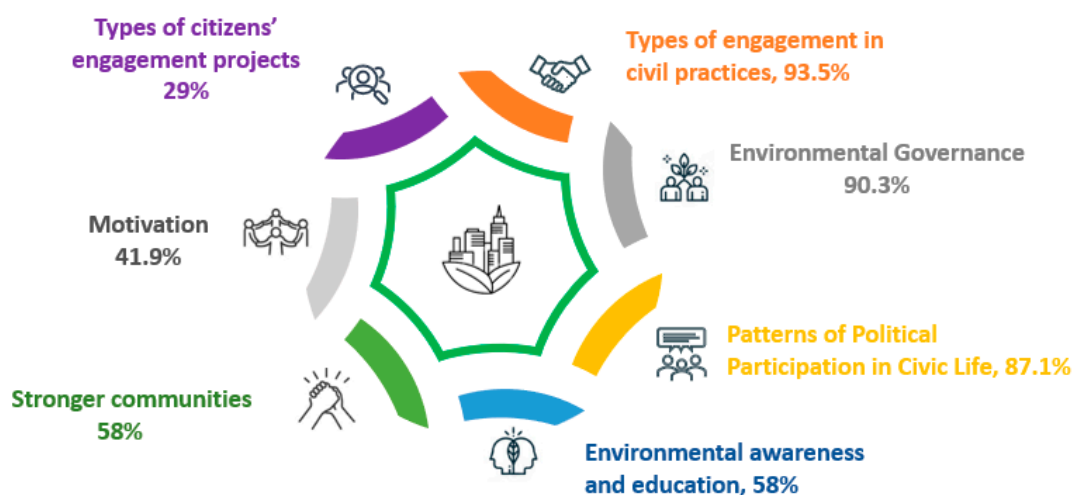


Figure 4. Citizens’ Engagement in Green cities.

Table 2. Absolute Number and Percentage of the Citizens’ Engagement Dimensions (N = 31 cities).

Citizens’ Engagement in Green Cities	N	%
Environmental Governance	<i>n</i> = 28	90.3%
Partnership between the Public and the Private sector (PPP)	<i>n</i> = 20	64.5%
Citizens become aware due to Access to Open Data and Information (CAODI)	<i>n</i> = 13	41.9%
Stakeholders engaged in Environmental Governance (e.g., NGO’s) (SEG)	<i>n</i> = 9	26.59%
Citizens participated in Environmental Governance (CEG)	<i>n</i> = 7	22.5%

Table 2. Cont.

Citizens' Engagement in Green Cities	N	%
Agents of Change	<i>n</i> = 7	22.5%
Citizens participated in Environmental Governance via Social Media (CEGSM)	<i>n</i> = 4	12.9%
Citizens took part in Opinion Polls (COP)	<i>n</i> = 1	3.3%
Stronger Communities	<i>n</i> = 18	58%
Promoting Community Engagement (PCE)	<i>n</i> = 12	38.7%
Citizens' Engagement through the creation of Forums/Stakeholders (CEFS)	<i>n</i> = 11	35.4%
Volunteering (Vo)	<i>n</i> = 5	16.1%
Promoting a Sense of Community (PSC)	<i>n</i> = 4	12.9%
Promoting a Sense of Place (PSP)	<i>n</i> = 2	6.4%
Respecting Fellow Community Members (RFCM)	<i>n</i> = 2	6.4%
Environmental Awareness and Education	<i>n</i> = 18	58%
Increase Awareness of the local Environment (IALE)	<i>n</i> = 12	38.7%
Educational Programs for Citizens (EPC)	<i>n</i> = 8	25.8%
Enhance University Student Environmental Learning (EUSEL)	<i>n</i> = 6	19.3%
Continuous Environmental Learning (CEL)	<i>n</i> = 2	6.4%
Engagement with Science-Environmental Knowledge (ESEK)	<i>n</i> = 2	6.4%
Training for Stakeholders (TS)	<i>n</i> = 2	6.4%
Citizens' Engagement Projects	<i>n</i> = 9	29%
Ecological projects in Neighborhoods (EPN)	<i>n</i> = 5	15.1%
City-Nature Hybrids-Urban Farming (CNH-UF)	<i>n</i> = 2	6.4%
Citizens Co-owned Power plants (CCPP)	<i>n</i> = 1	3.3%
Community Service Projects (CSP)	<i>n</i> = 1	3.3%
Ecological Projects in Households (EPH)	<i>n</i> = 1	3.3%
Motivation	<i>n</i> = 13	41.9%
Environmental Motivation (EnM)	<i>n</i> = 10	30.3%
Economic Motivation (EcM)	<i>n</i> = 10	30.3%
Social Motivation (SM)	<i>n</i> = 6	18.1%
Political Motivation (PM)	<i>n</i> = 0	0%
Type of Engagement in Civil Practice	<i>n</i> = 29	93.5%
Civic Engagement (CE)	<i>n</i> = 17	54.8%
Social Involvement (SI)	<i>n</i> = 13	41.9%
Activism (A)	<i>n</i> = 2	6.4%
Formal Political Participation (FPP)	<i>n</i> = 2	6.4%
Non-Participation (NP)	<i>n</i> = 2	6.4%
Patterns of Political Participation in Civic Life	<i>n</i> = 27	87.1%
Inform (Inf)	<i>n</i> = 11	35.4%
Consult (Con)	<i>n</i> = 16	51.6%
Involve (Inv)	<i>n</i> = 9	29%
Collaborate (Col)	<i>n</i> = 3	9.6%
Empower (Emp)	<i>n</i> = 5	16.1%

According to our findings, the reviewed green cities promoted several dimensions of Environmental governance, which contributed to citizens' active engagement with the implemented green policies (*n* = 28 green cities, 90.3%). The dimension that was most often applied was "Partnership between the Public and the Private sector (PPP)", which was reported in 20 (*n* = 20) out of the 31 reviewed green cities (64.5%). Less than half of the

reviewed green cities let their “Citizens become aware due to Access to Open Data and Information (CAODI)” ($n = 13$ green cities, 41.9%). As far as the dimension of Stronger Communities is concerned, the reviewed green cities also promoted the engagement of citizens as “community members” ($n = 18$ green cities, 58%). To transform green cities into “Stronger Communities”, 12 ($n = 12$, 38.7%) of the reviewed cities were “Promoting Community Engagement (CE)”. Also, eleven ($n = 11$, 35.4%) of the green cities encouraged “Citizens’ Engagement through the creation of Forums/Stakeholders (CEFS)”. In relation to Environmental awareness and education, the citizens in the reviewed green cities have opportunities to increase their awareness and take part in educational programs in relation to environmental problems in their city ($n = 18$ green cities, 58%). More specifically, one out of three green cities provided opportunities to their citizens to “Increase Awareness of the local Environment (IALE)” ($n = 12$ green cities, 38.7%). In addition, one out of the four green cities implemented “Educational Programs for Citizens (EPC)” ($n = 8$ green cities, 25.8%). Regarding the dimension of Citizens’ engagement projects, some of the reviewed green cities also applied specific types of projects to engage their citizens with their green policies ($n = 9$ green cities, 29%). For instance, five ($n = 5$, 15.1%) green cities supported “Ecological Projects in Neighborhoods (EPN)”. Also, Motivation was reported by 13 green cities. ($n = 13$ green cities, 41.9%). One out of three green cities encouraged citizens’ “Economic Motivation (EcM)” or “Environmental Motivation (EnM)” ($n = 10$ green cities, 30.3% in both cases). In addition, some cities ($n = 6$ green cities, 18.1%) encouraged citizens’ “Social Motivation (SM)”. Concerning the Type of engagement in civil practice, the green cities encouraged the civil engagement of their citizens in the implemented green policies and this engagement had various nuances ($n = 29$ green cities, 93.5%). In particular, more than half of the reviewed green cities supported “Civic Engagement (CE)” ($n = 17$ green cities, 54.8%), while less green cities ($n = 13$ green cities, 41.9%) promoted citizens’ “Social Involvement (SI)” in the implemented green policies. Only a few cities also promoted “Activism (A)” ($n = 2$ green cities, 6.4%) or “Formal Political Participation (FPP)” ($n = 2$ green cities, 6.4%). Finally, as for the patterns of political participation in civic life, the 27 green cities also supported the citizens’ political participation in civic life ($n = 27$ green cities, 87.1%). Among a rank of patterns of political participation in civic life, about half of the reviewed green cities “Consult (Con)” their citizens in relation to the implemented green policies ($n = 16$ green cities, 51.6%). Also, one out of three green cities, “Informed (Inf)” their citizens about the implemented green policies ($n = 11$ green cities, 35.4%). Yet there were only a few green cities, which encouraged citizens’ political participation in civic life. More specifically, one out of three green cities promoted the “Involved (Inv)” degree of political participation in the decision-making in relation to the implemented green policies ($n = 9$ green cities, 29%). Less green cities “Collaborated (Col)” with the citizens ($n = 3$ green cities, 9.6%) or “Empowered (Emp)” their citizens ($n = 5$ green cities, 16.1%).

5.4. Education for Environmental Citizenship

To address our RQ3 (“How do green cities contribute to (the development of) citizens’ Environmental Citizenship?”), we conducted a deductive analysis of the reviewed green cities based on the Education for Environmental Citizenship (EEC) model.

5.4.1. EC Competences

According to our findings, the green cities contributed to a certain degree to the development of citizens’ EC knowledge, skills, attitudes, values, and behaviors. Figure 5 illustrates the percentages of green cities that promote each of the EC competences. Table 3 shows also the absolute number and percentage of green cities reporting on EC competences. As shown in Figure 5, the reviewed green cities emphasized mainly the enhancement of citizens’ Behaviors ($n = 21$, 67.7%) and Knowledge ($n = 20$, 64.5%), which had a positive impact on the enhancement of citizens’ Attitudes ($n = 14$, 45.2%), and Skills ($n = 13$, 41.9%), but on a lesser scale, they also reported on citizens’ values ($n = 9$, 29%).

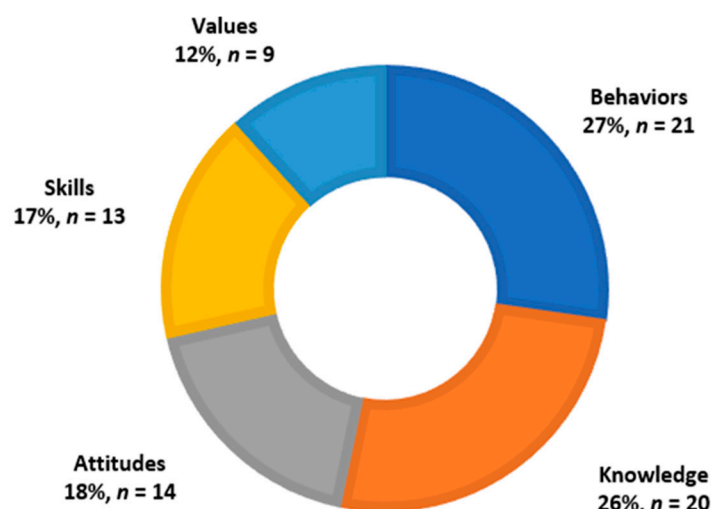


Figure 5. Percentage of Green Cities reporting on EC Competences.

Table 3. Absolute Number and Percentage of Green Cities Reporting on EC Competences (N = 31 cities).

EC Competences	N	%
Knowledge	n = 20	64.5%
Environmental Systems Knowledge (ESK)	n = 17	54.8%
Action-Related Knowledge (ARK)	n = 8	25.8%
Skills	n = 13	41.9%
Communication Skills (CS)	n = 8	25.8%
Collaboration and Social Interaction Skills (CSIS)	n = 6	19.3%
Constructive Participation Skills (CPS)	n = 6	19.3%
Attitudes	n = 14	45.2%
Willingness to Act in Society as Agents of Change (WASAC)	n = 8	25.8%
Willingness for Collective Environmental Actions (WCEA)	n = 7	22.5%
Willingness to Eliminate New Environmental Problems (WENEP)	n = 6	19.3%
Willingness to Take Responsibility for the Environment (WTRE)	n = 5	16.1%
Willingness for Democratic Decision-Making (WDDM)	n = 4	12.1%
Willingness for Environmental and Social Justice (WESJ)	n = 4	12.1%
Willingness for Networking to Solve Environmental Problems (WNSEP)	n = 1	3.2%
Willingness for Intercultural Communication for the Environment (WICE)	n = 1	3.2%
Values	n = 9	29%
Biospheric Values (BV)	n = 9	29%
Altruistic Values (AV)	n = 2	6.4%
Behaviors	n = 21	67.7%
Private Sphere Behaviors (PSB)	n = 15	48.3%
Non-Activist Behaviors (NAB)	n = 10	32.6%
Activism Behaviors (AB)	n = 6	19.3%

Focusing on the EC knowledge, as shown in Table 3, we found that the reviewed green cities gave opportunities to citizens to develop their Environmental Systems Knowledge (ESK) ($n = 17$ green cities, 54.8%) and their Action-Related Knowledge (ARK) ($n = 8$ green cities, 25.8%). Next, focusing on the EC Skills, we found that the green cities promoted mostly citizen's Communication Skills (CS) ($n = 8$ green cities, 25.8%), Collaboration and Social Interaction Skills (CSIS) ($n = 6$ green cities, 19.3%), as well as Constructive Participation Skills (CPS) ($n = 6$ green cities, 19.3%). In addition, we found that the

reviewed green cities also empowered their citizens' attitudes such as their Willingness to Act in Society as Agent of Change (WASAC) ($n = 8$ green cities, 25.8%), their Willingness for Collective Environmental Action (WCEA) ($n = 7$ green cities, 22.5%), their Willingness to Eliminate New Environmental Problems (WENEP) ($n = 6$ green cities, 19.3%), their Willingness to Take Responsibility for the Environment (WTRE) ($n = 6$ green cities, 19.3%), their Willingness for Environmental and Social Justice (WESJ) ($n = 4$ green cities, 12.1%), as well as their Willingness for Democratic Decision Making (WDDM) ($n = 4$ green cities, 12.1%). In one case, we found that the green city enhanced citizens' Willingness for Networking to Solve Environmental Problems (WNSEP) ($n = 1$ green city, 3.2%).

Finally, focusing on EC values and behaviors, our review showed that some green cities promote mainly Biospheric Values (BV), which underpin environmental preservation and restoration actions and encourage public behavior change ($n = 9$ green cities, 29%), and had a positive impact on citizens' Private Sphere Behaviors (PSB) ($n = 15$ green cities, 48.3%). Yet, we also found that two green cities ($n = 2$ green cities, 6.4%) promoted the development of Altruistic Values (AV), and one out of three green cities encouraged Non-Activist Behaviors (NAB) ($n = 10$ green cities, 32.6%), while less green cities ($n = 6$ green cities, 19.3%) supported Activism Behaviors (AB).

5.4.2. EC Actions

Our results indicated that the implemented green policies in cities also had a positive impact that went beyond the development of citizens' EC competencies into EEC outcomes (Table 4).

Table 4. Absolute Number and Percentage of Green Cities Reporting on EC Actions.

EC Actions	N	%
EC actions per dimension		
Individual Actions (IA)	$n = 20$	64.5%
Collective Actions (CA)	$n = 10$	32.6%
EC actions per sphere		
Public Sphere Actions (PuSA)	$n = 13$	41.9%
Private Sphere Actions (PrSA)	$n = 11$	35.4%
EC actions per scale		
Local Scale Actions (LSA)	$n = 12$	38.7%
National Scale Actions (NSA)	$n = 3$	9.6%
Global Scale Actions (GSA)	$n = 1$	3.2%

More specifically, according to our findings, most of the reviewed green cities promoted citizen's "Individual Actions (IA)" ($n = 20$ green cities, 64.5%), such as reducing energy consumption in residential properties in Vaxjö (Germany) (21 in Appendix A) and in Strasbourg (10 in Appendix A) or composting in each house in Surabaya (Indonesia) (19 in Appendix A). One-third of the green cities ($n = 10$ green cities, 32.6%) encouraged citizens' "Collective Actions (CA)" toward pro-environmentalism. Examples of the collective actions are students in Bristol (UK) raising money, assisting community groups, helping in workdays, designing and delivering workshops (4 in Appendix A), or the "Green Women" in Ilam (East Nepal) in maintaining the flowers and fountains and the overall cleanness of a bazaar area (5 in Appendix A).

At the same time, green cities allowed citizens to undertake "Public Sphere Actions (PuSA)" ($n = 13$ green cities, 41.9%) such as participating in community service programs in Surabaya (Indonesia) (4 in Appendix A) or reforestation activities in Toronto (14 in Appendix A). Green cities encourage also "Private Sphere Actions (PrSA)" ($n = 11$ green cities, 35.4%) that is, actions in relation to their everyday life at work and at home. We

also found that the majority of the reviewed green cities promoted “Local Scale Actions (LSA)” ($n = 12$ green cities, 38.7%), while only three ($n = 3$) green cities (9.6%) encouraged “National Scale Actions (NSA)”. Finally, we found that only one ($n = 1$) green city (3.2%) promoted “Global Scale Actions (GSA)”.

5.4.3. EEC Outcomes

Based on our findings, many of the EEC outcomes were frequently reported in the reviewed studies (Table 5). The most often reported EEC outcomes were the “Achievement of Critical and Active engagement and Civic Participation (CAE)” ($n = 12$ green cities, 38.7%), as well as the “Solution of Environmental Problems (SEP)” ($n = 11$ green cities, 35.4%). What followed was the “Achievement of Sustainability (AS)” ($n = 9$ green cities, 29%). Finally, lesser emphasis was given to the promotion of other EEC outcomes, such as the “Practice of Environmental Rights and Duties (ERD)” ($n = 7$ green cities, 22.5%), the “Development of Healthy Relationship with Nature (HRN)” ($n = 6$ green cities, 19.3%), and the “Promotion of Inter/Intra-Generational Justice (IGJ)” ($n = 6$ green cities, 19.3%).

Table 5. Absolute Number and Percentage of Green Cities Reporting on EEC Outcomes.

EEC Outcomes	N	%
Achievement of Critical and Active engagement and Civic Participation (CAE)	$n = 12$	38.7%
Solution of Environmental Problems (SEP)	$n = 11$	35.4%
Achievement of Sustainability (AS)	$n = 9$	29%
Practice of Environmental Rights and Duties (ERD)	$n = 7$	22.5%
Development of Healthy Relationship with Nature (HRN)	$n = 6$	19.3%
Promotion of Inter/Intra-Generational Justice (IGJ)	$n = 6$	19.3%

5.5. Interrelatedness among Implemented Green Policies, Citizens’ Engagement and Education for Environmental Citizenship

5.5.1. Bivariate Correlations

Addressing our RQ4 (“How can green cities support further the development of citizens’ Environmental Citizenship?”), we deployed Spearman’s coefficient to compute bivariate correlations among citizens’ engagement dimensions and the EEC model, in order to explore the potential relationships among them. Our correlation analysis resulted in various positive strong and moderate correlations, which we describe below.

Our statistical analysis led to several strong and moderate positive correlations between “Environmental Governance” and EC based on the EEC model (Figure 6). Focusing on the strong positive correlations, “Agents of change (CAC)” was correlated with (a) “Constructive Participation Skills (CPS)” ($r = 0.63, p < 0.01$), (b) “Public Sphere Actions (PuSA)” ($r = 0.60, p < 0.01$), and (c) “Achievement of Sustainability (AS)” ($r = 0.74, p < 0.01$). Another dimension of Environmental Governance that was also strongly correlated with EC was “Citizens’ participation in Environmental Governance (CEG)”. This dimension was strongly correlated with “Communication Skills (CS)” ($r = 0.60, p < 0.01$) and the “Biospheric Values (BV)” ($r = 0.6, p < 0.01$). “Stakeholders’ engagement with Environmental Governance (SEG)” was also strongly correlated with the “Practice Environmental Rights and Duties (ERD)” ($r = 0.62, p < 0.01$). Our statistical analysis led to several strong and moderate positive correlations between “Stronger Communities” and EC based on the EEC model (Figure 7). Focusing on the strong positive correlations, “Volunteering (Vo)” was strongly correlated with (a) “Constructive Participation Skills (CPS)” ($r = 0.60, p < 0.01$), (b) “National Scale Actions (NSA)” ($r = 0.60, p < 0.01$), and (c) “Achievement of Sustainability (AS)” ($r = 0.74, p < 0.01$). “Promoting a Sense of Place (PSP)” was strongly correlated with “Global Scale Actions (GSA)” ($r = 0.69, p < 0.01$). Moreover, “Promoting a Sense of Community (PSC)” was found to be strongly linked with “Achievement of Sustain-

ability (AS)" ($r = 0.65, p < 0.01$). In addition, the examined relations between Environmental Awareness and Education and EC based on the EEC model revealed two strong correlations (Figure 8). More specifically, "Educational Programmes for Citizens (EPC)" were strongly and positively correlated with "Collaboration and Social Interaction Skills (CSIS)" ($r = 0.65, p < 0.01$). In addition, "Training for Stakeholders (TS)" was found to be strongly and positively correlated with "Willingness for Intercultural Communication (WICE)" ($r = 0.69, p < 0.01$). Some strong correlations were found among two types of citizens' engagement projects with EC based on the EEC model (Figure 9). In more detail, "Ecological Projects in Households (EPH)" as well as "Citizens Co-owned Power plants (CCPP)" were strongly and positively correlated with "Willingness for Environmental and Social Justice (WESJ)" ($r = 0.69, p < 0.01$, respectively). In addition, "Citizens Co-Owned Power plants (CCPP)" were found to be also strongly linked with "National Scale Actions (NSA)" ($r = 0.69, p < 0.01$). Furthermore, the examined relations between "Motivation" and EC based on the EEC model revealed various moderate positive correlations, as well as strong positive correlations among motivation with one particular attitude (Figure 10). More specifically, and focusing on the strong correlations, "Environmental motivation (EnM)", "Economic Motivation (EcM)", and "Social motivation (SM)" were found to be positively associated with "Willingness to Take Responsibility for the Environment (WTRE)". The Spearman's coefficient was $r = 0.64$ ($p < 0.01$) in the first two cases and $r = 0.67$, ($p < 0.01$) in the last case. Our findings indicated strong and moderate positive correlations among the dimensions of "Types of engagement in civil practice" and EC based on the EEC model (Figure 11). In particular, "Activism (A)" was strongly associated with "Political Systems Knowledge (PSK)" ($r = 0.69, p < 0.01$) and with "Critical Understanding of Media Skills (CUMS)" ($r = 0.69, p < 0.01$). Also, "Civic Engagement (CE)" was found to be strongly correlated with "Local Scale Actions (LSA)" ($r = 0.61, p < 0.01$). Our correlational analysis among "Patterns of Political Participation in Civic Life" and EC based on the EEC model, revealed a series of positive moderate and strong connections (Figure 12). Focusing on the strong positive correlations, three of the five Patterns of Political Participation in Civic Life were linked with EC based on the EEC model: "Involve (Inv)", "Collaborate (Col)", and "Empower (Emp)". Interestingly, these patterns let citizens gain a more active role in the implemented green policies of the cities. More specifically, "Involve (Inv)" was strongly correlated with "Achievement of Critical and Active engagement and Civic Participation (CAE)" ($r = 0.63, p < 0.01$). "Collaborate (Col)" was strongly associated with "Constructive Participation Skills (CPS)" ($r = 0.71, p < 0.01$) and with "Altruistic Values (AV)" ($r = 0.68, p < 0.01$). Finally, "Empower (Emp)" was strongly correlated with "Willingness to support Gender Equality and Social Cohesion (WSGE)" ($r = 0.60, p < 0.01$), and with "National Scale Actions (NSA)" ($r = 0.60, p < 0.01$). The findings indicated only a few strong or moderate positive correlations between the Implemented Green Policies and EC based on the EEC model (Figure 13). In more detail, we identified only one strong correlation between "Achievement of Critical and Active engagement and Civic Participation (CAE)" and "Sustainable Build Environment (SBE)" ($r = 0.63, p < 0.01$).

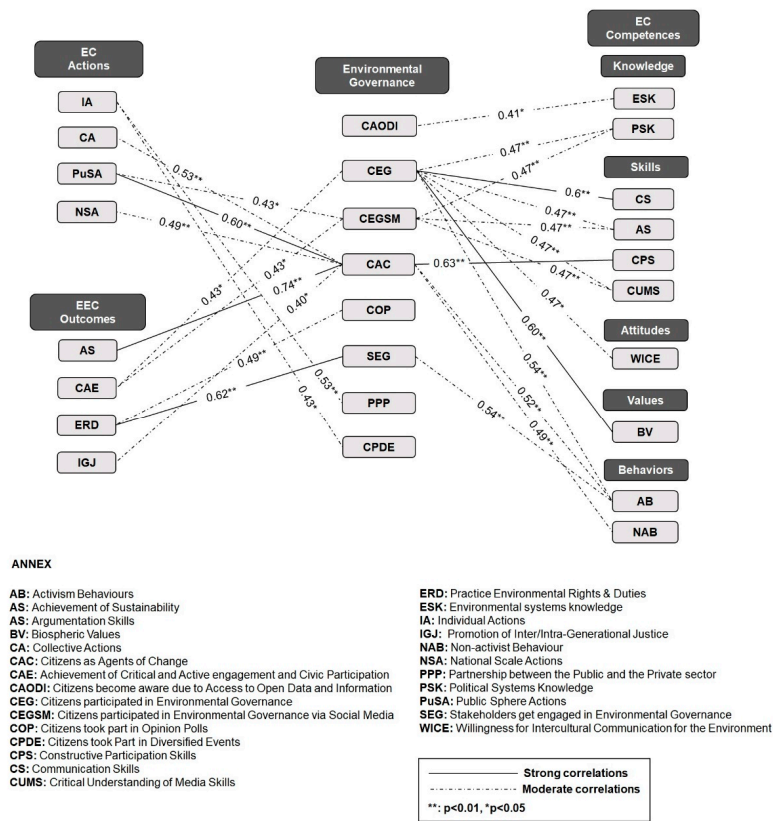


Figure 6. Correlations among Environmental Governance and Environmental Citizenship.

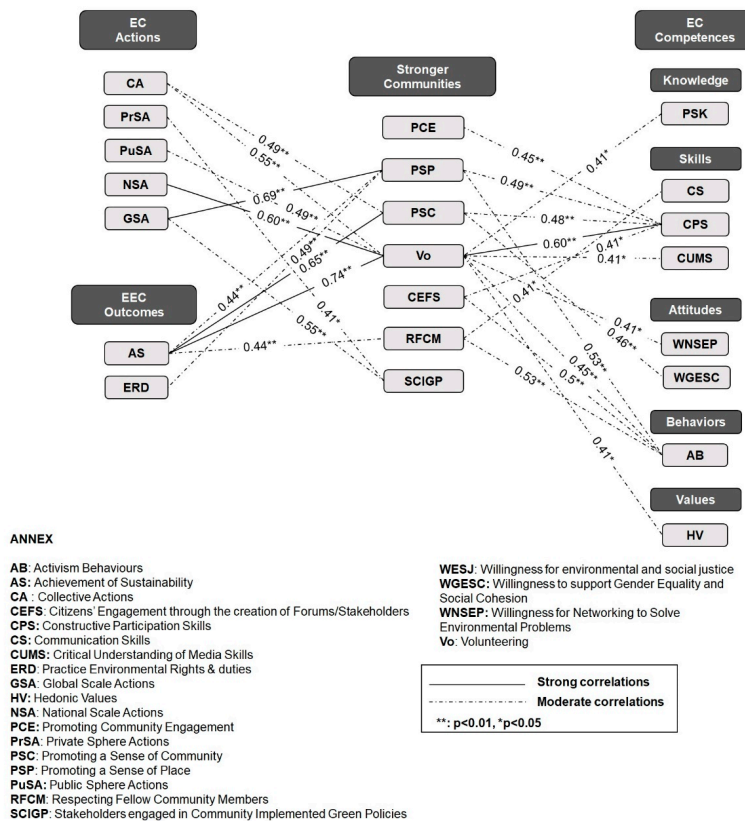


Figure 7. Correlations among "Stronger Communities" and Environmental Citizenship.

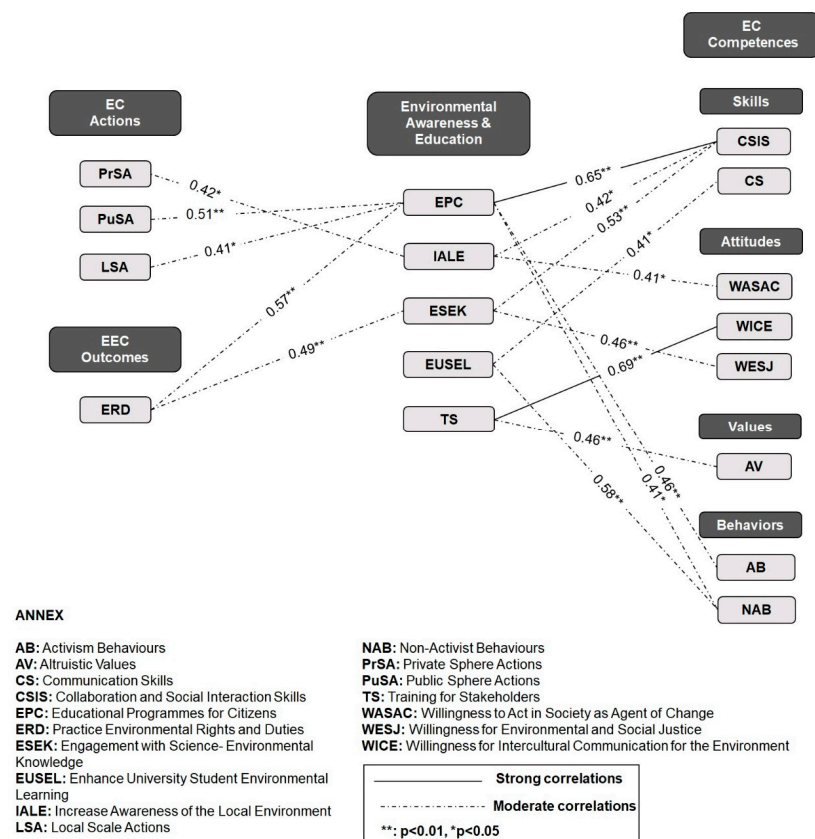


Figure 8. Correlations among “Environmental Awareness and Education” and Environmental Citizenship.

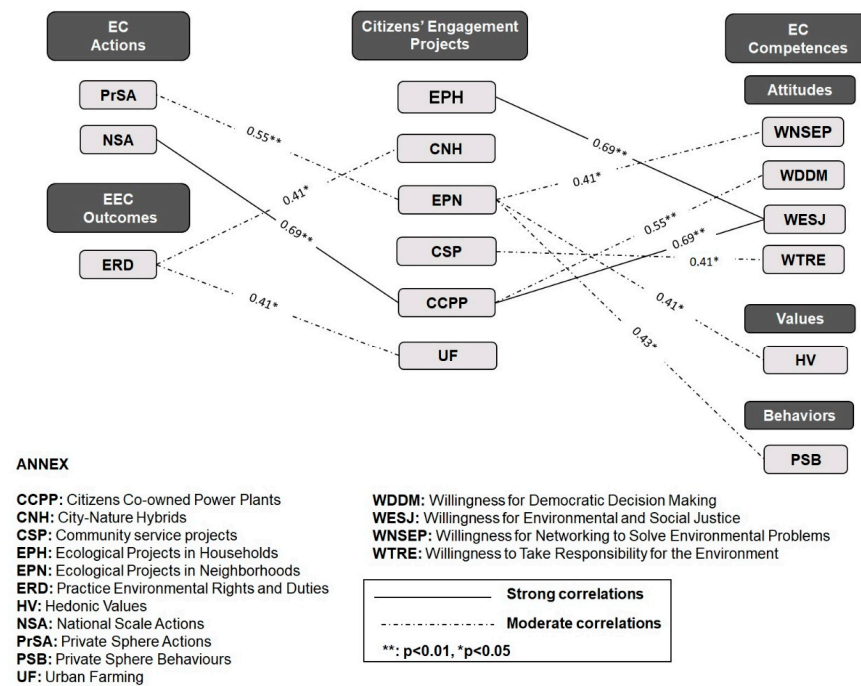


Figure 9. Correlations among “Citizens’ Engagement Projects” and Environmental Citizenship.

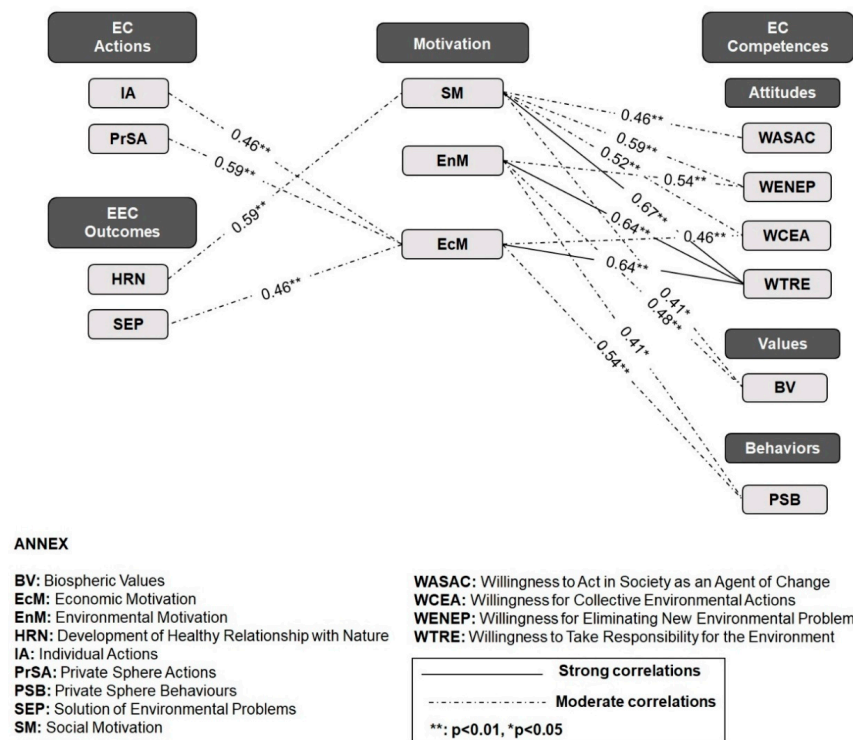


Figure 10. Correlations among “Motivation” and Environmental Citizenship.

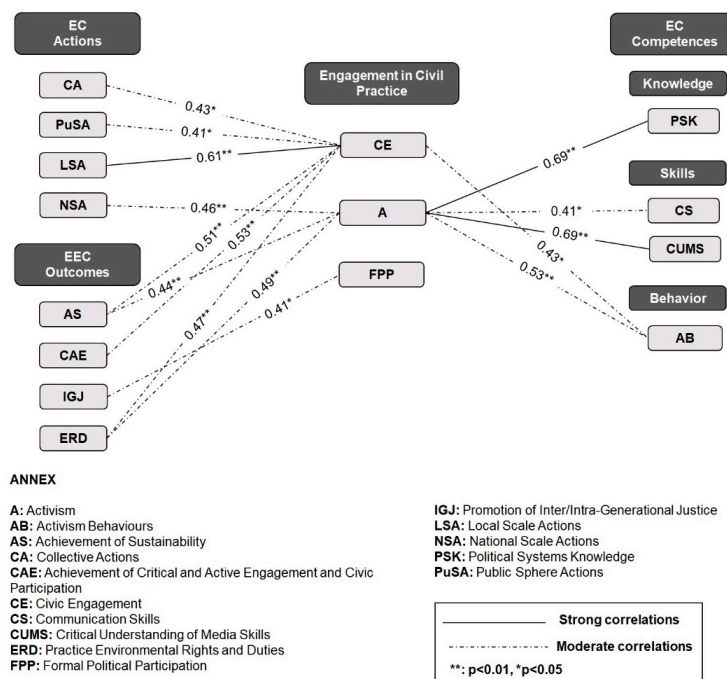


Figure 11. Correlations among Engagement in civil practice and Environmental Citizenship.

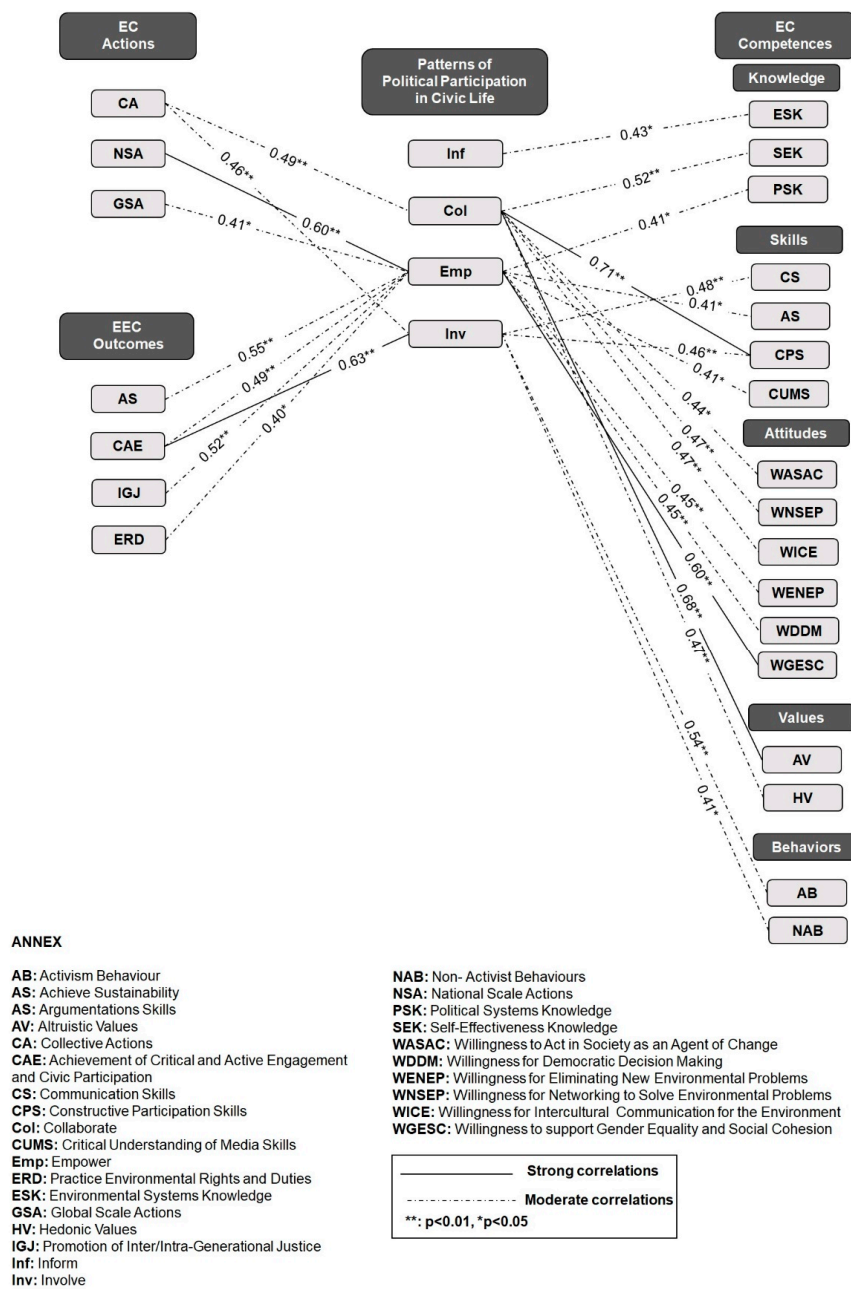


Figure 12. Correlations among “Patterns of Political Participation in Civic Life” and Environmental Citizenship.

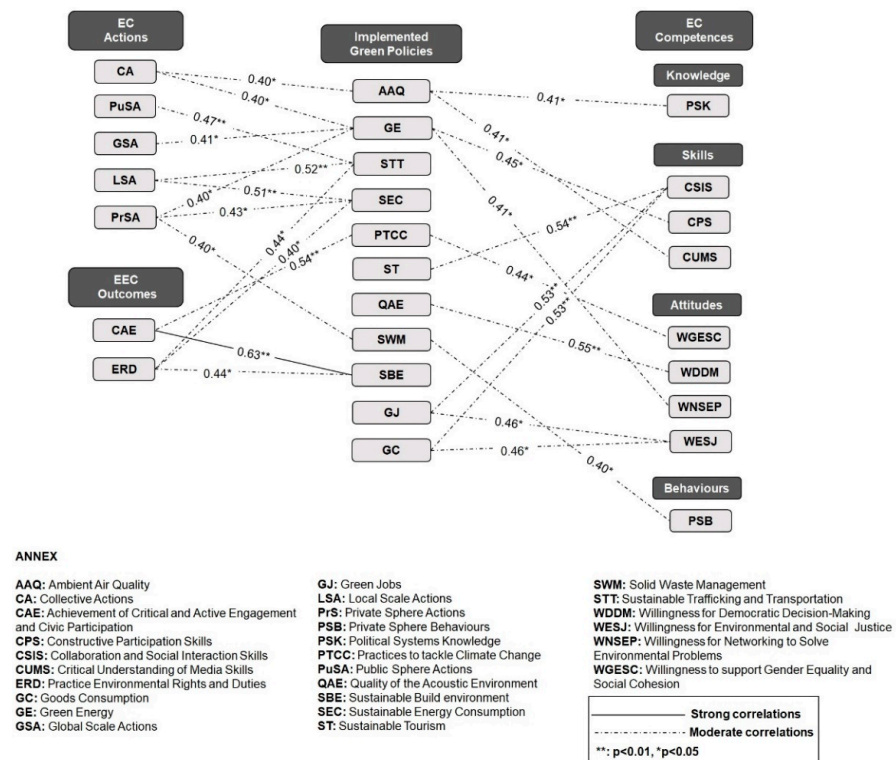
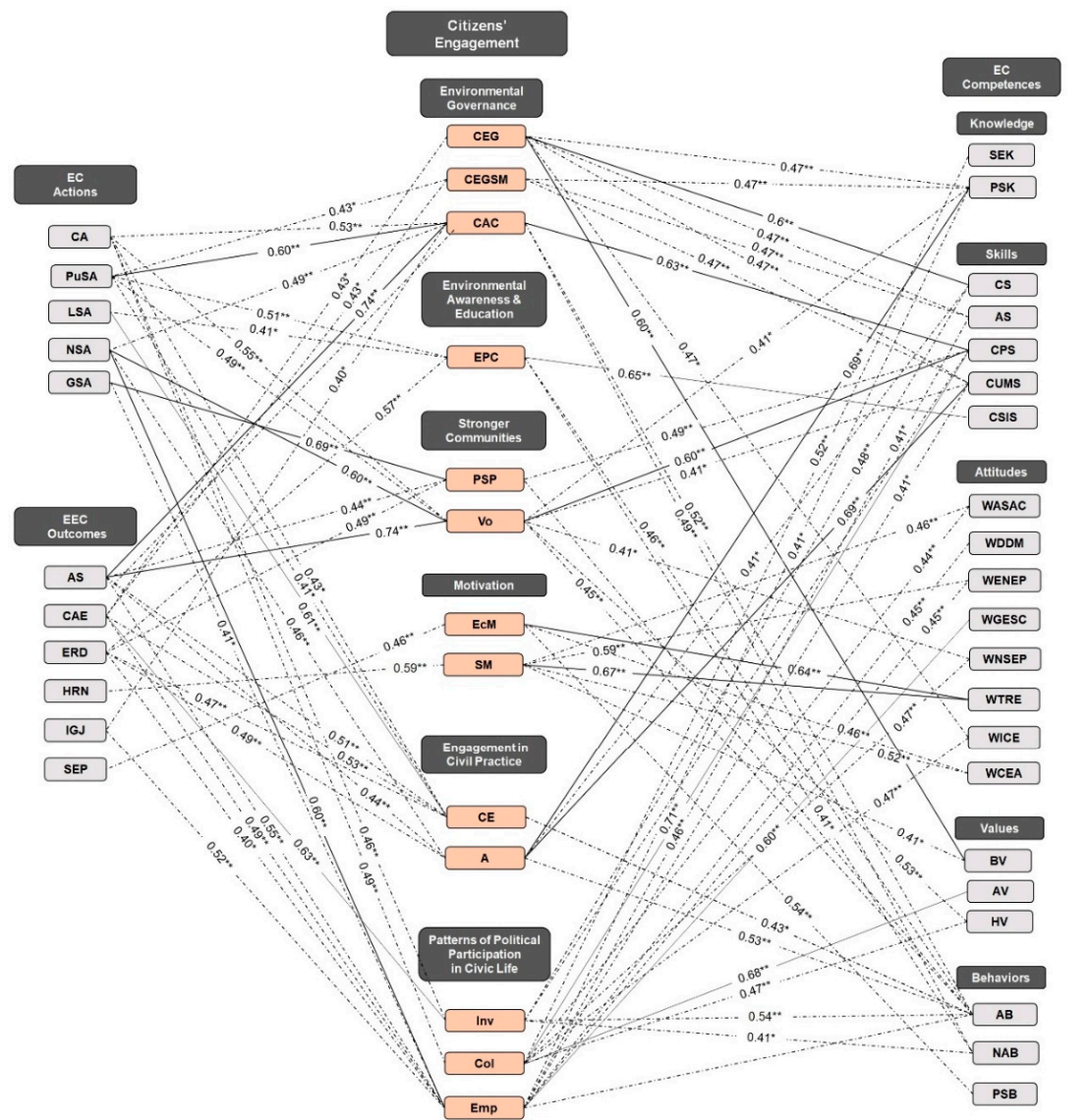


Figure 13. Correlations between Implemented Green Policies and Environmental Citizenship.

5.5.2. Keystone Components and Peripheral Components

Our cluster analysis helped us divide the components of our coding scheme into two categories, namely the Keystone Components (KCs) and the Peripheral Components (PCs). The cluster analysis determined a cut-off point between these two categories. More specifically, components with $5 \leq$ connections were classified as “Keystone components”. On other hand, components with $4 \geq$ connections were classified as “Peripheral components”. Therefore, based on this classification, the Keystone Components refer to the most important ones, whereas the Peripheral Components included the least important ones. The Keystone Components should be therefore seen as the backbone of Citizens’ Engagement and Environmental Citizenship in relation to green cities. We found Keystone Components in both the Citizens’ Engagement and Environmental Citizenship. The following two diagrams depict the Keystone Components of Citizens’ Engagement (Figure 14) and of Environmental Citizenship (Figure 15) and their connections with Peripheral Components. As for Citizens’ Engagement, there were 13 ($n = 13$) Keystone Components. The Keystone Component with the greatest number of connections was “Empower (Emp)” with 12 connections ($n = 12$), followed by “Volunteering (Vol)” with 10 connections ($n = 10$). There were also Keystone Components with eight connections ($n = 8$) namely, “Citizens acting as Agent of Change (CAC)”, and “Collaborate (Col)”. “Civic Engagement (CE)”, and “Activism (A)” were linked to seven ($n = 7$) components, while “Citizens participate in Environmental Governance (CEG)”, “Promoting a Sense of Place (PSP)”, “Educational Programs for Citizens (EPC)”, “Social Motivation (SM)”, “Economic Motivation (EcM)”, and “Involve (Inv)” were linked to six components ($n = 6$). This was followed by “Citizens participate in Environmental Governance via Social Media (CEGSM)”, which was linked with five ($n = 5$) components.



Annex

- A: Activism
- AB: Activism Behaviors
- AS: Achievement of Sustainability
- AS: Argumentation Skills
- AV: Altruistic Values
- BV: Biospheric Values
- CA: Collective Actions
- CAC: Citizens as Agents of Change
- CAE: Achievement of Critical and Active Engagement and Civic Participation
- CE: Civic Engagement
- CEG: Citizens participated in Environmental Governance
- CEGSM: Citizens participated in Environmental Governance via Social Media
- Col: Collaborate
- CS: Communication Skills
- CSIS: Collaboration and Social Interaction Skills
- CPS: Constructive Participation Skills
- CUMS: Critical Understanding of Media Skills
- Emp: Empower
- EcM: Economic Motivation
- EPC: Educational Programmes for Citizens
- ERD: Practice Environmental Rights and Duties
- HRN: Development of Healthy Relationship with Nature
- HV: Hedonic Values
- SEK: Self-Effectiveness Knowledge
- SEP: Solution of Environmental Problems
- SM: Social Motivation
- Vo: Volunteering
- WASAC: Willingness to Act in Society as an Agent of Change
- WCEA: Willingness for Collective Environmental Actions
- WENEP: Willingness for Eliminating New Environmental Problems
- WGESC: Willingness to support Gender Equality and Social Cohesion
- WDDM: Willingness for Democratic Decision Making
- WICE: Willingness for Intercultural Communication for the Environment
- WNSEP: Willingness for Networking to Solve Environmental Problems
- WTRE: Willingness to Take Responsibility for the Environment
- GSA: Global Scale Actions
- IGJ: Promotion of Inter/Intra-Generational Justice
- LSA: Local Scale Actions
- Inv: Involve
- NAB: Non-Activist Behaviors
- NSA: National Scale Actions
- PSB: Private Sphere Behaviors
- PSK: Political Systems Knowledge
- PSP: Promoting a Sense of Place
- PuSA: Public Sphere Actions

— Strong correlations

- - - Moderate correlations

Keystone Components (KCs)

Peripheral Components (PCs)

** : p<0.01, *p<0.05

Figure 14. Correlations among the Keystone Components (KCs), belonging to the Citizens' Engagement Theme and the Peripheral Components (PCs).

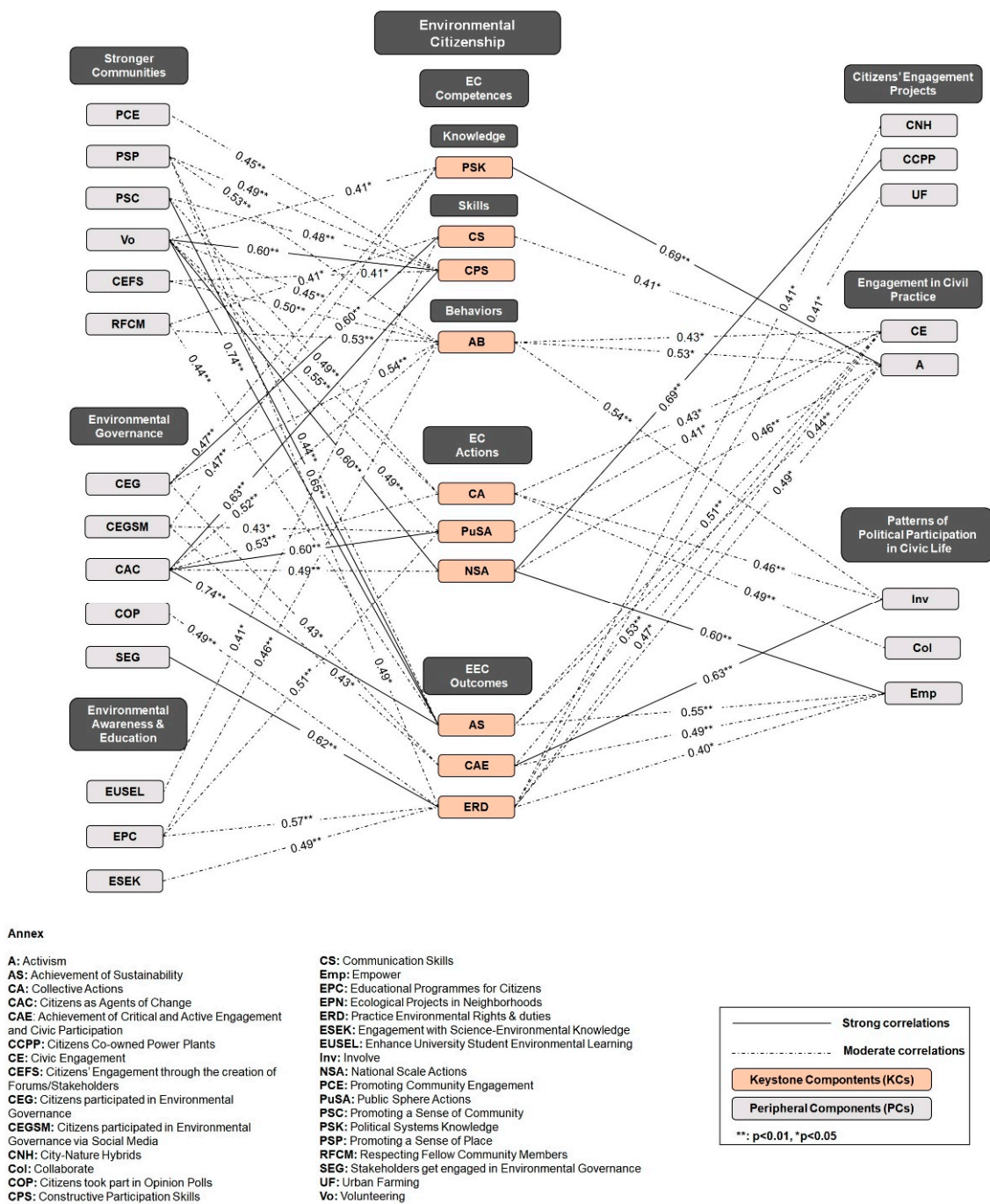


Figure 15. Correlations among the Keystone Components (KCs) of Environmental Citizenship and the Peripheral Components (PCs).

In addition, there were Keystone Components coming from Environmental Citizenship based on the EEC model, which were ten ($n = 10$) in total. The EC components with the higher number of connections with other components were the “Practice of Environmental rights and Duties (ERD)”, which was connected with 10 components ($n = 10$). This was followed by the “Activism Behaviors (AB)”, which was linked with nine components ($n = 9$). Also, “Constructive Participation Skills (CPS)” was associated with eight components ($n = 8$), “Achievement of Sustainability (AS)” with seven components ($n = 7$), and “Collective Actions (CA)” with six components ($n = 6$). Last but not least, “Political Systems Knowledge (PSK)”, “Communication Skills (CS)”, “Public Sphere Actions (PuSA)”, “National Scale

Actions (NSA)", and "Achieve Critical and Active Engagement and Civic Participation (CAE)" were found to be correlated with five components ($n = 5$).

6. Discussion

This review study provided a systematic synthesis of the literature to advance the field's understanding of how green cities encourage citizens' engagement in the implemented green policies and influence citizens' EC. The key findings for each of the research questions that guided this review study are presented below.

6.1. *The Main Implemented Green Policies Adopted by the Green Cities (RQ1)*

One of the most often implemented green policies was the "Green Areas and Biodiversity". Green areas and biodiversity in the cities are thought to enhance human well-being and this is confirmed by numerous studies, e.g., Refs. [35–39]. Moreover, "Green economy" and especially, "Circular Economy" was also promoted by green cities. The hypothesis that the circular economy is gaining momentum in green cities [40] is therefore confirmed by this systematic literature review. This study also provides evidence for the new trend to promote "Sustainable Tourism (ST)" in green cities [41].

6.2. *Opportunities for Citizens' Engagement in Green Cities (RQ2)*

According to our findings, the reviewed green cities engaged their citizens in the implemented green policies to an extended degree and in multiple ways. First, "Citizens engaged in Environmental Governance (CEG)" in relation to green policies. Green cities mostly encouraged consultation with the citizens to get citizens' feedback on the intended city decisions (e.g., via opinion polls) or sometimes their involvement, too. There is, thus, the need for more elaborate public participatory processes for citizens [42]. It is encouraging though that, in general, green cities supported citizens' "Civic Engagement". Green cities supported citizens' interactions, communication, and effective participation skills. Social media and digital platforms allowed the scaling of deliberative processes beyond small group face-to-face discussions to broad public participation [43]. Moreover, private-public sector partnerships and the participation of stakeholders were also often supported in being part of it or ensuring its effective implementation. These sorts of collaborations were considered a positive step toward effective governance [44].

6.3. *Green Cities Contribute to Citizens' Environmental Citizenship (RQ3)*

Citizens in green cities were willing to actively take part in collective environmental actions with large impact and as such acted as agents of change, which is about initiating policies with the goal of implementing decisions related to the city's environmental concerns. Nevertheless, according to our findings, the citizens did not have opportunities to act in order to guarantee intercultural communication for the environment, as well as for environmental and social justice. It should be acknowledged that the apparent lack of these attitudes may be critical for advancing EC citizenship [32,45]. Likewise, "Altruistic Values" were not promoted to a great extent by the green cities. Green cities often facilitated the development of "Biospheric Values", which, along with altruistic ones, advocate public behavior change and support environmental preservation and restoration efforts [45]. Our correlational analysis has shown that "Altruistic Values" helped citizens to collaborate with the city at the decision-making and implementation levels. Also, "Biospheric Values" (caring about the environment) boosted citizens' participation in public participation processes. This is also confirmed by Bouman et al. (2021), who found that "Biospheric Values", compared to other values, were rather strongly and persistently associated with climate action [46].

Citizens often enough adopted "Private Sphere Behaviors" in green cities. Also, a few cities promoted "Non-activists Behaviors" while some encouraged "Activism Behaviors". Our correlational analysis indicated that to effectively adopt well-informed activist actions, citizens need to have deep knowledge of the political system. Curtin and McGarty (2016)

have also found that advanced political knowledge leads to elaborate activist behaviors [47]. We also found that activists may have a critical stance against the media and the information they provide. Critical thinking skills in relation to socio-environmental issues and toward media or other sources are also of great importance [45,48].

Finally, the undertaken EC actions resulted also in various EEC outcomes. We could affirm that green cities successfully achieve their environmental objectives since they had achieved the majority of them. Most importantly, our review confirmed that effectively participating in public action toward socio-environmental issues is of crucial importance to achieve sustainability [45,49,50].

6.4. Green Cities Support Citizens' Environmental Citizenship through Their Engagement in Implemented Green Policies (RQ4)

Our findings indicated that green cities contributed significantly to the promotion of EC competencies. Encouragingly enough, green cities placed emphasis on all categories of EC competencies. To cultivate EC, it is critical to empower citizens' attitudes and values, cultivate their skills and behaviors and foster their knowledge [31,45,51]. EC actions were also promoted mainly at the individual and private levels. Implemented green policies in green cities adopted a place-based approach and in this regard, they put a priority on civic actions at the local level. Feeling and functioning as community members is also closely connected to the way to sustainability. The green policies implemented should be acknowledged by the community to effectively reach their environmental goals [52]. This is because having a feeling of belonging to the city community, makes citizens take part in the sustainability initiatives of the green city [53]. Moreover, if citizens are bonded with their local environment through a sense of place and they will most possibly also act against global environmental problems by taking global action in global campaigns. This reminds us of the well-known motto: "Think globally, act locally". Nevertheless, multi-scalar EC should not be considered a disadvantage [54]. Furthermore, the correlational analysis allowed us to conclude that educational programs for citizens help them to foster their "Collaboration and Social Interaction Skills" in relation to socio-environmental problems, which enables them to think of and practice together solutions by working in a cooperative team environment.

The strong association between "Communication Skills" and "Citizens' participated in Environmental Governance" implies their mutual relationship. On the one hand, citizens need advanced "Communication Skills" to help them take part in environmental governance processes. On the other hand, their engagement in environmental governance offers them the opportunity to advance their "Communication Skills". The same goes for "Constructive Participation Skills" and "Volunteering". As community members, citizens need sufficient participation skills to be able to volunteer. In green cities, "Constructive Participation Skills" are necessary for citizens to help them comprehend the changes taking place in their environment and participate actively in those changes [55]. At the same time, taking part in volunteering activities helps citizens to acquire new skills such as "Constructive Participation Skills" [56,57].

Our review has also shown that "Willingness to Take Responsibility for the Environment" was strongly correlated with "Environmental, Social, and Economic Motivation". For more than 20 years, research has supported the influence of motivation on pro-environmental behaviors and actions, e.g., Refs. [58–60]. Yet, the dilemma of economic benefits or environmental quality comes to the front again for the citizens themselves, e.g., Ref. [61]. However, green cities advance peoples' understanding of how natural ecosystems work ("Environmental Systems Knowledge") and what measures could be made to address an environmental issue ("Action-related Knowledge"), which will allow citizens to prioritize environmental protection.

Often, citizens had the opportunity to participate in "Ecological Projects in Neighborhoods" (Freiburg in Germany, Stockholm in Sweden, Strasbourg and Saint-Dié in France) or "Citizens' Co-Owned Power Plants" (see, for instance, Higashi-Ohmi in Japan). According

to our correlational analysis, this was related to their “Willingness to Act for Environmental and Social Justice”. This is not surprising since both projects were intended to achieve environmental and social fairness [61–63]. Moreover, we observed in our correlational analysis that the engagement of stakeholders in environmental governance guaranteed that environmental rights were respected. In addition, environmental duties were employed by the various stakeholders to succeed in fulfilling their role in relation to socio-environmental issues, which helped citizens to “Practice their Environmental Rights and Duties” [64].

Finally, we found a balance between the number of Keystone Components in relation to Citizens’ Engagement (thirteen Keystone Components) and the number of Keystone Components coming from Environmental Citizenship (ten Keystone Components). This indicates that increased levels of citizens’ engagement in the implemented green policies in green cities are of crucial importance for the development of EC competencies, the employment of EC actions, and the achievement of EEC outcomes in green cities. Especially, the active participation of citizens in environmental governance and, in general, their engagement in all facets of the implemented green policies by acting as agents of change are of high significance for the EEC model. A particular type of engagement in civic practice, namely “Activism”, appears to have a great influence on EEC Outcomes. “Activism” actuates citizens in green cities leading to the “Practice of Environmental Rights and Duties” and finally, to the “Achievement of Sustainability”. The participation of citizens in green cities in educational programs in relation to the implemented green policies seems to have boosted not only the adoption of “Activism Behaviors” and “Public Sphere Actions” but also the “Practice of Environmental Rights and Duties”.

7. Conclusions

Despite the constraints indicated above, we conducted thorough research and statistical analysis of the existing empirical data in our review study, which led us to important findings. In the last two decades, a few cities worldwide have put their efforts into effectively implementing green policies and thus, turned into green cities. Citizens were, to a great extent, engaged at the decision and implementation levels in green cities and this is of great importance to the success of any green policy in cities. Our findings can be used to drive future research in relation to the role of citizens in green cities. Based on our findings, we propose several future research directions.

Firstly, we have found that along with the promotion and establishment of green areas and biodiversity in green cities, there are also additional green policies, that have lately emerged. This study confirms the latest trends of circular economy, sustainable tourism, sustainable food systems in green cities, and of turning the cities into city-nature hybrids, as well.

Secondly, green cities let their citizens get engaged with environmental governance in relation to green policies, in a variety of ways. The citizens had the opportunity to perform as agents of change, since they were not asked to passively apply the previously decided policies but to be actively engaged at the environmental governance level, as well. However, according to our findings, green cities encouraged mostly low levels of citizen participation such as consultation with the citizens.

Thirdly, according to our review, it seems that to encourage their citizens to get more actively engaged, green cities need to promote citizens’ altruistic values toward fellow (non-) humans to warrant environmental and social justice. Altruistic values will allow citizens not only to adopt a consultant role but also to substantially collaborate with the city administration under the prism of green policies. Another factor that facilitates citizens’ engagement in green policies is if citizens feel bonded with their local environment.

Finally, green cities not only encouraged citizens’ engagement in the implemented green policies but also fostered citizens’ EC. This is quite encouraging because the model of green cities could be adopted to adequately promote citizens’ EC. Notably, according to our findings, green cities promoted the development of all EEC model components (Competences, Actions, and Outcomes). This is of high significance because EC competences are

seen as a prerequisite for EC actions and in turn, EC actions are considered a prerequisite for EEC Outcomes. Green cities should be seen as EC exploratoriums and thus foster EC competences, actions, and outcomes leading to green transition [65]. As for EEC outcomes, it appears that green cities should put more emphasis on inter/intra-generational justice and on citizens' practicing environmental rights and duties, as well as on the cultivation of a healthy relationship with nature.

8. Limitations

Despite the fact that the findings of this review study may help to flesh out a more comprehensive picture of citizens' engagement and EC in green cities, there are several limitations to be aware of. Search engines should be used with caution when retrieving scientific publications by filtering the existing literature with specified keywords [66]. Furthermore, our method resulted in the review of scholarly articles published in English over the last two decades (2010–2021), but not in other languages. This could result in chronological and geographic bias [67]. Lastly, the fact that our study only contained 25 empirical research for 31 green cities could be seen as a drawback.

9. Future Directions

Still little is known about how these recent policies are understood and implemented in green cities. Future research should seek to meet this gap. Even if green cities let citizens' voices be heard, this does not guarantee that citizens' proposals will be applied. Other actors such as private–public sector partnerships or stakeholders often influence the decisions made regarding green policies and facilitate their implementation. The collaboration among city administration, citizens, private or other public actors, and stakeholders should be investigated to provide us with more insights as to which elaborate public participation processes could be applied. Future research should also focus on successful case studies, to explore whether green cities have achieved higher levels of citizen engagement in green policies and to reveal more factors that may facilitate citizens' successful engagement. Likewise, case studies on green cities that fail to actively engage their citizens in their green policies would allow us to examine potential barriers. Finally, future empirical research should put emphasis on specific green cities in order to provide more details on each of the themes of the study (Environmental Governance, Stronger Communities, Environmental Awareness and Education, Citizens' Engagement Projects, Motivation, Engagement in Civic Practice, and Patterns of Political Participation in Civil Life) in order to provide recommendations for policymakers and several stakeholders who facilitate citizens' engagement in green cities.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su142316223/s1>. Table S1: Definitions and indicative excerpts of the coding schemes; Table S2: Absolute Number of the Green Cities Reported and their Country.

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Appendix A

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