Enhancing Urban Resilience through Environmental Justice

A Case Study of Rawalpindi & Islamabad, Pakistan

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THESIS ACCEPTANCE CERTIFICATE

Certified that final copy of the thesis titled "Enhancing Urban Resilience through Environmental Justice: A Case Study of Rawalpindi & Islamabad, Pakistan" written by Mr. Usama Athar Malik (Registration No. 00000330310), of Urban and Regional Planning (NIT-SCEE) has been vetted by the undersigned, found complete in all respects as per NUST Statutes/Regulations, is free of Plagiarism, errors and mistakes and is accepted as partial fulfillment for the award of MS degree. It is further certified that necessary amendments as pointed out by GEC members of the scholar have also been incorporated in the said thesis.

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Date: _____

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Date: _____

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Date: _____

DEDICATION

This thesis is dedicated to my beloved parents, brother and grandparents for always being an unending source of love and encouragement.

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All praises to the Allah Almighty, the merciful and the most beneficent who showers his blessings upon us every day. He beholds all the knowledge of the universe and beyond.

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Usama Athar Malik

ABSTRACT

The idea of environmental justice is intricate and encompasses multiple disciplines. It is increasingly being utilized to cultivate resilience in tackling climate change. Rapid technological advancements have caused urbanization to increase in most cities, leading to unprecedented environmental and social challenges. To address these challenges, it is crucial to focus on enhancing the resilience of urban areas. This study aimed to develop various strategies for promoting urban resilience through environmental justice. To achieve this, the study investigated public perceptions, attitudes, and readiness for environmental justice. Additionally, the study identified challenges faced by institutions in implementing environmental justice and analyzed social inequalities in relation to environmental justice, providing a comprehensive understanding of the situation. The research findings were analyzed using bibliometric and thematic analyses, as well as other analytical tools like index based analysis and descriptive statistics. This allowed for the proposal of a framework that provides guidelines on enhancing urban resilience through environmental justice and how it can contribute to future research in urban systems and governance-related fields.

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Chapter 1

INTRODUCTION

1.1 Background

Long-term changes in temperature and weather patterns are referred to as "climate change" in general. Climate change is recognized as the biggest threat to our society in the ensuing decades due to its enormous area of effect, with the potential to have an impact on numerous huge and diversified groups of urban people in this century of urbanization. (Reckien et al., 2017). The riskier component of climate change is the role that human activities play in raising the severity of environmental stresses like severe heat and heavy precipitation, which is more and more linked to the worsening of extreme events like droughts and wildfires. As a result, communities around the world are faced with an increasing difficulty as a result of stressors that have an impact on human health and safety, urban and rural infrastructure, food security, and water availability. In turn, this threatens future economic growth in communities with limited resources and exacerbates current imbalances. (Hoffman, 2020).

It is evident from the above discussion that climate change is one of the most dangerous phenomenon as it not only damage the environment but also it imposes serious threats to the wellbeing of the people living in the vicinity consequently deteriorating the quality of life. Therefore Climate change adaptation requires a strong and effective policy framework to implement rules and regulations to deal with climate change's negative effects in order to make our environment more resilient (Hoffman, 2020). However before moving we must understand the concept of urban resilience. Resilience in general refers to the ability of a system to withstand detrimental effects of a catastrophic event or disaster. Thus resilience is not only limited to environmental events rather it has extended to social and economic crisis as well making it a crucial element of governing urban systems. Urban resilience is defined as the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience (Ziervogel et al., 2017b).

Therefore an important step towards enhancing urban resilience is to advance the policies and regulations comprising the governance systems however these policies will be ineffective if

they are not implemented properly and justly. In other words, if the measures taken to counter the detrimental effects of environmental change do not equally affect all sections of society, they will be useless and lose their true purpose (Hill, 2016). This has led to the emergence of the concept of environmental justice.

As the name suggest environmental justice refers to the "the fair treatment and meaningful involvement of people of all races, cultures, incomes, or education levels, with respect to the development and enforcement of environmental laws, policies and regulations" (Ajibade, 2019). Moving on environmental justice is not a new concept. It first emerged in 1980s and gained popularity as a social movement but with the passage of time different dimensions of this concept were explored and people started to realize its true potential. Being a multidimensional phenomenon, environmental justice have positive implications in different fields however if we combine it with urban resilience, it will have profound impacts in strengthening the urban governance and climate change adaptation. By examining the relationship between environmental justice and resilience, we can gain a better understanding of the role that environmental justice plays in the governance of cities and the potential benefits it offers.

Despite the significance of environmental justice in enhancing urban resilience as discussed above, it is not a common practice in Pakistan. In fact its full potential is not being explored in most of the countries worldwide. However if implemented properly into the policy making and the field of planning and engineering, experts and concerned personnel would benefit a lot in combating the negative effects of environment and strengthening the urban governance systems to make them more resilient.

1.2 Justification

This study is going to analyze the household data which would indeed facilitate in determining indicators for quantifying social inequalities in the region of Rawalpindi and Islamabad in the context of environmental justice.

Furthermore, this study attempts to develop a framework which would provide guidelines and recommendations for enhancing urban resilience in terms of environmental justice. The

Rawalpindi-Islamabad region also referred to as twin cities would serve as the perfect study area as Islamabad being the capital of city comprises of not only the governance structure which runs the whole country but also has a unique mix of people from all parts of the society. Our results would be more effective as we would be examining the effects of events taking place in Islamabad in the neighboring city of Rawalpindi as well

1.3 Problem Statement:

Environmental justice is a relatively new phenomenon that originated in the 1980s. It took some time to gain recognition among researchers, scholars, planners, and policymakers due to its focus on the equal distribution of impacts and burdens of natural and environmental events among all members of society. As we all know urban areas are particularly vulnerable to environmental stresses and shocks such as natural disasters, climate change, and pollution. While these challenges affect all residents, they disproportionately impact low-income communities and communities of color due to structural inequalities and social injustice. Despite increasing efforts to build urban resilience, including policy interventions and infrastructure investments, there is a persistent gap in addressing the needs and priorities of demoted communities. Environmental justice, as a framework for understanding and addressing these inequities, has been gaining momentum in policy and research circles. However, there remains a lack of understanding about how environmental justice can be integrated into urban resilience planning and implementation, particularly in the context of deprived communities. In order to increase the efficiency of environmental justice as a tool to enhance urban resilience, we should focus on analyzing the social inequalities prevalent in the society through the lens of environmental justice. This would enable us to have a holistic view of the whole situation by facilitating in examining multiple dimensions of these inequalities. This would indeed help in increasing the efficiency of resilience planning and urban governance. Furthermore, one should also emphasize on understanding the public perception and attitude towards environmental justice. It would facilitate the planners and policy makers to better analyze the needs of public and incorporating their opinions would thus make our policies and practices more inclusive and just thus increasing their effectiveness and performance. Moving on, it is a known fact that no policy or framework could be successfully implemented without having a critical knowledge about the challenges and

hurdles which would be possibly faced in its implementation by the institutions. An effective framework providing guidelines and strategies for enhancing urban resilience through environmental justice would only be possible by keeping in mind the above discussed factors and research needs to be done in this regard to tackle the subject issue. Therefore this thesis aims to address this gap by exploring the role of environmental justice in enhancing urban resilience, and by providing practical recommendations for policymakers and practitioners to incorporate environmental justice principles into resilience planning and implementation.

1.4 Objectives:

i. To quantify social inequalities through the lens of environmental justice
ii. To understand public perceptions, attitudes and readiness for environmental justice
iii. To identify institutional challenges and barriers affecting environmental justice
iv. To propose framework to enhance urban resilience through environmental justice in urban areas.

The primary purpose of this study is to be identifying the indicators for quantifying the social inequalities in terms of environmental justice which would then facilitate in formulation of more inclusive and just policies ultimately increasing urban resilience.

This study is only limited to the urban areas and its surroundings. This study considered household characteristics, social characteristics such as education, income, ethnicity, status etc.

1.6 Research/Thesis Organization:

Chapter 1 provides general introduction to environmental justice and urban resilience, problem statements, research objectives, scope, and justification of this research. Chapter 2 presents the literature review in the light of the research study topic and research objectives. Chapter 3 is the research methodology. It sheds lights on the entire process of the research, selecting the study design, sample size, selection of instrument for data collection and data analysis techniques. Chapter 4 includes profile of the respondents and summarizes findings

of the social inequalities in the light of environmental justice and public perception about the environmental justice . It also consists of the institutional challenges encountered in the incorporation of environmental justice to enhance urban resilience. Chapter 5 presents conclusion and future research. At the end, references for the research study are provided along with Research Questionnaire as annexures.

Chapter 2

LITERATURE REVIEW

2.1 Background:

Climate change refers to the long-term shifts in temperature and weather patterns (Herreros-Cantis & Mcphearson, 2021). Even small changes in the climate can have significant and lasting effects on the atmosphere and various regions (Archer & Dodman, 2015)(Bautista et al., 2015). . These changes can be natural or human-induced, such as the burning of fossil fuels like coal, oil, and gas, and the release of other pollutants (Bautista et al., 2015). The long-term effects of climate change include melting ice caps, warmer oceans, rising sea levels, and ocean acidification (Cousins, 2021). These effects can have severe consequences for humanity and the environment, so it is important for us to take bold steps to become more resilient to climate change (Kim et al., 2018);(Bautista et al., 2015);(Hill, 2016).

Climate change adaptation requires a strong and effective policy framework to implement rules and regulations to deal with climate change's negative effects (Hoffman, 2020). However, these policies will be ineffective if they are not implemented properly and justly. In other words, if the measures taken to counter the detrimental effects of environmental change do not equally affect all sections of society, they will be useless and lose their true purpose (Hill, 2016). This has led to the emergence of the concept of environmental justice. As the name suggests, environmental justice refers to the fair and equitable distribution of the impacts of environmental changes among all members of society. It means that everyone should be treated equally while fulfilling the principles of justice (Corburn, 2017). In simpler terms, maintaining justice and equity in society in terms of dealing with the hazards posed by rapidly changing environments and the measures taken to address them is what the concept of environmental justice implies (Herreros-Cantis & Mcphearson, 2021).

To understand why environmental justice matters, one must remember that the movement fighting environmental racism is the result of what happens when people fear that their lives and health are being disproportionately put at risk because of the color of their skin or the sound of their accent The differences based on socio-cultural factors and the prejudice people

face on this basis are one of the most painful things one can experience. If these factors start affecting your lifestyle and threaten your survival, the penalties and results will be catastrophic. This led to increased awareness regarding the issue, and people started pondering different ways to deal with the emergent situation. In such circumstances, the concept of environmental justice started gaining more popularity Although there were problems initially, the condition became better but not perfect with the passage of time. The inequality based on race, income, caste, religion, and other social and cultural factors must be considered in policy and decision-making in order for our efforts to be successful (Lewis et al., 2017);(Colten et al., 2018). Without addressing these issues, our efforts will always has unintended consequences and the problem will not be completely resolved. To understand why environmental justice matters, one must remember that the movement fighting environmental racism is a response to people feeling that their lives and health are being disproportionately put at risk because of their race or accent (Mohai et al., 2009). The differences based on socio-cultural factors and the prejudice people face because of them are some of the most painful experiences one can have. When these factors start impacting one's lifestyle and threatening their survival, the consequences can be catastrophic. This has led to increased awareness of the issue and people have begun to explore different ways of addressing it. Environmental justice is a relatively new concept, but it is increasingly important as the world faces a range of environmental challenges (Hill, 2016). Despite its many benefits, many countries still do not give it the attention it deserves.

Environmental justice offers guidance to policymakers, planners, and other concerned individuals on how to address environmental change and its consequences (Mohai et al., 2009). This guidance can be used to develop inclusive and effective policies and frameworks for implementing them (Bowser & Cid, 2020). . This can greatly improve the quality of life for those affected by environmental changes and associated hazards, and it can also help to restore green spaces and the natural habitats of plants, animals, and birds. This not only enhances the beauty of the surrounding area, but also has a positive impact on the environment (Anguelovski et al., 2016);(Mabon, 2020).

In analyzing the fundamentals of resilience, it is important to consider who the resilience is

for, what it is for, when it is needed, where it is applicable, and why it is crucial. This will help clarify any misunderstandings about the relationship between environmental justice and resilience and provide guidance for the future (Archer & Dodman, 2015). We must also consider the tradeoffs between different stakeholders in an urban environment, asking ourselves whose vision of a desirable resilient future prevails and who stands to gain or lose as a result. The purpose of this study is to review current literature on the connection between environmental justice and urban resilience through bibliometric and thematic analysis. The study identifies key themes and applications of environmental justice that can help enhance urban resilience. The study also summarizes the diverse benefits of environmental justice and recommends strategies for improving urban resilience. Overall, the study provides a comprehensive overview of the relationship between environmental justice and urban resilience.

2.2 Environmental justice:

2.2.1 What is environmental justice?

The environmental justice as a concept evolved out of the social movement whose primary goal was to address the disproportionate environmental burdens on the marginalized communities, particularly low-income groups and people of color. These communities experience higher levels of exposure to environmental harms, such as pollution and toxic waste, and receive less legal protection than the affluent and privileged (Voelkel et al., 2018);(Lewis et al., 2017). The discriminatory and unequal exposure to environmental hazards started to get massive attention in socio-political and academic circles in the United States as early as 1982. This was the time when civil rights activists organized to stop the state of North Carolina from dumping 120 million pounds of contaminated soil in a predominantly African American county(Mohai et al., 2009); (Adams & Charnley, 2020). However, the acceptance of this concept has been slow and it is still not widely recognized in many countries.

The recent surge in the scholarship on ‘environmental justice’ confirms unequal impacts of environmental pollution on different social classes and racial/ethnic groups. It has been found

that ethnic minorities, indigenous people, people of color, and low-income communities are at an increased risk of environmental exposure due to industrialization, militarization, and consumer activities that pollute the air, water, and soil. This also led this concept to find measures to address and correct these inequalities (Bowser & Cid, 2020). Therefore, environmental justice as a movement wants to create a conducive environment where everyone has the chance to participate in decisions that have an impact on their environment and health. Additionally, it promotes the impartial implementation of environmental laws and regulations that safeguard the rights of underrepresented groups and avoid the unfair distribution of environmental costs (Corburn, 2017).

Although environmental justice is a relatively new and evolving field but it has the potential to impact not only environmental sciences, but fields such as urban planning. By exploring and applying this concept, we can benefit from more inclusive and effective solutions to environmental issues in cities. It can also provide guidelines in formulating policies for planning, implementing and evaluating urban environmental plans. Overall, the idea of environmental justice is crucial because it will help reduce inequalities in turn establish equal access to a safe and healthy environment for everyone. Fig 2.1 explains the different dimensions of environmental justice and its capabilities.

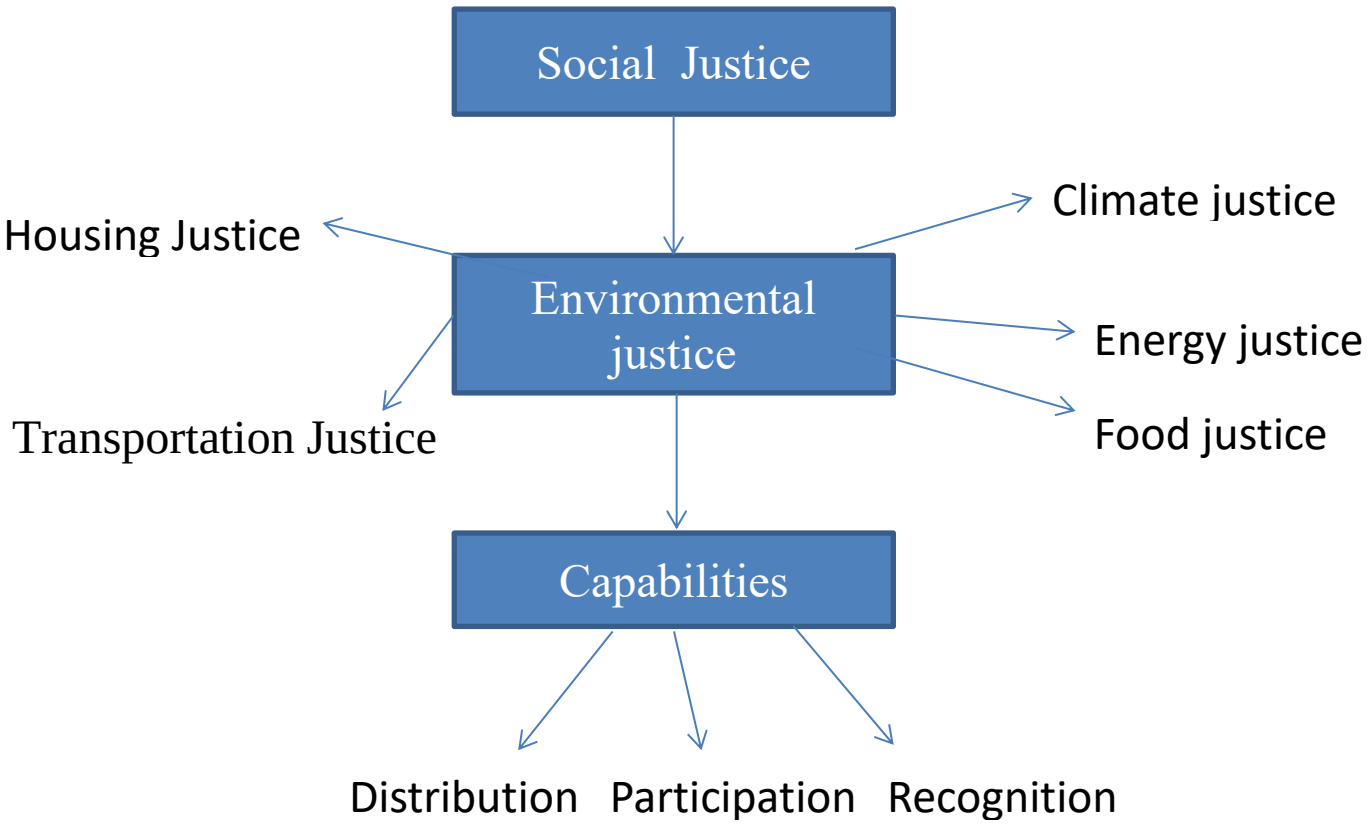

Figure 2.1 Environmental Justice today

2.2.2 Environmental justice and resilience

Resilience is the ability to recover quickly from an event or difficulty. Similarly urban resilience would mkatean an ability of a city to stay diligent over time no matter how many stresses and acute shocks it experience (Nagenborg, 2019). It is an important quality for systems to have, and it is especially important for policies and governance to be resilient in order to be effective (Fainstein, 2015); (Wijsman & Feagan, 2019). This can be achieved by increasing inclusivity in the planning process, incorporating justice, and considering the needs of vulnerable populations when developing solutions to environmental hazards ((Ziervogel et al., 2017);(Ranganathan & Bratman, 2021)

Furthermore, while conceptually applying urban resilience, it is crucial to consider whether it should be applied on a generic or specific scale including the temporal and spatial aspects of resilience are also crucial (Gordon et al., 2018). The case study of green infrastructure planning in Los Angeles provides insight into the reasons behind the need for resilience, as well as its potential benefits for different communities (which includes managing the interdisciplinary boundaries and the need to determine the five W's of resilience i.e. whom, what, when, where & why). By comparing two hypothetical scenarios such as storm water management and access to green spaces related to green infrastructure in Los Angeles, it is clear that different spatial outcomes can be achieved, providing multiple benefits for the concerned communities within a specified area related to spatial characteristics of resilience (Meerow & Newell, 2019). In light of the discussion above it is clear that analyzing the relationship between resilience and environmental justice on urban scale would enable to investigate a variety of angles and facets, ultimately permitting the investigation of environmental justice's full potential to improve urban resilience.

2.2.3 Environmental justice, disaster risk reduction, and climate change adaptation

The concept of disaster risk reduction is complex and has many dimensions. Ensuring justice and equity in the implementation of environmental policies can help reduce the risk of disasters and mitigate their consequences (Torabi et al., 2017). Urban resilience, with its focus

on non-equilibrium and system stability, offers a different perspective on disaster risk reduction than the traditional approach of predicting and responding to hazards. In order for disaster risk reduction to be effective, it is essential to incorporate social equity into the planning process. It is necessary to consider equity and justice implications during the formulation and implementation process for effective resilience policies. Equitable resilience involves addressing the unequal distribution of costs and benefits, including risk distribution, and overcoming or rejecting dominant narratives that fail to do so. Social factors such as gender, age, ethnicity, disability, and sexual orientation have an impact on resource distribution and human-environment relationships (Li et al., 2020). Incorporating these considerations into policies and regulations will strengthen them and make their implementation more effective. This highlights the interdisciplinary relationship between environmental justice and disaster risk reduction.

One of the key factors leading towards the development of concept of that engenders environmental justice issues is was climate change, as it is was recognized that countries that have contributed little to climate change in the past may be disproportionately impacted by it in the future (Reckien et al., 2017);(Mohai et al., 2009). This is due in part to the fact that these countries may not have the knowledge or resources to prepare for and adapt to the potential effects of climate change (Corburn, 2017). To address this issue, there must be a fair distribution of the negative impacts of environmental hazards and events within society in order to achieve equality and justice. Environmental justice addresses the injustices that exist in society based on factors such as caste, race, income, and other social constructs (Logan et al., 2021). To understand this concept fully, it is important to have a thorough understanding of the underlying injustices that drive the environmental justice movement.

Climate change adaptation is critical in the context of environmental justice. Without adapting to the rapidly changing climate, it will be difficult to develop the necessary response strategies. This is why it is so important for us to adapt physically, socially, and mentally. In addition to this, there are many other disciplines that can benefit from exploring the phenomenon of environmental justice, such as environmental sciences, health, climate finance, and social sciences. In short, environmental justice is a multidisciplinary phenomenon that can have many benefits if studied and utilized properly.

2.2.4 Need for review

Environmental justice is a relatively new phenomenon that originated in the 1980s. It took some time to gain recognition among researchers, scholars, planners, and policymakers due to its focus on the equal distribution of impacts and burdens of natural and environmental events among all members of society. Initially, it was widely seen as a social movement rather than a scientific discipline. However, as research on environmental justice advanced, it became clear that there was much more to it than was initially understood. Today, environmental justice is recognized as an important area of study that has significant implications for people's well-being and the environment.

The purpose of this review is to highlight the importance and multidisciplinary nature of environmental justice and provide guidelines for future policy and decision-making. To show that environmental justice is more than just a social movement, we explore its relationship with urban planning and engineering. In particular, we focus on the connection between environmental justice and resilience. As a vast and multidisciplinary field, environmental justice offers many insights and opportunities to explore the advantages and disadvantages of resilience. By examining the relationship between environmental justice and resilience, we can gain a better understanding of the role that environmental justice plays in the governance of cities and the potential benefits it offers.

This systematic review aims to provide valuable information on the relationship between environmental justice and resilience, and to use this information to develop effective strategies for addressing the challenges posed by the changing climate. The review and analysis of the available literature will identify key themes and correlations that can inform decision-making and the formulation of implementation frameworks for these strategies. The resulting policies, regulations, and guidelines will help the research community better incorporate environmental justice into their work, and will provide future policymakers, academics, and planners with a plan of action for using available data to address environmental issues and reduce disaster risk. By implementing these strategies, we can improve the competency and efficiency of the justice system, and ensure that the benefits and burdens of environmental change are distributed equitably among all members of society**.**

2.3 Methodology:

The research design of this study is a longitudinal literature review and exploratory analysis, using bibliometric and thematic analyses. The data for this study was obtained from the Web of Science (WoS) database, using a subscription at the host institution. The study focuses on exploring research articles published on the topics of environmental justice and urban resilience. The data was analyzed using keyword and citation analyses, and visualized with the help of VOSviewer, an open-source software.

2.3.1 Data collection

The Web of Science Core Collection database was systematically searched for research articles on environmental justice and urban resilience using the keywords shown in Table 1. The search included the title, abstract, and author's keywords fields and was not limited by publication year. The oldest article found through this search was from 2012, indicating that the search covered a period of approximately ten years. The database search was conducted on November 8, 2021, and the resulting records were exported into a text file for later analysis. The exported records included publication information such as the title, authors, publication year, abstract, journal name, author's keywords, subject categories, language, and number of citations. Since only one database was used, the likelihood of repetition was minimal. Additionally, the online "Analyze Results" tool from the Web of Science website was used to confirm the research findings.

2.3.2 Data analytical methods

This study uses descriptive statistics to analyze the environmental justice debate in the context of urban resilience. Two different analyses were performed: keyword analysis and citation analysis. The keyword analysis was performed on the author's keywords to understand the concepts and linkages used by the authors. VOSviewer 1.6.14 was used to create visualizations of the co-occurring keywords. The co-occurrence limit was set to create easily readable and comprehensible keyword figures. The citation analysis was used to identify the number of citations for each article. Microsoft Excel 2019 was used for tables and lists,

Mendeley Desktop was used for referencing and records, and VOSviewer 1.6.14 was used for keyword analysis.

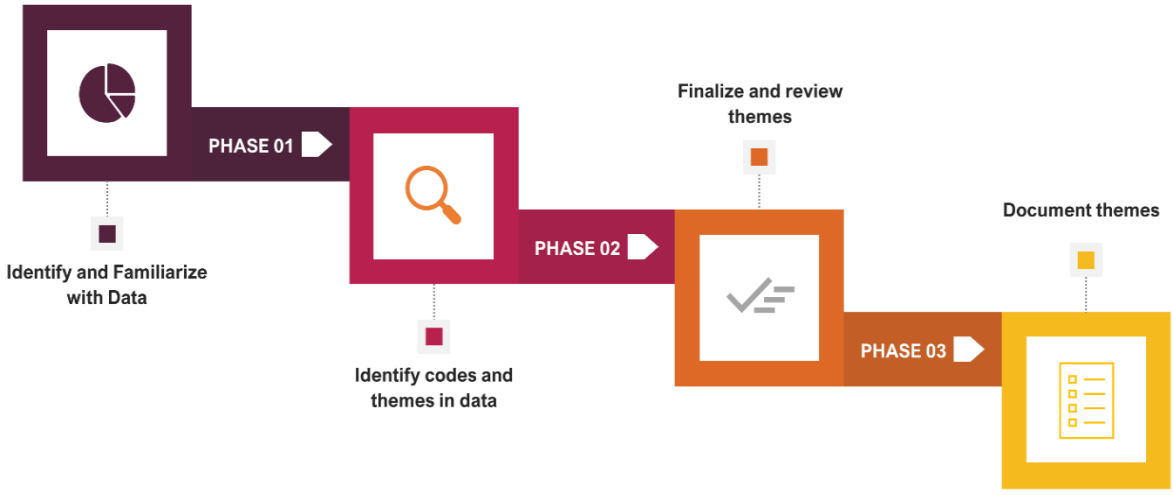

Figure 2.2: Thematic Analysis

Thematic analysis is a method used to identify and analyze patterns of meaning in a dataset. This technique is particularly useful for identifying themes and categorizing research patterns. Fig. 1 above shows the steps followed in performing thematic analysis. These same steps were followed in this research. The relevant data was collected from the Web of Science database, and after a thorough review of the papers, we compiled different points or codes. From these codes, we developed themes and refined them by comparing them with the goals of our topic. Through this process, we developed eight themes related to our topic.

2.4. Results and discussion:

2.4.1 Publications overview

In this study, the desired categories were researched as a single unit instead of being studied separately. The results are summarized in Table 2. There were a total of 201 publications on environmental justice and urban resilience, covering a period of 11 years (2010-2021). Given that this is a relatively new concept, there is still a lot of potential for further research. As shown in Fig. 2, there has been a significant increase in the number of publications in recent years. A total of 3946 citations were observed, resulting in an average of 19.63 citations per

article. A total of 727 authors published studies on environmental justice and urban resilience. Most of the publications were in English. A quick overview reveals that research on climate change resilience is leading in terms of publications, citations, authors, institutions, and countries, followed by research on disaster and integrated resilience. The number of publications by an academic researcher can partially represent their research strength and effectiveness. Table 3 shows the authors with the most publications on the selected topics. Prof. Anguelovski led with 11 publications. Prof. Anguelovski's research interests include urban greening, environmental justice, and interrelations. On the other hand, Prof. Arnold Craig Anthony had only four publications, with research interests in urban resilience and urban governance.

Articles	201
Sources (Journals)	115
Citations	3946
Average citations per article	19.63
Authors	727
Articles per author	0.27
Authors per article	3.61
Author's keywords	667
Institutions	424
Countries	48

Table 2.1 Summary of publications

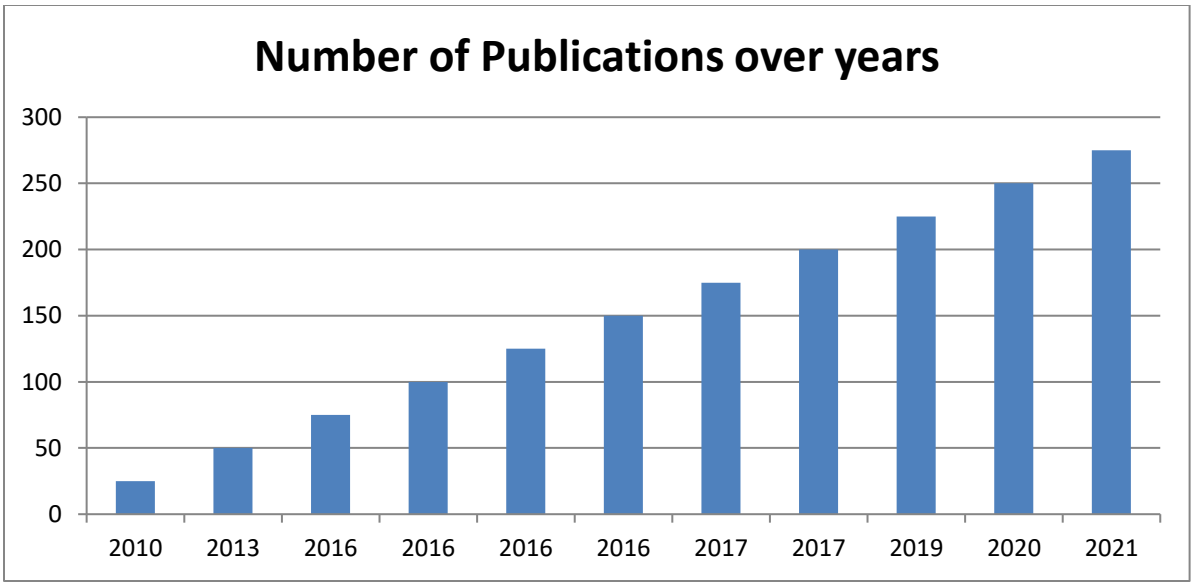

Fig 2.3 Number of publications over the years

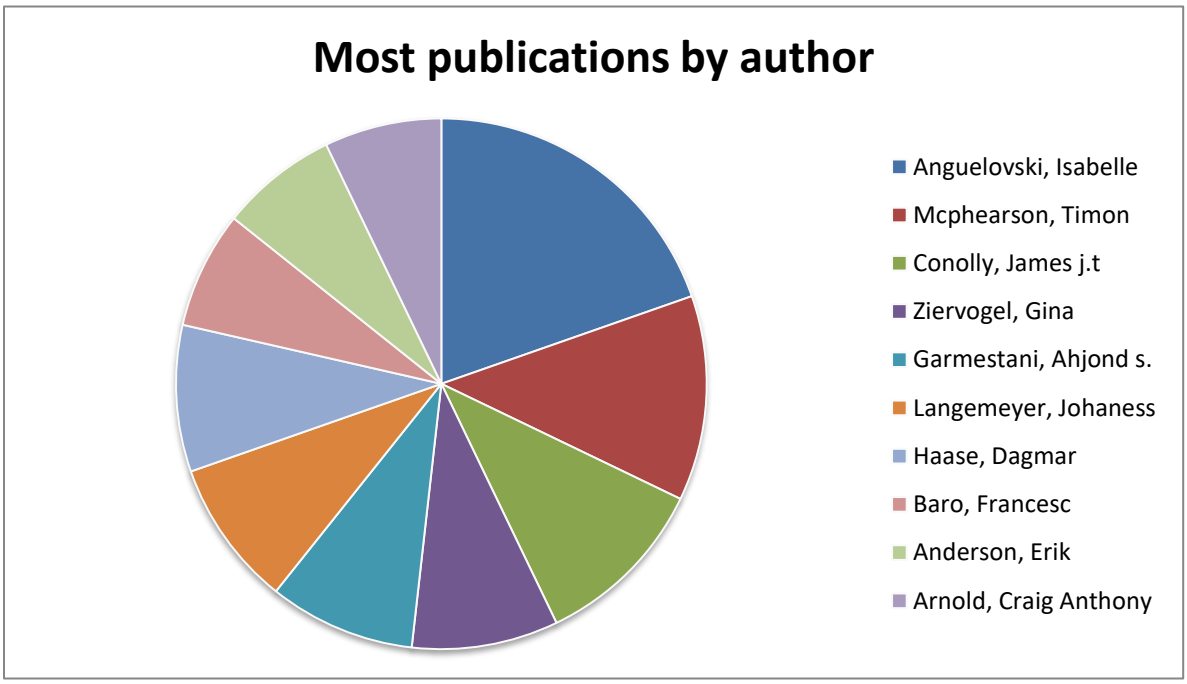

Fig 2.4 Most Publications by an Author

2.4.2 Keyword analysis:

Environmental justice and urban resilience studies focus on the intersection of environmental issues and social justice in urban settings. Researchers often use a variety of keywords to

describe their work in this field, including vulnerability, resilience, environmental justice, and climate change. Visualization tools, such as VOS viewer, are used to analyze and understand the co-occurrence and linkages between these keywords in research studies. This analysis reveals that the concepts of resilience, environmental justice, and climate change are among the most frequently used keywords in resilience research, and that much emphasis has been placed on understanding the relationship between resilience and environmental justice

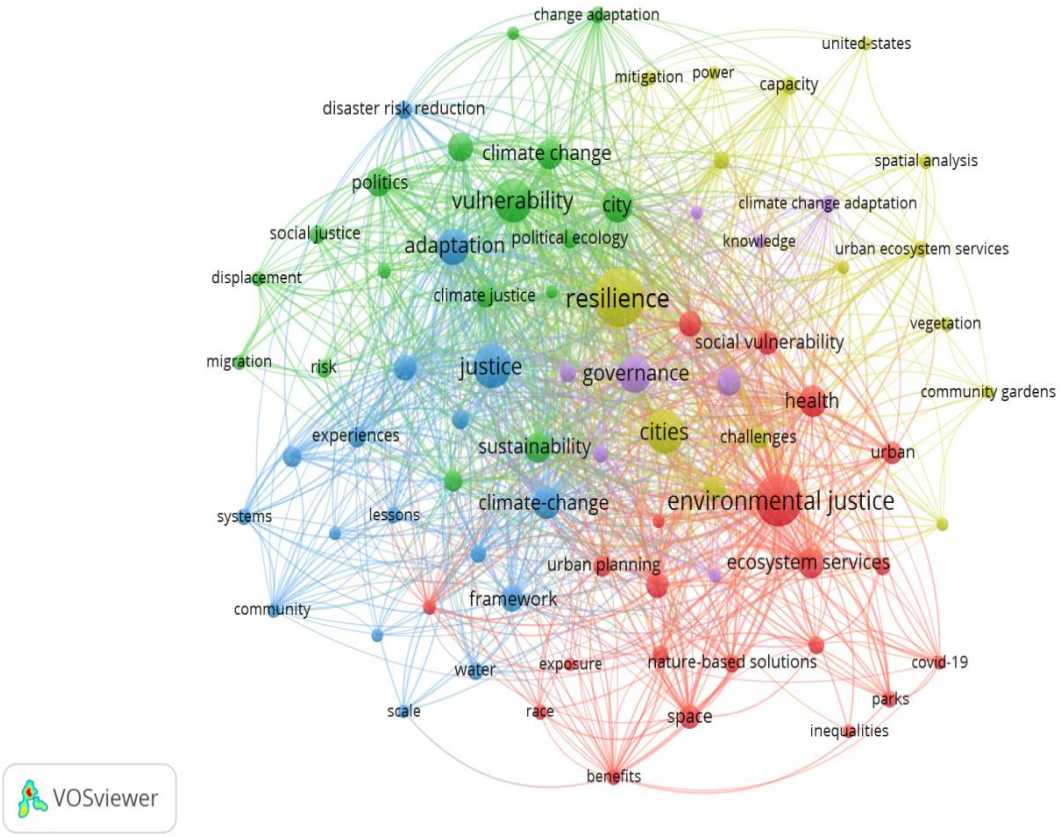

Figure 2.5 Co-occurrence analysis of environmental justice and urban resilience

2.4.3 Citation analysis

The citation analysis reveals the most frequently cited journal articles in the research on environmental justice and urban resilience. The study "Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action" by Kabisch et al. is the most cited article in this literature. In contrast, the study "From brown to green? Assessing social vulnerability to environmental gentrification in New York City" by Pearsall is the least cited. Table 4 summarizes these findings.

Sr No	Article Title	Times Cited, All Databases	Publication Year
1	Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action	313	2016
2	The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes	223	2013
3	Roadmap	156	2016

	towards justice in urban climate adaptation research		
4	Greening cities - To be socially inclusive? About the alleged paradox of society and ecology in cities	149	2017
5	Urban resilience for whom, what, when, where, and why?	148	2019
6	Equity Impacts of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South	146	2016
7	Inserting rights and justice into urban resilience: a focus on everyday risk	121	2017
8	Urban nature in a time of crisis: recreational use of green space increases	101	2020

	during the COVID-19 outbreak in Oslo, Norway		
9	Inclusive approaches to urban climate adaptation planning and implementation in the Global South	82	2016
10	From brown to green? Assessing social vulnerability to environmental gentrification in New York City	80	2010

Table 2.2: Top ten most cited publications

2.4.4 Thematic analysis

The study found nine recurrent and common themes on environmental justice and urban resilience (Figure 5). Each theme is discussed in detail in this section

Figure 2.6: Results of Thematic Analysis

2.4.4.1 Green infrastructure

The term green infrastructure refers to the use of natural systems to address challenges posed by the changing environment and urban landscapes. It includes strategies such as reducing the carbon footprint of buildings and implementing stormwater management systems to reduce negative impacts on the environment. Green infrastructure is gaining popularity among researchers, planners, and policymakers as a way to address the challenges of a changing environment. When combined with the concept of environmental justice, green infrastructure can provide valuable insights and solutions.

Analysis of the literature on the subject reveals that much of the research focuses on the need for guidelines and regulations for planning and implementing green infrastructure policies. It also highlights various initiatives that aim to enhance environmental justice through green infrastructure, such as urban forest strategy and fair blue urbanism. These efforts can help to explore new avenues for using green infrastructure to promote environmental justice (Hoover et al., 2021).

2.4.4.2 Climate gentrification

The term gentrification refers to the process of a certain group or class of people moving into and transforming a previously disinvested or underinvested neighborhood (Shokry et al., 2020);(Shokry et al., 2020). This process often leads to the displacement of the original residents, who are typically low-income and/or members of marginalized communities. Climate gentrification, on the other hand, refers to gentrification that is driven by concerns about the effects of climate change and the desire to live in neighborhoods that are better equipped to handle these effects.

The increased awareness of the negative impacts of climate change has led many people to prioritize living in green, sustainable neighborhoods when making housing decisions. This has resulted in an increase in demand for such neighborhoods, leading to gentrification and the displacement of the original residents. The phenomenon of climate gentrification raises concerns about environmental justice and the need for inclusive policies and regulations to address it.

An intersectional approach, which combines qualitative and quantitative methods, can provide useful insights into the issue of climate gentrification and inform the development of effective policies and strategies. By considering the intersecting factors of race, class, gender, and other identities, an intersectional approach can help scholars, planners, and concerned professionals gather comprehensive information on the subject. In the future, inclusive strategies that take into account the needs of all members of a community can help promote environmental justice and address the issue of climate gentrification (Shokry et al., 2022).

2.4.4.3 Urban greening

Urban greening refers to the use of landscaping and forestry techniques to enhance the presence of vegetation in urban areas. This can include projects such as green belts, increased tree planting in public spaces, and the creation of green spaces in strategic locations. Urban greening has a number of benefits, including improving the aesthetic appeal of a neighborhood, enhancing the local environment and climate, and reducing the negative impacts of climate change. It is often seen as a key solution for improving the built environment in urban areas and making them more

sustainable.

However, access to urban greening services is not always equitable among different sections of society. This raises concerns about environmental justice and the need to ensure that all members of a community have access to the benefits of urban greening. An intersectional approach, which combines qualitative and quantitative data with different socio-economic indicators, can provide valuable insights into the issue of environmental justice in relation to urban greening. This approach can help planners, researchers, and policymakers develop inclusive strategies and policies that promote environmental justice and ensure that all members of a community have access to the benefits of urban greening (Anguelovski et al., 2020).

2.4.4.4 Ecosystem services

Ecosystem services are the benefits that humans derive from healthy ecosystems and natural environments, such as storm water management, local temperature regulation, and air purification. The effectiveness of these services depends on their availability to the public and their utilization by individuals. Therefore, it is important to maintain a fair and balanced environment to ensure the smooth functioning of ecosystem services.

The relationship between ecosystem services and environmental justice is a crucial one. Research on this topic has often neglected the imbalances in the supply and demand of ecosystem services in urban areas. More inclusive studies are needed to address this issue. For example, a study conducted in New York examined the potential for using nature-based solutions to address environmental justice issues. Additionally, various frameworks and techniques have been developed to assess the relationship between ecosystem services and environmental justice, and to determine whether they can serve as indicators of environmental justice.

One interesting aspect of this topic is the concept of cultural ecosystem services, which refers to the non-material benefits that people derive from nature, such as aesthetic enjoyment and spiritual fulfillment. Case studies have demonstrated the importance of cultural ecosystem services in promoting environmental justice. Overall, the relationship between ecosystem services and environmental justice is a complex and multifaceted one, and further research is needed to fully understand and address this issue.

2.4.4.5 Environmental health and pollution

Environmental justice refers to the fair distribution of the burdens of environmental hazards and processes, such as pollution. For example, people living near factories, oceans, and other sources of pollution are often disproportionately affected by environmental pollution and its negative health effects. To promote environmental justice, it is necessary to find innovative solutions to reduce exposure to hazardous substances and pollutants, so that fewer people are impacted.

To achieve this, we need to identify indicators that can help us understand the relationship between different phenomena and environmental justice. This will enable planners, researchers, and policymakers to develop inclusive strategies to address this issue. For example, we can analyze various pollution indicators, such as outdoor air quality and soil lead concentration, using a range of quantitative and qualitative analysis techniques. This analysis can be used to identify health inequalities and injustices that are linked to individuals' environments and surroundings. This can help pave the way for new research and policymaking in this field.

2.4.4.6 Urban retreat

To address the challenges of a changing environment and the negative impacts of climate change, it is necessary to develop innovative solutions that are both effective and fair. One such solution is an urban retreat, which involves the planned migration of people from areas exposed to environmental hazards and climate change risks to safer locations. However, the implementation of urban retreats can be complex. In many countries, the urban poor are often the main group of people who are part of these programs, despite the fact that they are disproportionately affected by climate change and have contributed the least to the problem. To ensure environmental justice, urban retreats must be inclusive and involve people from all socio-economic backgrounds. If this is not possible, then alternative sources of livelihood and income must be provided to displaced individuals.

The literature on this topic reveals a mixed picture. While some countries, like the Philippines, provide compensation to those affected by urban retreats, others, like Lagos, do not. Another issue is forced land grabbing in the name of green planning, which has been the subject of several case

studies. These studies can provide valuable insights for planners, engineers, and policymakers as they develop strategies for future urban planning and decision-making.

2.4.4.7 Environmental governance

To ensure environmental justice, it is crucial to have a well-functioning governance system with strategies, rules, and regulations in place. Any rule, principle, or policy will not be effective unless it takes into account all relevant factors and represents the needs, wishes, and desires of the people. We reviewed existing literature on the subject, including thought-provoking case studies that can serve as guidelines for future research. These studies examined the role of law in governance and how well-crafted policies and strategies can ensure the efficient operation of environmental governance systems. They also analyzed how decision-making patterns can impact a governance system's legal obligations and provided examples of green infrastructure and the challenges related to their governance. We also found research illuminating the role of participation in policymaking, with a focus on gender participation, which provides a more comprehensive understanding of the phenomenon and can inform future policymaking. Another approach discussed was shared streets, which gained popularity during the Covid-19 pandemic as a way to address the limited public spaces available for use.

2.4.4.8 Climate finance

Finance is a crucial element of any system, and it is especially important for addressing environmental issues. Climate finance, in particular, plays a key role in environmental governance. It is essential that climate finance be distributed equitably among all stakeholders to ensure its effective use. Without equitable distribution of climate finance, we cannot guarantee environmental justice.

Studies have analyzed the distribution of climate finance and discussed the challenges and problems that arise from unequal distribution of funds at the government level. These studies also explore the politics involved in the allocation of climate finance. Research suggests that climate finance should be distributed at the local level to support the effective operations of authorities responsible for addressing environmental issues and threats. This approach can provide guidance

for future planning and policymaking, and open up new avenues for research on environmental justice.

2.4.4.9 Food, energy, water (FEW) nexus

Food, energy, and water are essential requirements for human beings to live. If these amenities would not provide to the people at an equitable level maintaining justice, then there would be serious consequences for the efficient management of the environment and climatic system. Moving forward, we would debate the case studies and research related to the subject matter. These studies included the analysis of FEW nexuses to act as a potential resource to enhance the resilience of urban systems and further facilitate the environmental justice implications. Some of the research presented alternatives to cope with the food shortage issues in the future, like urban farming, community gardens, etc. Similarly, research implied the intersectional approach utilizing quantitative analysis techniques to discuss the inequalities in electricity outages. This would help determine the requisite solutions and open avenues for future research. Moving on, we had innovative case studies which thoroughly analyzed the situation of water justice and its repercussions. Furthermore, it provided advanced solutions for problems like waterscapes, soft water paths, etc. The study material provided a holistic view of the FEW Nexuses and their implications for enhancing resilience through environmental justice (Schlör et al., 2018).

2.5. A way forward:

In this section we will be enlisting some recommendations for the future scholars/[policymakers to benefit from:

- Planning decisions that aim to build resilience should take into account both procedural and distributive factors of capacity building. This means considering who is involved in the decision-making process and how they are selected, as well as examining how the outcomes of these decisions affect different groups. The elements of justice in these processes can be both implicit and explicit, but it is crucial to critically evaluate whether they contribute to a more transformative pattern of urban resilience.

- In addition, future studies could analyze the process of green gentrification in urban areas. This would involve examining whether different neighborhoods experience negative effects from changes in resident socio-demographic characteristics and increased land costs due to an increase in green spaces in neighboring areas. Research could also investigate the relationship between individual-level and community-level resilience, and how community movements can disrupt gentrification and promote a more socially just revitalization process. It would be interesting to evaluate whether individual-level resilience can contribute to community-level resilience in these cases.
- To address urban poverty and the needs of newly arrived migrants, support agencies and governance structures should be established and included in national and international decision-making processes. This is especially important in cities with a high low-income population. While local governments can play a key role in adaptation and resilience, they cannot address these issues alone and must be part of coordinated intergovernmental responses.
- In the context of flood risk reduction, it is crucial to integrate resilience thinking more clearly. Practitioners should use multiple PARA (Protect, Accommodate, Retreat, or Avoid) approaches and work to integrate the principles of resilience across different institutional scales and geographic spaces. Flood risk planning must also take into account the specific nuances of where, when, how, and for whom resilience measures are taken.
- As the nature-based adaptation agenda advances globally, it is important to understand how international best practices are "localized" and integrated with existing local knowledge of green space and climate. This collection, created in collaboration with community stakeholders and researchers, aims to fill the gap in the integration of science and social justice issues and advance the interdisciplinary field of climate justice and global environmental sustainability. It emphasizes the need for greater integration of interdisciplinary knowledge.

2.6. Summary of chapter:

Environmental justice refers to the fair distribution of environmental benefits and burdens among all members of society. This means that no one group, such as a particular race or socioeconomic class, should bear a disproportionate share of the negative effects of environmental hazards or disasters. When this principle is not upheld, it can lead to severe consequences for both individuals and communities. As a result, environmental justice is often considered a social movement, as it advocates for the rights of marginalized groups to have access to clean air, water, and other resources. However, it is important to recognize that environmental justice is not just a movement, but a fundamental principle that should be upheld in all policy decisions and actions.

The purpose of this study was to provide a comprehensive review of the literature on environmental justice and urban resilience, and to identify the linkages and interrelated themes between these two concepts. In this research, we performed a bibliometric and thematic analysis of online literature on the web of science database related to environmental justice and urban resilience. Urban resilience, like environmental justice, is a broad field with multiple connections to other fields and has great potential for future research. Through the bibliometric analysis, we were able to gain a better understanding of the patterns of publications and the implications of this literature. The thematic analysis identified the interrelated themes and ideas, which can serve as guidelines for future research and open up new avenues of investigation. The identified themes will be particularly beneficial for planners, policymakers, and scholars in the near future. The findings of this study will be useful for scholars and other related personnel, and serve as a guide for future efforts to improve society.

Chapter 3

METHODOLOGY

3.1 Topic selection:

The topic for my research is enhancing urban resilience through environmental justice. This topic addresses the urgent need for incorporation of environmental justice in resilience planning. It has clearly been understood how important it is to make our urban centers and systems more resilient in order to combat the ever changing climate. Therefore we need to look for advanced approach to make our policies more just in order to ensure environmental justice.

3.2 Literature Review:

After thorough and a vigorous process of reading and analyzing research papers and books, it was found that environmental justice has a lot to offer but is not yet being fully implemented by authorities. The principle of environmental justice is not much popular in the industry, yet its need is increasing exponentially for the purpose of enhancing urban resilience.

3.3 Designing Survey Sample

A large sample size generally leads to increase precision when estimating unknown parameters, but it would be too expensive and a waste of time and effort, where a smaller sample size would save time and effort over accuracy. Therefore, between these two extremes lies the most efficient sample size for the given study objective.

By using Slovin's formula, sample size was calculated (Slovin, 1960).

Slovin's formula

$$n = \frac{N}{1+Ne^2}$$

where, n = sample size

N: = size of the population

E = error margin

According to the census of 2017, the total population of twin cities of Rawalpindi and Islamabad city was 3,108,063. With a 90% confidence level the Slovin's formula gave the sample size of 100. However in order to increase the accuracy of results, a total of 210 samples were collected.

3.4 Data Collection:

This research used a case study research design. In order to fulfill the objectives, two questionnaires were designed to collect the data from households and institutions. For household data collection a questionnaire comprising of simple open ended questions regarding different indicators of social inequalities and public perceptions in the light of environmental justice was being circulated. Household data was collected both in the hard and soft form i.e. responses were obtained by online forms and were collected in hard form from every household. The data was collected from different areas of Rawalpindi and Islamabad. A total of 210 responses were being collected.

Now coming towards the institutional data, semi-structured expert interviews were conducted with representatives of different government organizations in Rawalpindi and Islamabad city to gather information on the challenges and problems faced in urban governance, building urban resilience and environmental justice. A semi-structured questionnaire containing mainly qualitative and open-ended questions was used to obtain the desired information. The respondents included key government officials and working in the planning and development sector of the region. The questionnaire included questions about the key challenges faced by institutions in developing mechanisms for improving the efficiency of institutions in dealing with environmental hazards, the policies adopted to combat the impacts of climate change, and the implementation of these policies for enhancing urban resilience thus ensuring environmental justice.. The respondents were also asked to provide recommendations for future policy measures and adapting to the ever changing environment**.**

3.5 Data Analysis:

This study used three types of analysis to determine the results in order to fulfill the objectives of the research namely:

- Index Based Analysis
- Descriptive Analysis
- Qualitative Analysis.

3.5.1 Index Based Analysis:

In order to quantify the social inequalities, the data collected from household was analyzed with respect to a total of 16 indicators extracted from the detailed literature review which facilitated in having a holistic view of the social inequalities in the society in terms of environmental justice . These indicators were then grouped into different indexes and afterwards a composite inequality index was calculated.

In order to calculate the inequality index, five dimensions of inequality were examined namely:

- Education
- Gentrification
- Energy
- Location Based Hazard
- Health Benefits & Greenspaces

Now we will discuss about the indicators against which data was collected for each of the dimensions mentioned above:

Sr. No	Indicators	Question Asked	References
Education			
1	Access to schools	Q. What is the minimum distance between your house and the nearest school?	(Voelkel et al., 2018)
2	No of people having professional education	Q. How many persons in your house have acquired professional degree ?	(Voelkel et al., 2018)
3	Educational Background of breadwinners of a family	Q. What is the qualification of breadwinners of the family?	(Voelkel et al., 2018)
4	Access of media facilities to people	Q. Do you have access to print/electronic/social media facilities? Q. If yes is it useful or not?	(Donahue et al., 2018)
Gentrification			
1	Gentrification	Q .Is there any discrimination in your society on the basis of cast, income, ethnicity etc?	(Graham et al., 2016)
2	Positionality	Q .Do you face any difficulty due to your status in the society? (discrimination in the access to facilities, benefits, social cohesion etc?	(Wijsman & Feagan, 2019)
3	Environmental Migration	Q .Have you ever relocated on the basis of development in the name of environmental protection? Q .Do you know about anyone in the society who has gone through this procedure?	(Colten et al., 2018)
4	Recognitional Climate	Q .Do you face any discrimination on the	(E. Chu & Michael, 2019)

	Justice(issues faced by the migrants	basis of your ethnicity in terms of benefits of environmental protection?	
Energy			
1	Energy insecurity	Q. Does your area face electricity shortage?	(Liévanos & Horne, 2017)
2	Water Justice	Q .Do you have access to clean water? Q Does your area face water shortage as compared to other areas?	(Hawken et al., 2021)
Location Based Hazard			
1	Location based hazards	Q .Are you exposed to environmental hazards due to the location of your home, work place etc?	(Reckien et al., 2017)
2	Heat Exposure	Q. Are temperatures in your area higher than the surrounding area? Q.Based on your daily routine, do you have more heat exposure than others?	(Voelkel et al., 2018)
3	Distribution of risks and benefits across space and society	Q.Do you think that risks and benefits of development projects are equally distributed in the society?	(Mabon, 2020)
Health Benefits & Green Spaces			
1	Green space provision	Q.Do you have provision of green space in your house? Q.Does your society have adequate green spaces (parks, street trees)?	(Haase, 2020)

2	Health benefits provided by the parks and open spaces	Q. Is there any park or open space near your house? Q. What is the minimum distance form you house to the parks/ open spaces? Q Do you think these parks/open spaces have positive effect on your health?	(Yildirim et al., 2021)
3	Inequitable distribution of health benefits	Q. Are there any medical facilities (hospitals, clinics, basic health units etc)near your house? Q. Are these facilities equipped with requisite equipment, medicines, personnel etc to provide health care in case of emergencies? Q.Do you face any problem in the access of health care facilities	(Anguelovski et al., 2020)

Table 3.5.1 List of Indicators for Index Based Analysis

The indexes for each dimension were determined by calculating the average of all the responses collected against the indicators for each dimension. Consequently, the composite inequality index was determined by calculating the average of all the indexes. The equations used to calculate the indexes are shown below:

$$\textit{Index for Education} = \frac{E1+E2+E3+E4}{4}$$

where,

E1, E2, E3, E4 = Indicators for Education

$$\textit{Index for Gentrification} = \frac{G1+G2+G3+G4}{4}$$

where,

G1, G2, G3, G4 = Indicators for Gentrification

$$\textit{Index for Energy} = \frac{E1+E2}{2}$$

where,

E1, E2 = Indicators for Energy

$$\textit{Index for Location Based Hazard} = \frac{LBH1+LBH2+LBH3}{3}$$

where,

LBH1,LBH2, LBH3, LBH4 = Indicators for Location Based Hazard

$$\textit{Index for Health Benefits \& Greenspaces} = \frac{HB1+HB2+HB3}{3}$$

where,

HB1, HB2, HB3 = Indicators for Health benefits & Green spaces.

$$\textit{Composite Index for Inequality} = \frac{IE1+IG2+IE3+ILBH4+IHB5}{5}$$

where,

IE1 = Index for Education.

IG2 = Index for Gentrification

IE3 = Index for Energy

ILBH4 = Index for Location Based Hazard

IHB5 = Index for Health benefits & Green spaces

3.5.2 Descriptive Analysis:

In order to assess the public perception and attitudes towards environmental justice, descriptive analysis was performed. After the detailed review of literature, a total of 8 indicators were determined. The results were depicted through descriptive analysis in the form of graphs and charts.

Now we will discuss about the indicators against which data was collected for each of the dimensions mentioned above:

Sr. No	Indicators	Question Asked	References
1	Cumulative perception regarding environmental threats (earthquake, floods, heatwaves etc)	Q .Do you understand the intensity of different environmental threats like earthquake, floods, heat waves etc.? Q .Are you aware of the damages caused by these events?	(Kim et al., 2018)
2	Cumulative perception regarding environmental injustice	Q. Do you understand the concept of environmental injustice? Q.Are you aware of the damages caused by environmental injustice?	(Kim et al., 2018)
3	Resources available in case of emergency and hazards	Q. What type of resources are available to deal with emergency situations?(relative equipment, personnel, financial resources et	(Andersson et al., 2019)
4	Formulation and implementation of	QAre you satisfied with the current policies, procedures	(Andersson et al., 2019)

	policies, procedure and regulations	adopted by the concerned institutions? Q.In your opinion how often should these policies/regulations be revised and updated(after 5 years, 10 years, 15 etc.)?	
5	Distrust in government	Q.Are you satisfied with the performance of your government? Q.Do you consider the development schemes, projects carried out by the government necessary? Would these be profitable or not?	(Colten et al., 2018)
6	Discrimination in distribution of climate finance	Q.Do you think government provides requisite aid in case of a disaster or for environmental protection? Q .Do you consider these aids are distributed on an equitable basis?	(Colenbrander et al., n.d.)
7	Realistic and inclusive plans,policies considering social factors	Q .Have you ever relocated on the basis of development in the name of environmental protection? Q .Do you know about anyone in the society who has gone through this procedure?	(E. K. Chu & Cannon, 2021)
8	Detrimental effects faced by the society due to the environmental hazard	Q.What type of damages are faced by the society as a result of these environmental hazards (loss of life, financial problems. Damages to health)	(E. K. Chu & Cannon, 2021)

		Q.Does the duration of hazard effects the intensity of damages on the society or not?	

Table 3.5.2 List of Indicators for Descriptive Analysis

3.5.3 Qualitative Analysis:

Two frequently used methods for analyzing qualitative data are systematic/thematic analysis and qualitative content analysis. Since qualitative data is dependent on interpretations, a thorough justification is necessary. This is due to the fact that substantial amounts of qualitative evidence are frequently gathered, and it can be challenging to differentiate between the processes of data gathering and analysis because analysis and interpretation frequently blend together to reach a conclusion. The findings of several studies can be combined and summarized using systematic or thematic analysis. The steps in systematic analysis include creating a questionnaire to gather the required data, data filtering, and data extraction. The outcomes are then derived from the data after it has been organized and synthesized.

In this research, thematic area analysis is used to analyze the data collected through semi-structured interviews with experts from public institutions. The opinions of all the respondents were first recorded through semi-structured interviews, and the repeated ideas/challenges identified by the key respondents were grouped into different thematic areas. For example, many respondents identified rapid urbanization and unplanned growth as key institutional challenges. Similarly, challenges such as inadequate land-use planning, fragmented and rigid policies, and limited access to vulnerable communities were extracted and grouped into broader themes. After detailed examination of the responses, the challenges and issues highlighted by the experts during the interviews were re-examined and grouped into distinct themes.

3.6 Research Methodology:

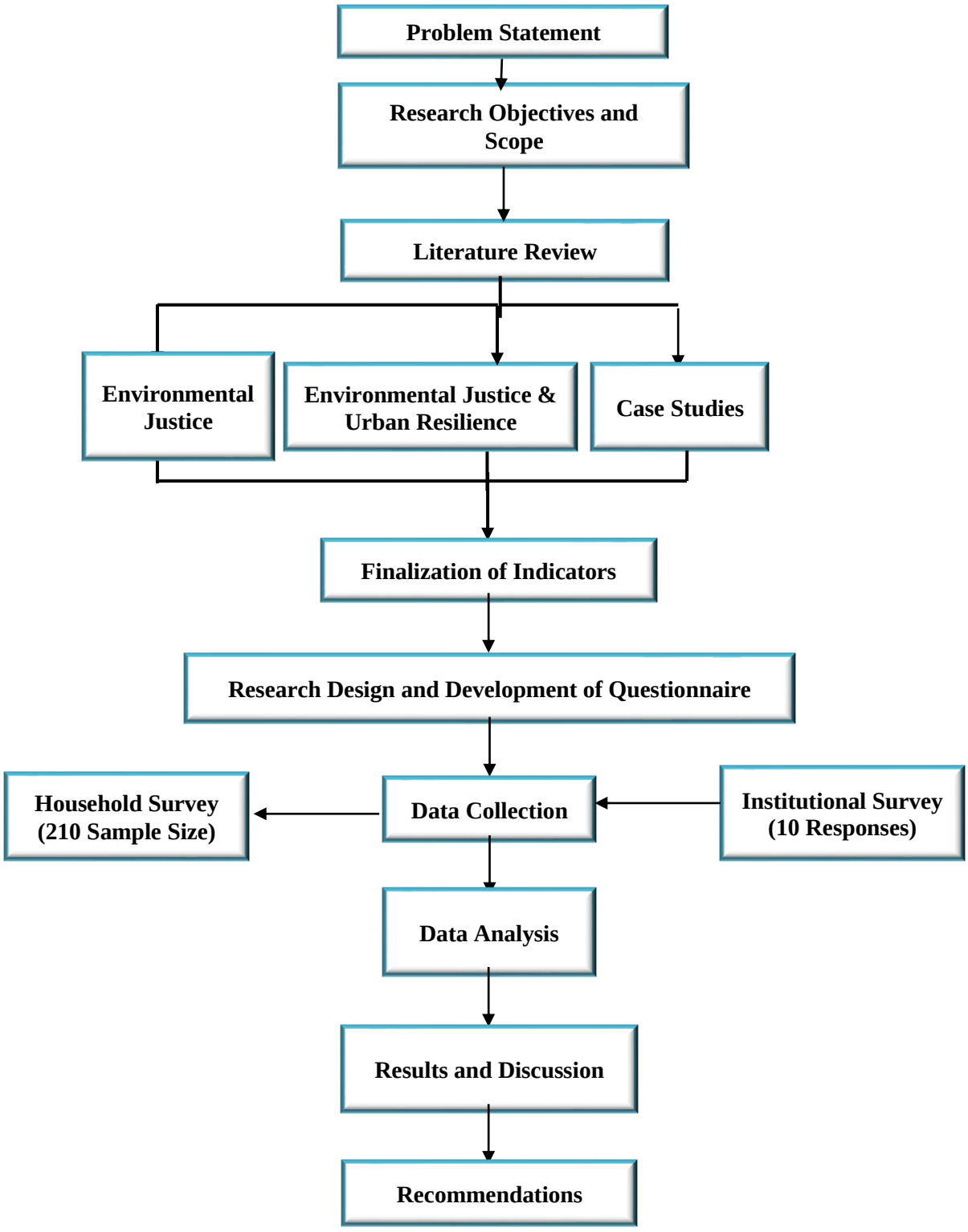

Figure 3.6 Timeline of Research Methodology

Chapter 4

RESULTS:

4.1 Introduction:

The main purpose of this research was to propose a framework to enhance urban resilience through environmental justice in urban areas. In order to achieve it we needed to have comprehensive knowledge about the social inequalities in the society and challenges faced by the institutions in implementing environmental justice in urban areas. This chapter contains the results of the case study obtained from the data analyzed as discussed in the above chapter. The results include:

- Analysis of the data analyzed in relation to 24 indicators representing the social inequalities through the lens of environmental justice
- Institutional challenges faced in implementation of environmental justice in urban resilience planning
- A comprehensive framework providing guidelines to enhance urban resilience in environmental justice.

4.2. Respondents profile:

In social sciences study respondent's personal profile have a very major role to play in conveying and providing the responses about certain issue.

Keeping this in view, this research a variety of personal attributes such as age, gender, education, family income, etc. of the 210 respondents were analyzed.

4.2.1 Age:

In any research, the age of respondent plays an important role in analyzing and understanding the views of people on a specific issue as it would give a better idea of the level of maturity and thought

process of respondents as well. For this study, Table 4.1 represents the data of age of respondents**.**

Age in Years	Frequency	Percentage
<=25	52	24.8
26 – 35	90	42.9
36 – 45	47	22.4
46 – 55	16	7.6
56+	5	2.4
Total	210	100.0

Table 4.2.1 Age of Respondents

From the above table it is evident that majority of respondents (42.9%) lie in the range of age 26-35 and only 2.4% were above the age of 56. Thus it is clear that majority of respondents were young adults.

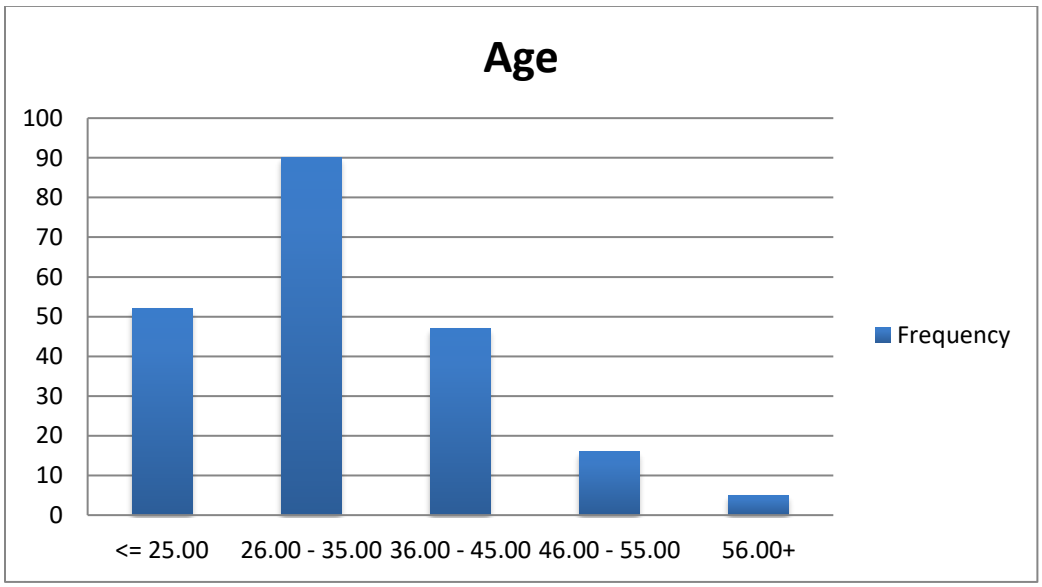

Figure 4.2.1 Distribution of Respondents by Age

4.2.2 Gender:

The second most important variable in any respondents profile is the gender of respondents. It helps in understanding the perception of any phenomenon with respect to both the genders and is also affected by economic and social factors. Table 4.2 shows the data of gender of respondents for this study.

Gender	Frequency	Percentage
Male	104	49.5
Female	106	50.5
Total	210	100.0

Table 4.2.2 Gender of Respondents

From the table it is evident that our respondents are equally balanced in the terms of gender with 49.5% males and 50.5% females. Figure 4.2 shows the distribution of respondents by age.

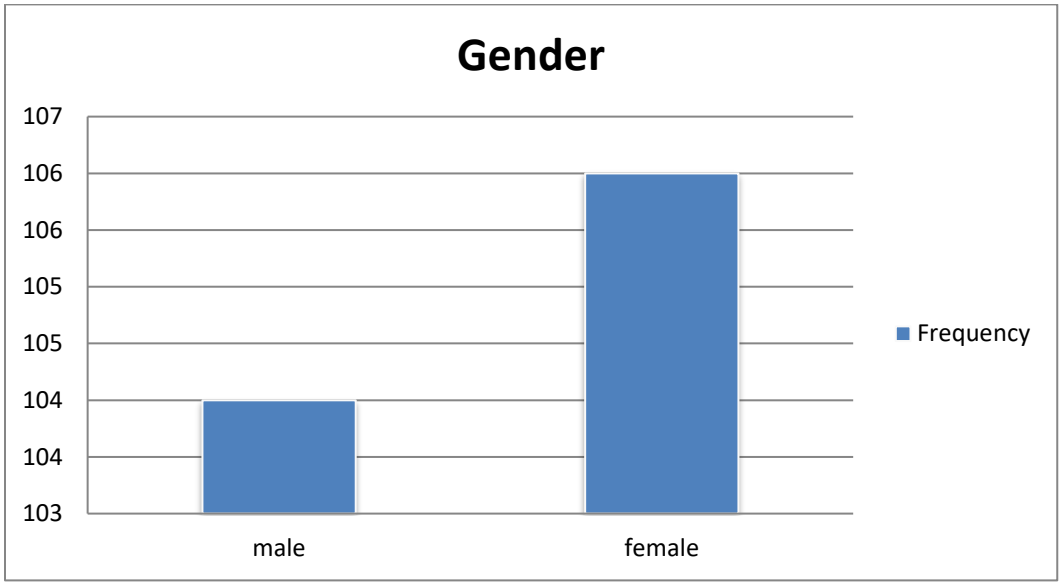

Figure 4.2.2 Distribution of Respondents by Gender

4.2.3 Income:

Household income plays a significant role in forming an individual's financial conditions which, in turn gives a better understanding of the economic situation of the respondents. This will help in analyzing the trends of inequality more effectively. Therefore, this study intended to examine the household income as a variable, and the data relating to the respondents' family income is presented in Table. 4.3.

Household Income (Rs/Month)	Frequency	Percentage
<= 35000.00	37	17.6
35001.00 - 50000.00	40	19.0
50001.00 - 60000.00	29	13.8
60001.00 - 80000.00	40	19.0
80001.00 - 150000.00	42	20.0
150001.00+	22	10.0
Total	210	100.0

Table 4.2.3 Household Income of Respondents

From the above table it is evident that majority of respondents (20%) fell in the range of 80,000 – 150,000 whereas 13.8% of the respondents fell in the range of 50,000 – 60,000. It is evident from the above mentioned figures that most of the respondents were in the higher income group.

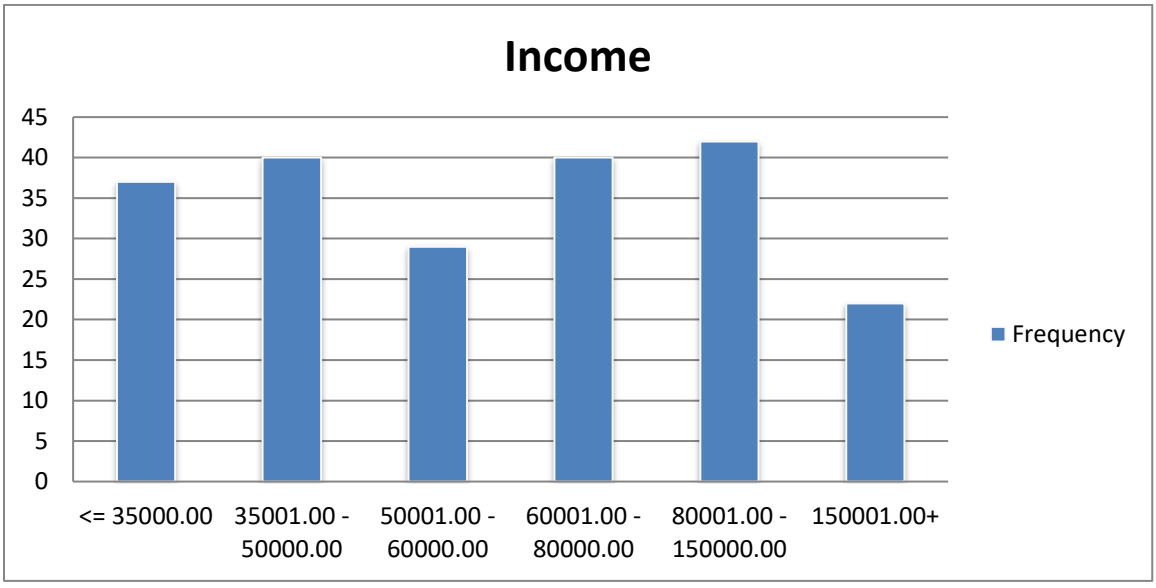

Figure 4.2.3 Distribution of Respondents by Income

4.2.4 Education:

Education gives you a better idea of the attitudes and attributes of a person i.e. it will enable you to better analyze the reaction of a respondent towards a certain phenomenon. For this study, table 4.4 shows the data for education of the respondents.

Education	Frequency	Percentage
Matric	5	2.3
Intermediate	13	6.19
Bachelors	123	58.57
Masters	69	32.85
Total	210	100.0

Table 4.2.4 Education of Respondents

From the above data it is clear that majority of respondents (58.57%) have attained Bachelors degree whereas 32.85% of respondents have attained Masters degree. On the contrary only 2.3% of the respondents have completed their secondary education. Thus it is evident that most of the respondents of this study are well educated and consequently would be able to respond in a better way to research questionnaire. Figure 4.4 shows the distribution of respondents by education.

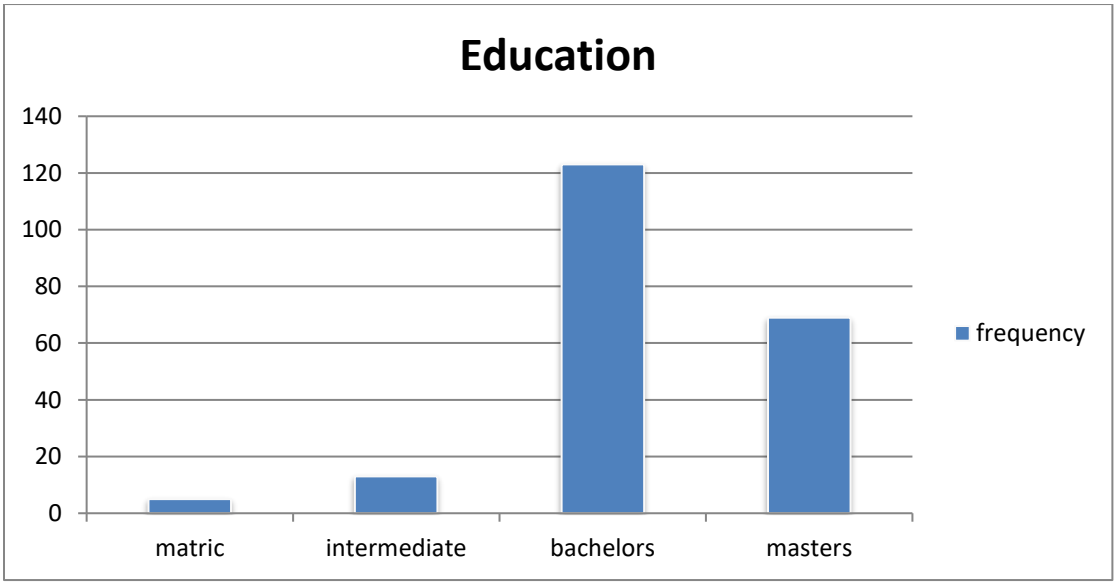

Figure 4.2.4 Distribution of Respondents by Education

4.2.5 Household Size:

The size of the household and its composition (number of people living in a house) impact the distribution of monetary and other resources between members of the household, which in turn affects the general welfare of those individuals. Therefore household size would prove to be a valuable variable for our study. Household size data is set out in Table: 4.5

Household Size	Frequency	Percentage
< = 5	105	50.0
6 – 10	95	45.2
11 – 15	6	2.85
16+	4	1.9
Total	210	100.0

Table 4.2.4 Household Size of Respondents

Table 4.5 shows that half of the respondents (50%) have < = 5 members in their family, whereas 45.2% of the respondents comprises of 6 – 10 members and only 1.9% of the respondent's family size included 16+ members.

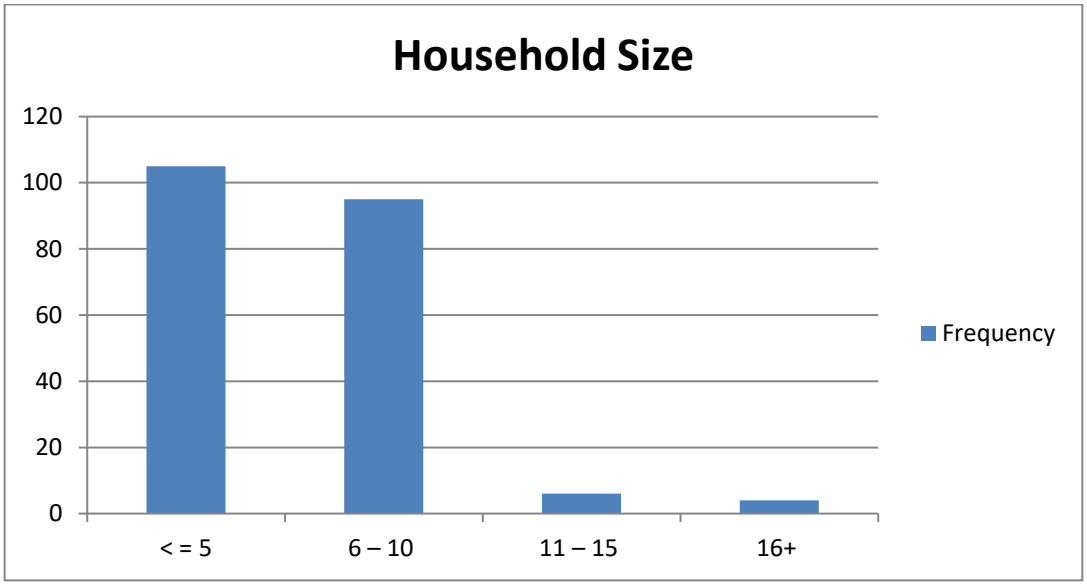

Figure 4.2.5 Distribution of Respondents by Household Size

4.3 Results of Index Based Analysis:

In this section we will be deliberating upon the results of index based analysis. As explained earlier this analysis is used to quantify the social inequalities in the light of environmental justice, the details about its computation and analysis have been discussed in the previous chapter. No we will discuss the results as per follows:

4.3.1 Education:

In order to quantify the inequality index, we used five dimensions of inequality and calculated index for each of them. The first dimension which we will discuss is education. Education is one of the basic need of a person and everybody should have equal opportunities to access of educational facilities thus ensuring right of education for all. Therefore in this study we determined four indicators namely access to school, no of people having professional education, educational background of breadwinners of family and access of media facilities to the people to calculate the index for determining inequalities in terms of education. Table 4.3.1 shows the results for the index of education.

Index for Education	Frequency	Percentage	Mean	Standard Deviation
<=0.47	21	10.0	0.69	0.14
0.47-0.6	38	18.09		
0.6-0.8	124	59.04		
0.8+	27	12.8		
Total	210	100.0	0.69	0.14

Table 4.3.1 Results for Index of Education

As discussed earlier, the index for education was calculated by taking the average of all the responses collected against the indicators allotted to education. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that majority of people suffered inequality in terms of education as 59% of the total values fell in the range of 0.6-0.8 which depicts higher range of inequality. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered higher level of

disparity in terms of education. Figure 4.3.1 signifies the results in graphical form.

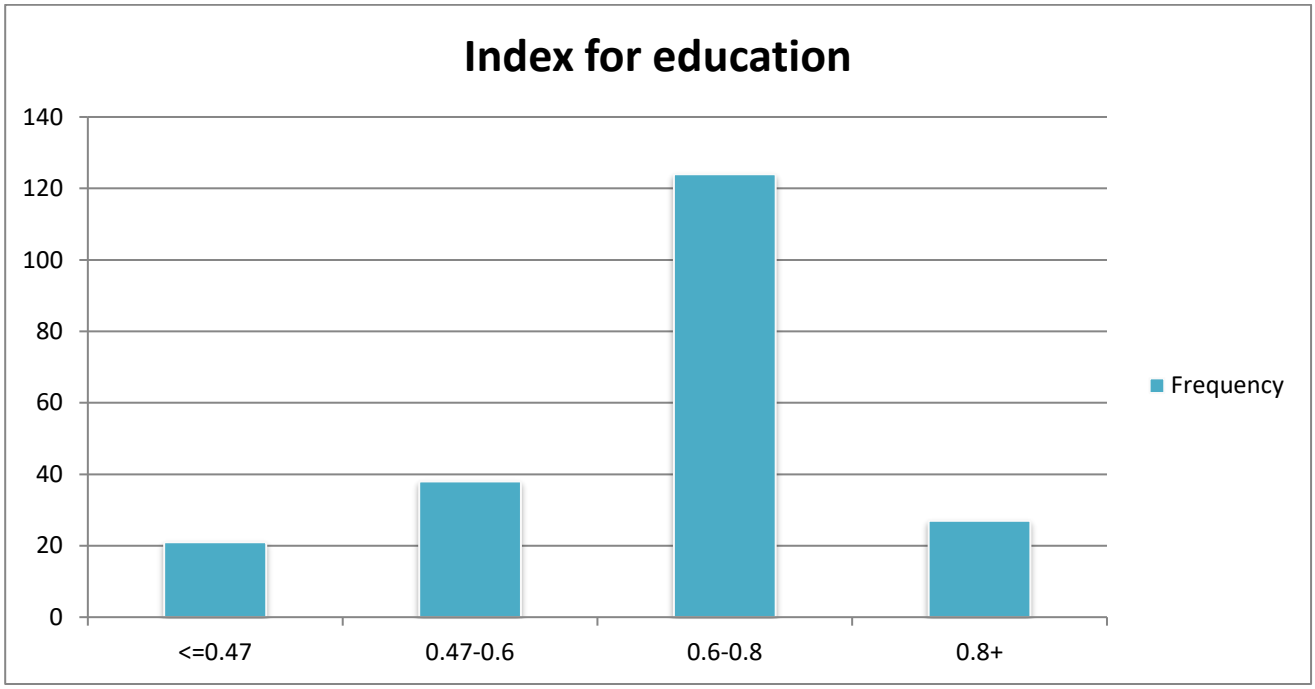

Figure 4.3.1 Results for Index of Education

4.3.2 Gentrification:

The second dimension used in this analysis was gentrification. Gentrification refers to development of an area by influx of more wealthy people moving in and displacing the original residents. In simple words it is the phenomenon of modernizing and revolutionizing an area by replacing people who can add less value with the people who can bring more opportunities for the development of an area. Gentrification has been on the rise in recent years due to the fast pace of urbanization but recently another dimension has been added into it. With the rapidly changing climate and its impacts on urban areas, people are now moving to places where lesser impact of an environmental event is expected. This phenomenon is known as climate gentrification. Understanding different dimensions of gentrification in the name of environmental justice could help us to have a better knowledge of inequalities prevalent in the society. Table 4.3.2 depicts the results for index on gentrification.

Index for Gentrification	Frequency	Percentage	Mean	Standard Deviation
<= .00	38	18.1	0.35	0.25
.01 - .20	58	27.6		
.21 - .40	52	24.8		
.41 - .60	39	18.6		
Total	210	100.0	0.35	0.25

Table 4.3.2 Results for Index of Gentrification

As discussed earlier, the index for gentrification was calculated by taking the average of all the responses collected against the indicators allotted to gentrification. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that most of people did not suffer inequality in terms of gentrification as 27.6% of the total values fell in the range of 0.01-0.2 which depicts lower range of inequality whereas only 18.6% of the total values were in the higher range of inequality i.e. 0.41-0.60. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered lower level of disparity in terms of gentrification. Figure 4.3.2 signifies the results in graphical form.

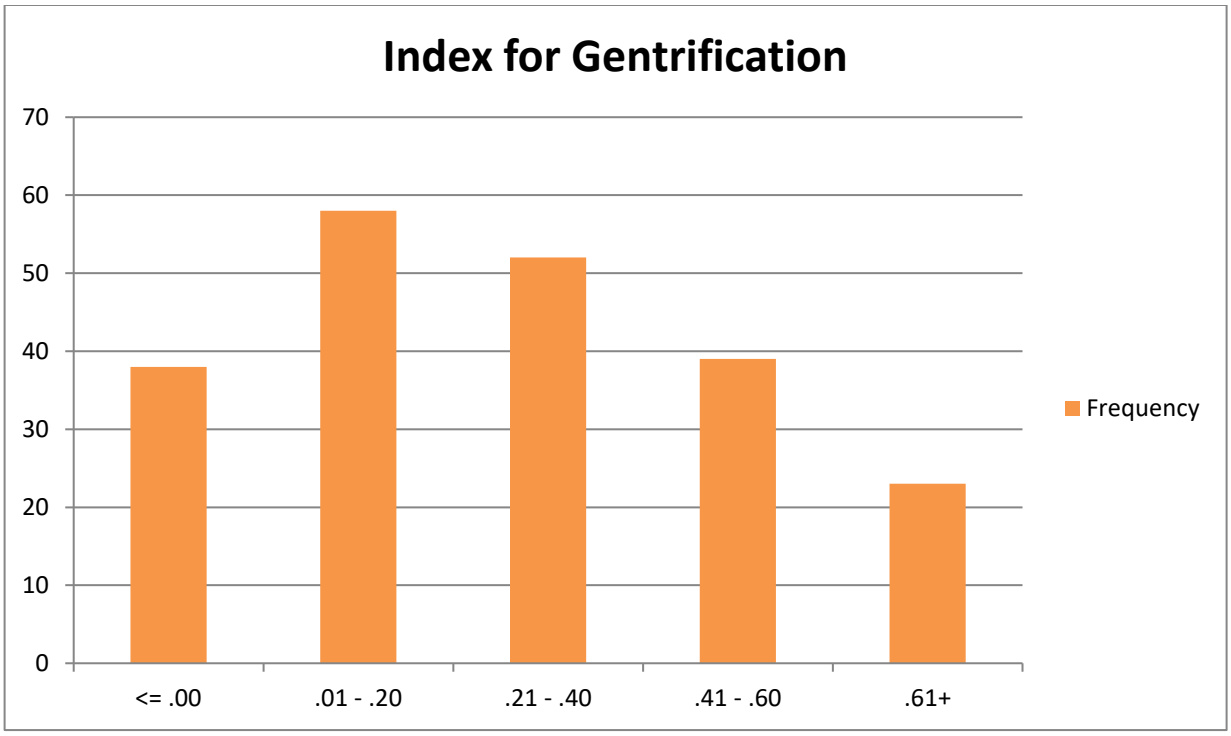

Figure 4.3.2 Results for Index of Gentrification

4.3.3 Energy:

The third dimension used in this analysis was energy. Energy is one of the most important components of a livelihood of a person. A person cannot survive in case of an emergency if he faces inequality in terms of access to energy. For this study we determined two indicators namely energy justice and water justice to calculate index for determining social inequality. The indicators chosen for this analysis helps in understanding patterns of discrimination in terms of access of electrical energy and access to water. Table 4.3.3 represents the results for the index of energy.

Index for Energy	Frequency	Percentage	Mean	Standard Deviation
<= .33	4	1.9	0.70	0.26
.34 - .67	131	62.4		
.68 - 1.00	75	35.7		
Total	210	100.0	0.70	0.26

Table 4.3.3 Results for Index of Energy

As discussed earlier, the index for energy was calculated by taking the average of all the responses

collected against the indicators allotted to energy. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that most of people suffered inequality in terms of energy as 62.4% of the total values fell in the range of 0.34-0.67which depicts higher range of inequality whereas only 1.9% of the total values were in the lower range of inequality i.e.0.33. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered higher level of disparity in terms of gentrification. Figure 4.3.3 signifies the results in graphical form.

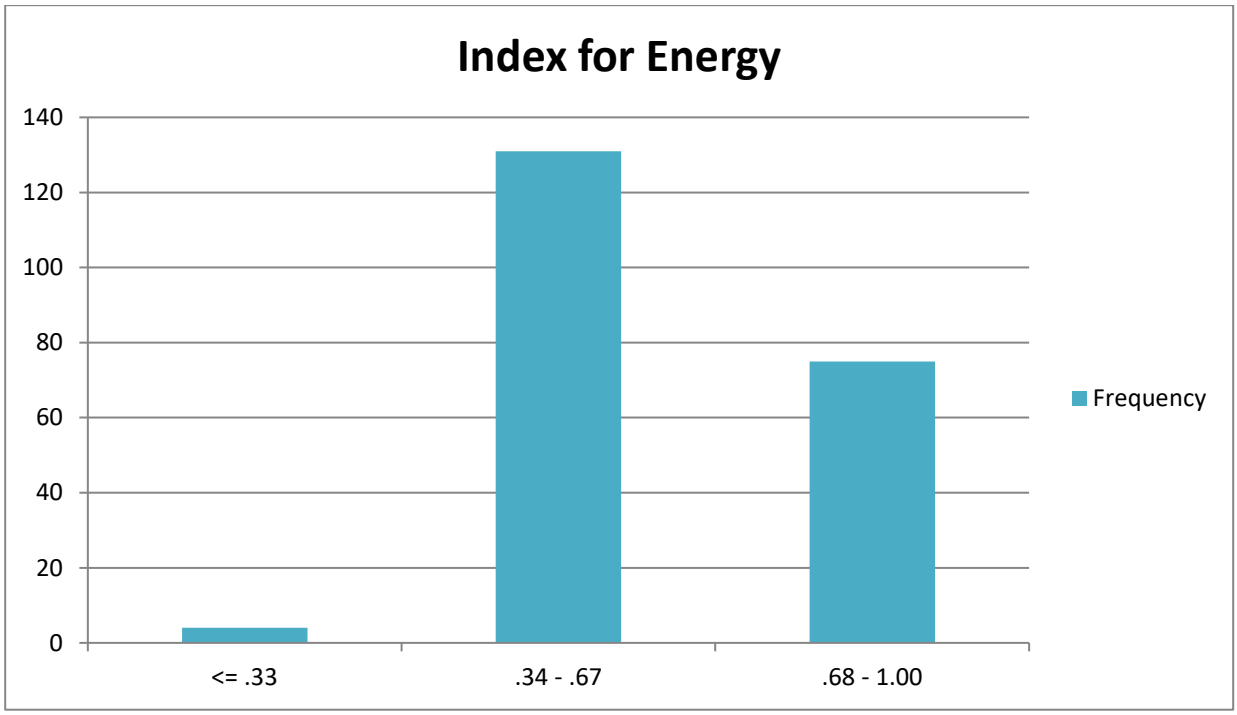

Figure 4.3.3 Results for Index of Energy

4.3.4 Location Based Hazard

The fourth dimension used in this analysis is location based hazard. It refers to the hazards faced by people due to the location of their place of living, workplace etc. This parameter provides a holistic view of the difficulties faced by the people in the case of an environmental hazard. Analyzing this would facilitate in understanding the inequalities in terms of location based hazard. The indicator used include location based hazard, heat exposure and distribution of risks and benefits across the society. Table 4.3.4 represents the results of index of location based hazard.

Index for Location based hazard	Frequency	Percentage	Mean	Standard Deviation
<= .25	82	39.0	0.49	0.28
.26 - .50	60	28.6		
.51 - .75	43	20.5		
.76+	25	11.9		
Total	210	100.0	0.49	0.28

Table 4.3.4 Results for Index of Location based Hazard

As discussed earlier, the index for location based hazard was calculated by taking the average of all the responses collected against the indicators allotted to energy. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that most of people did not suffer inequality in terms of location based hazard as 39% of the total values fell in the range of 0.25which depicts lower range of inequality whereas only 11.9% of the total values were in the higher range of inequality i.e.0.76. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered lower level of disparity in terms of location based hazard. Figure 4.3.4 signifies the results in graphical form.

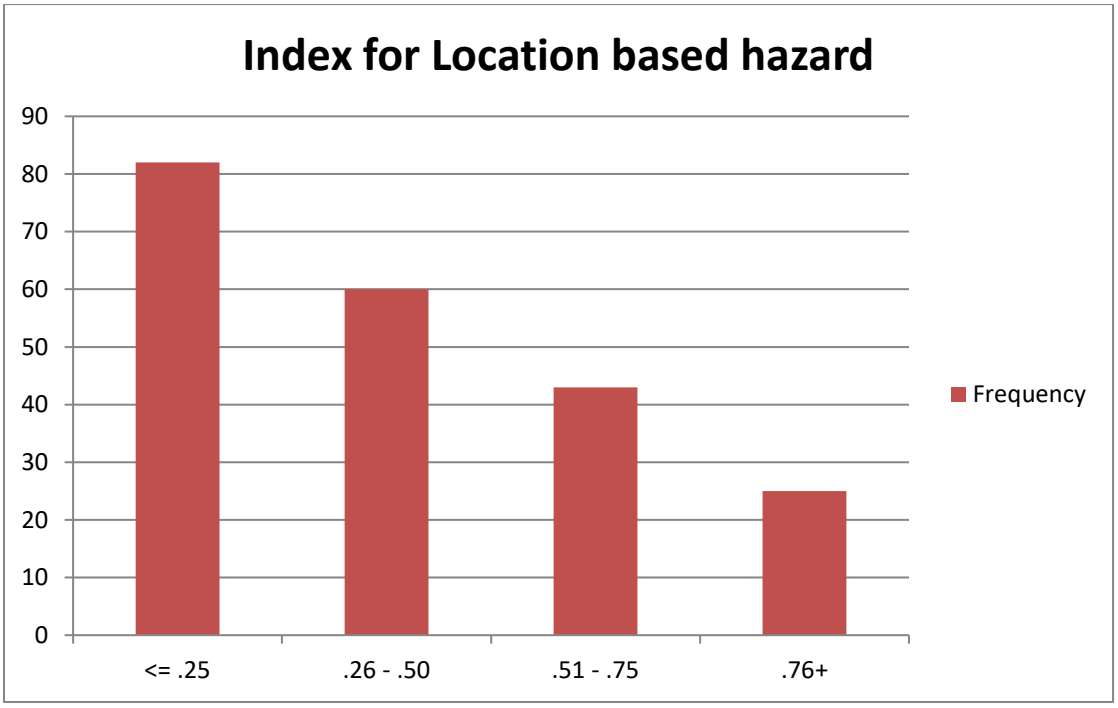

Figure 4.3.4 Results for Index of Location based Hazard

4.3.5 Health Benefits & Green spaces:

The fifth dimension used in this analysis is health benefits & green spaces. The provision of green spaces is an important factor to reduce the drastic impacts of climate change. It not only helps in making our environment better but also it can have positive influence on our health as it would help improve the air quality and lessen the temperature. The indicators used in this analysis are provision of green spaces, health benefits provided by green spaces etc. Table 4.3.5 demonstrates the results for the index of health benefits and green spaces.

Index for Health benefits and Green Spaces	Frequency	Percentage	Mean	Standard Deviation
<= .42	37	17.6	0.63	0.17
.43 - .54	41	19.5		
.55 - .67	57	27.1		
.68 - .79	50	23.8		
.80+	25	11.9		
Total	210	100.0	0.63	0.17

Table 4.3.5 Results for Index of Health benefits and Green Spaces

As discussed earlier, the index for location based hazard was calculated by taking the average of all the responses collected against the indicators allotted to energy. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that most of people suffered inequality in terms of health benefits & green spaces as 27% of the total values fell in the range of 0.55-0.67 which depicts higher range of inequality whereas only 11.9% of the total values were in the higher range of inequality i.e.0.80. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered higher level of disparity in terms of health benefits & green spaces. Figure 4.3.5 signifies the results in graphical form.

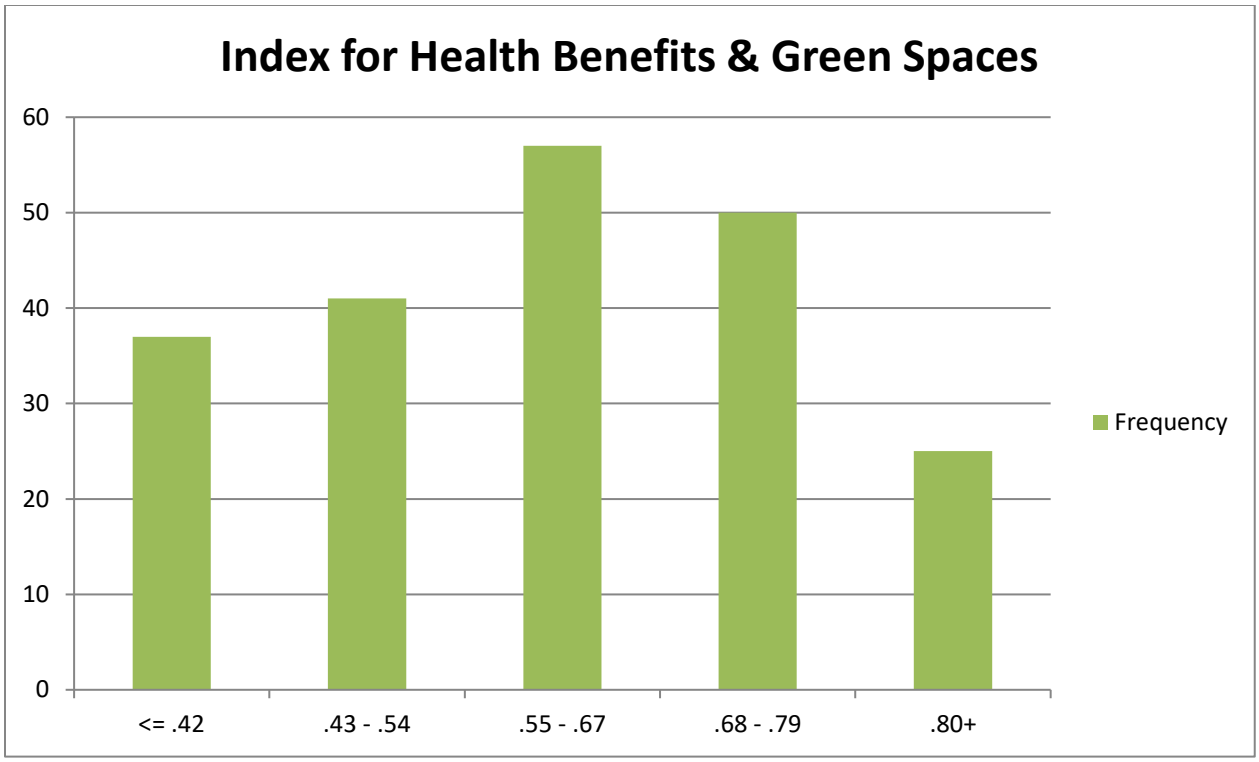

Figure 4.3.5 Results for Index of Health benefits and Green Spaces

4.3.6 Inequality Index:

In this section we will be entailing the details of the composite inequality index. This index is calculated by taking the average of indexes of all five dimensions of inequality as mentioned above namely energy, education, gentrification, location based hazard and health benefits and green spaces. Table 4.3.6 represents the results of inequality index.

Inequality Index	Frequency	Percentage	Mean	Standard Deviation
<= .49	36	17.1	0.57	0.10
.50 - .54	34	16.2		
.55 - .59	36	17.1		
.60 - .64	34	16.2		
.65 - .66	37	17.6		
.67+	33	15.7		
Total	210	100.0	0.57	0.10

Table 4.3.6 Results for Inequality Index

As discussed earlier, the inequality index was calculated by taking the average of all the indexes of the inequality dimensions. The values of the index range from 0 to 1 with 0 representing low inequality and 1 representing high inequality. From the above table it is clear that most of people suffered social inequalities as 17.6% of the total values fell in the range of 0.65-0.66 which depicts higher range of inequality whereas only 16.2% of the total values were in the lower range of inequality i.e.0.50-0.64. Therefore it is concluded that people in the region of Rawalpindi and Islamabad encountered higher level of disparity in terms of social inequalities in light of environmental justice. Figure 4.3.6 signifies the results in graphical form.

Figure 4.3.6 Results for Inequality Index

At the end we compared the mean values of all indexes whose results are shown in Figure 4.3.6(i).

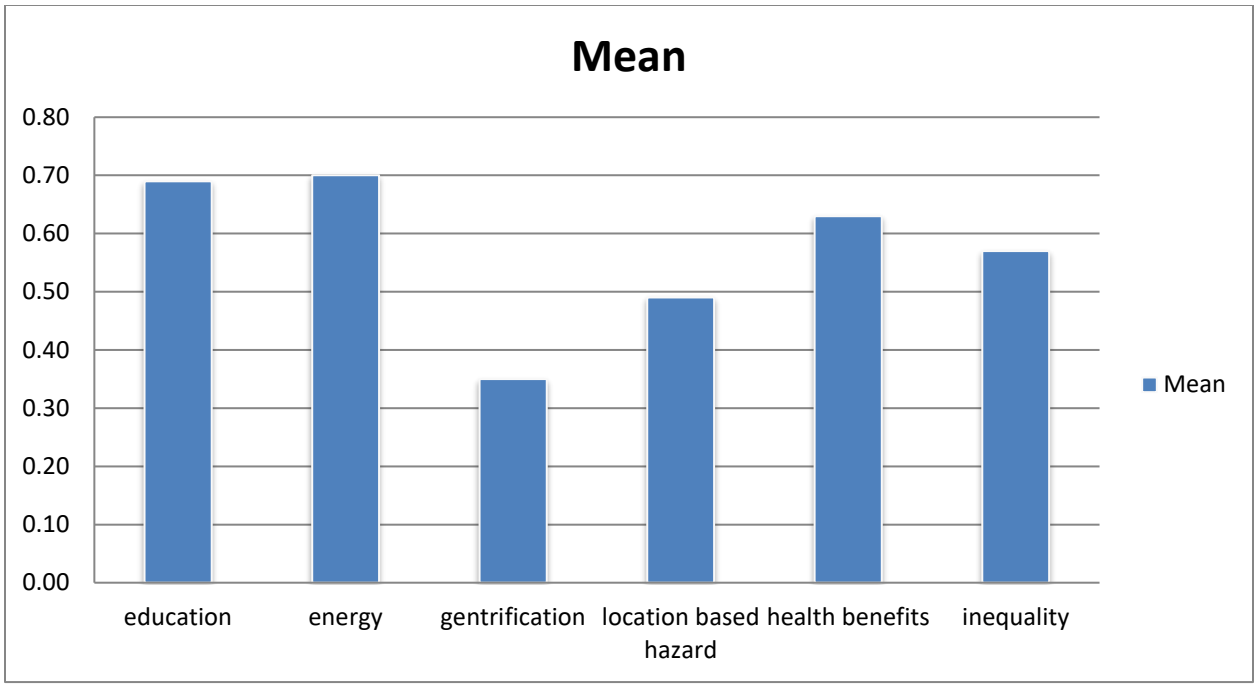

Figure 4.3.6(i) Mean Values of Inequality Indexes

4.4 Descriptive Analysis:

In this section we will be deliberating upon the details of descriptive analysis performed to understand the public perceptions and attitudes towards environmental justice. Following are the results of descriptive analysis**:**

4.4.1 Cumulative Perception Regarding Environmental Threats:

This indicator would help in analyzing the public perception regarding environmental threats such as floods, heat waves, earthquakes etc. The questions asked in this regard were related to perception of threats and intensity of damages of these threats. Figure 4.4.1 depicts the results.

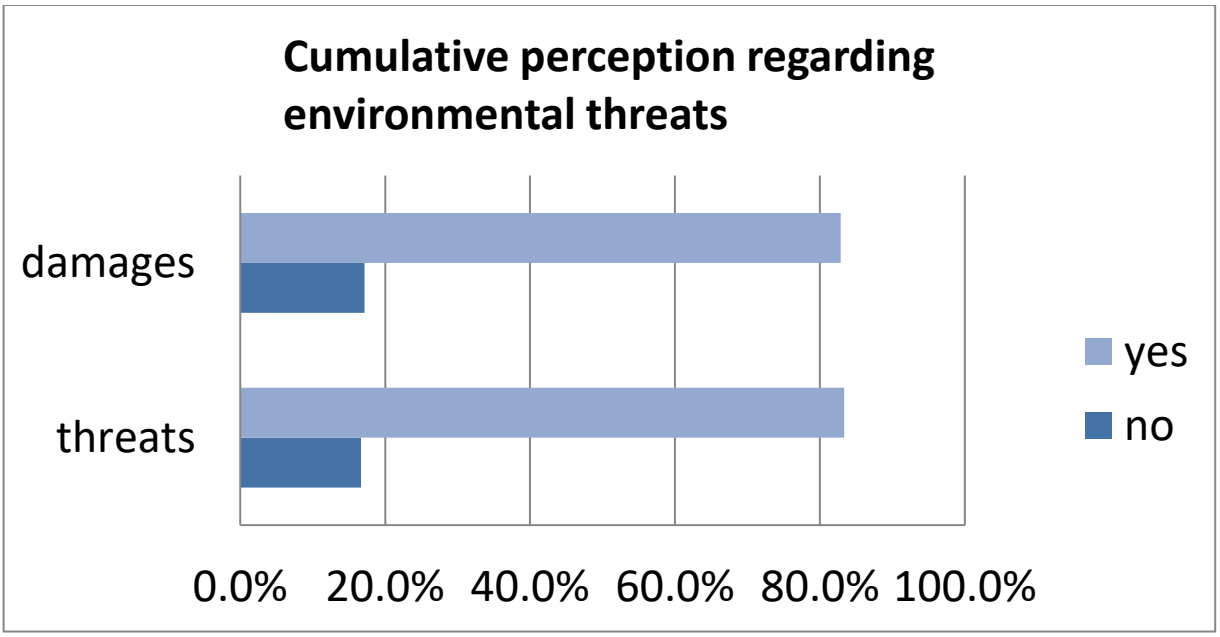

Figure 4.4.1 Results of cumulative perception regarding environmental threats

From the above figure it is clear that a vast majority of respondents i.e. 83% were aware of the environmental threats and the intensity of the damages it could cause.

4.4.2 Cumulative Perception Regarding Environmental Injustice:

This indicator would help in analyzing the public perception regarding environmental injustice and its damages. The questions asked in this regard were related to perception of concept of environmental injustice and intensity of damages it could cause in the society.. Figure 4.4.2 depicts the results.

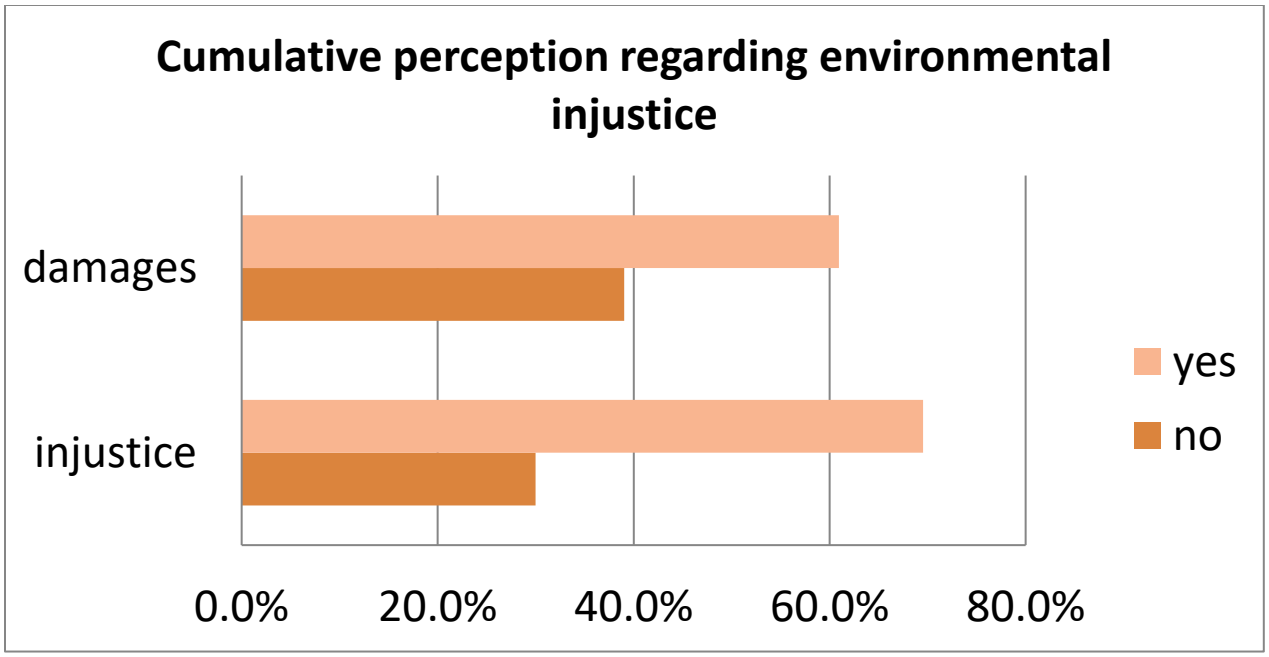

Figure 4.4.2 Results of cumulative perception regarding environmental injustice

From the above figure it is clear that a considerable majority of respondents i.e. 70% were aware of the concept of environmental injustice whereas 60% of the respondents were aware of the intensity of the damages it could cause.

4.4.3 Resources available in the case of hazard:

This indicator would help in analyzing the public perception regarding resources available in the case of hazard The questions asked in this regard were related to perception of resources available in the case of a hazard and its awareness in the society. Figure 4.4.3 depicts the results.

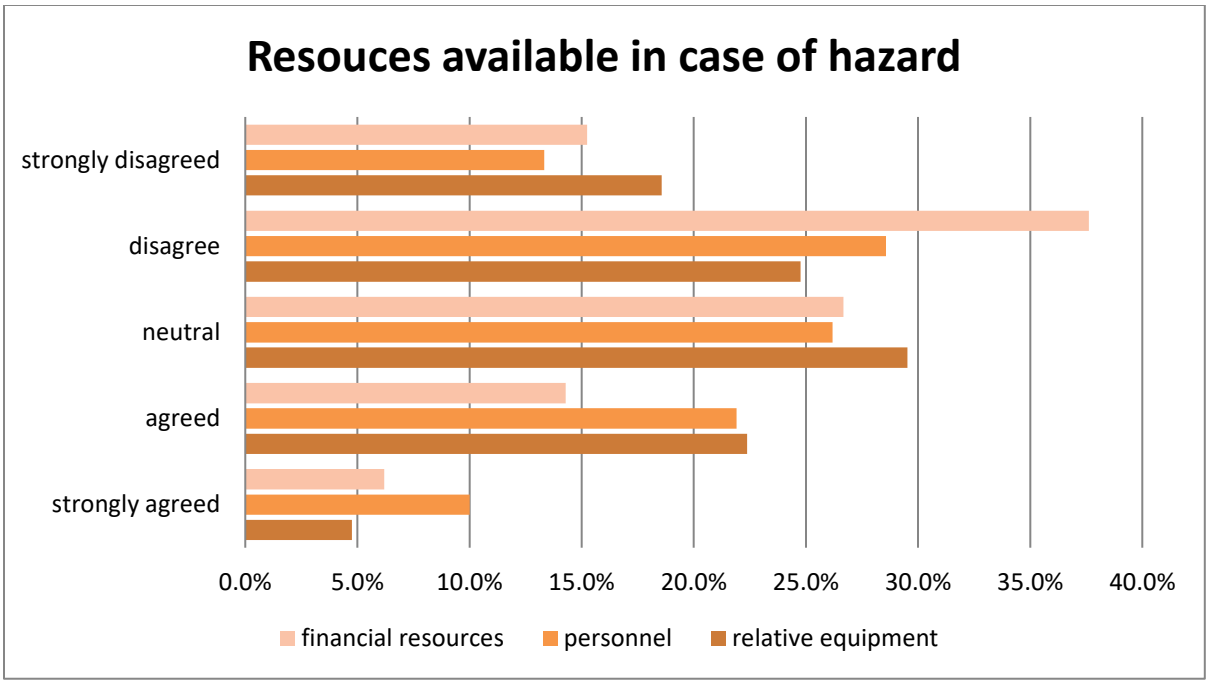

Figure 4.4.3 Results of resources available in the case of hazard

From the above figure it is clear that in terms of financial resources 15.2% of the respondents strongly disagreed whereas 6.2% strongly agreed regarding its availability and 27% of the people remained neutral. Similarly in terms of personnel 13.3% of the respondents strongly disagreed whereas 10% strongly agreed regarding its availability and 26.2% of the people remained neutral In terms of relative equipment 18.6% of the respondents strongly disagreed whereas 4.8% strongly agreed regarding its availability and 29.5% of the people remained neutral

4.4.4 Formulation and implementation of policies:

This indicator would help in analyzing the public perception regarding Formulation and implementation of policies The questions asked in this regard were related to perception of implementation and formulation of policies. Figure 4.4.4 depicts the results.

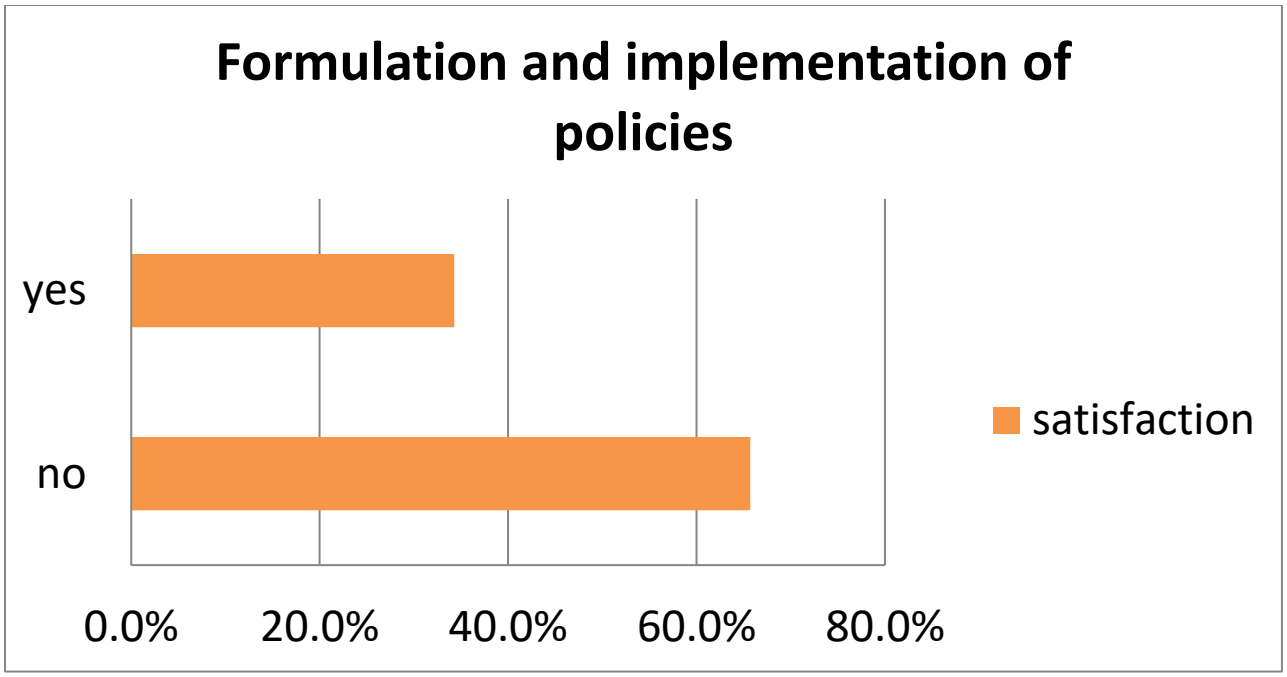

Figure 4.4.4 Results of Formulation and Implementation of Policies

From the above figure it is clear that a considerable majority of respondents i.e. 65% were not satisfied whereas 35% of the respondents were satisfied with the policies formulated and implemented by the government for environmental protection.

4.4.5 Distrust in Government:

This indicator would help in analyzing the public perception regarding distrust in government's action and policies. The questions asked in this regard were related to perception of performance of government and success of plans being implemented by the government. Figure 4.4.5 depicts the results.

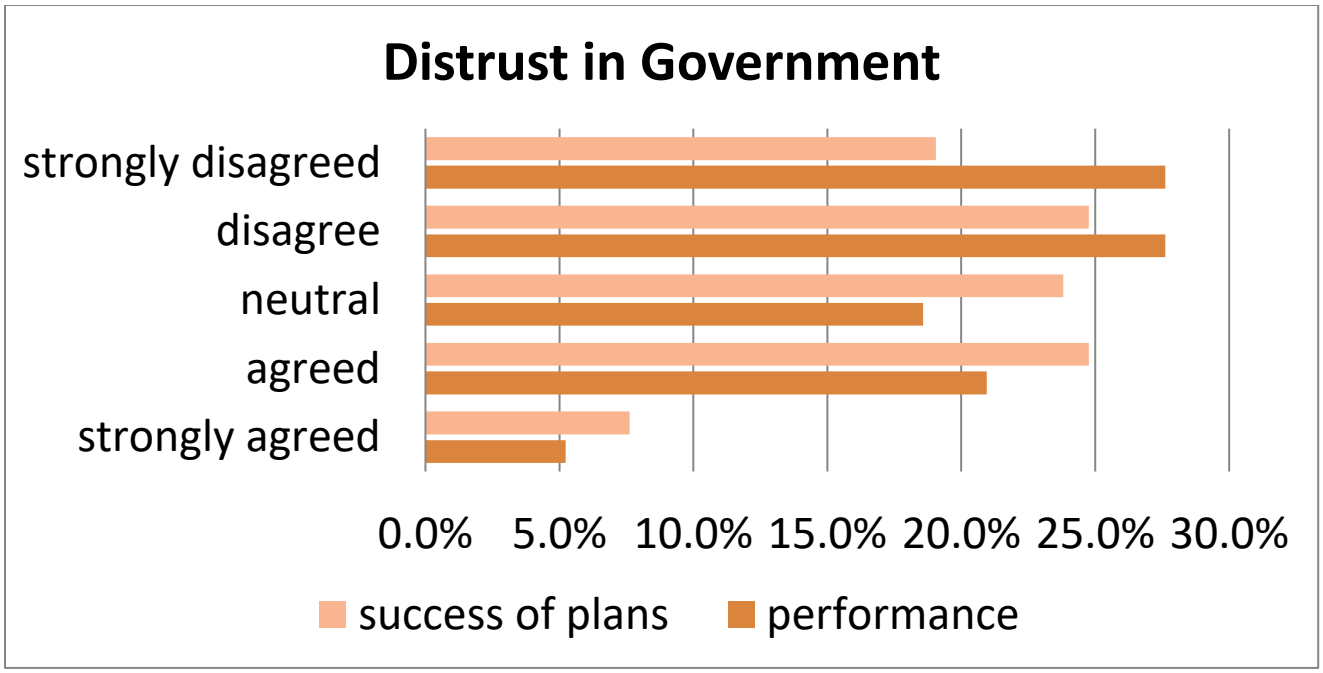

Figure 4.4.5 Results of Distrust in Government

From the above figure it is clear that in terms of success of plans 19% of the respondents strongly disagreed whereas 7.6% strongly agreed and 23.8% of the people remained neutral. Similarly in terms of performance 27.6% of the respondents strongly disagreed whereas 5.2% strongly agreed regarding its availability and 18.6% of the people remained neutral.

4.4.6 Discrimination In Distribution Of Climate Finance:

This indicator would help in analyzing the public perception regarding Discrimination in distribution of climate finance. The questions asked in this regard were related to perception of performance of provision of aid by the government and equity being maintained in this process. Figure 4.4.6 depicts the results.

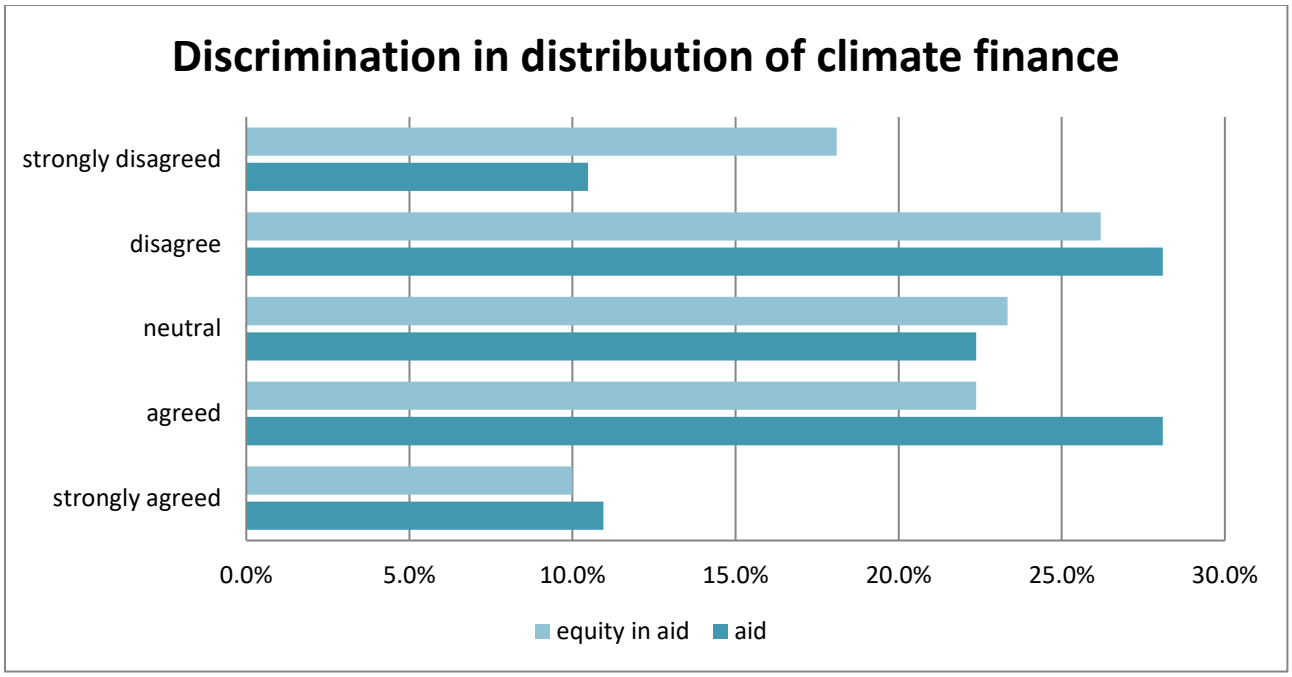

Figure 4.4.6 Results of Discrimination in the distribution of climate finance

From the above figure it is clear that in terms of equity in aid 18.1% of the respondents strongly disagreed whereas 10% strongly agreed and 23.3% of the people remained neutral. Similarly in terms of provision of aid 10.5% of the respondents strongly disagreed whereas 11% strongly agreed and 22.4% of the people remained neutral.

4.4.7 Realistic and Inclusive Plans, Policies Considering Social Factors:

This indicator would help in analyzing the public perception regarding realistic and inclusive plans, policies considering social factors. The questions asked in this regard were related to perception of formulation of policies considering social factors like status, income, ethnicity, age. Figure 4.4.7 depicts the results.

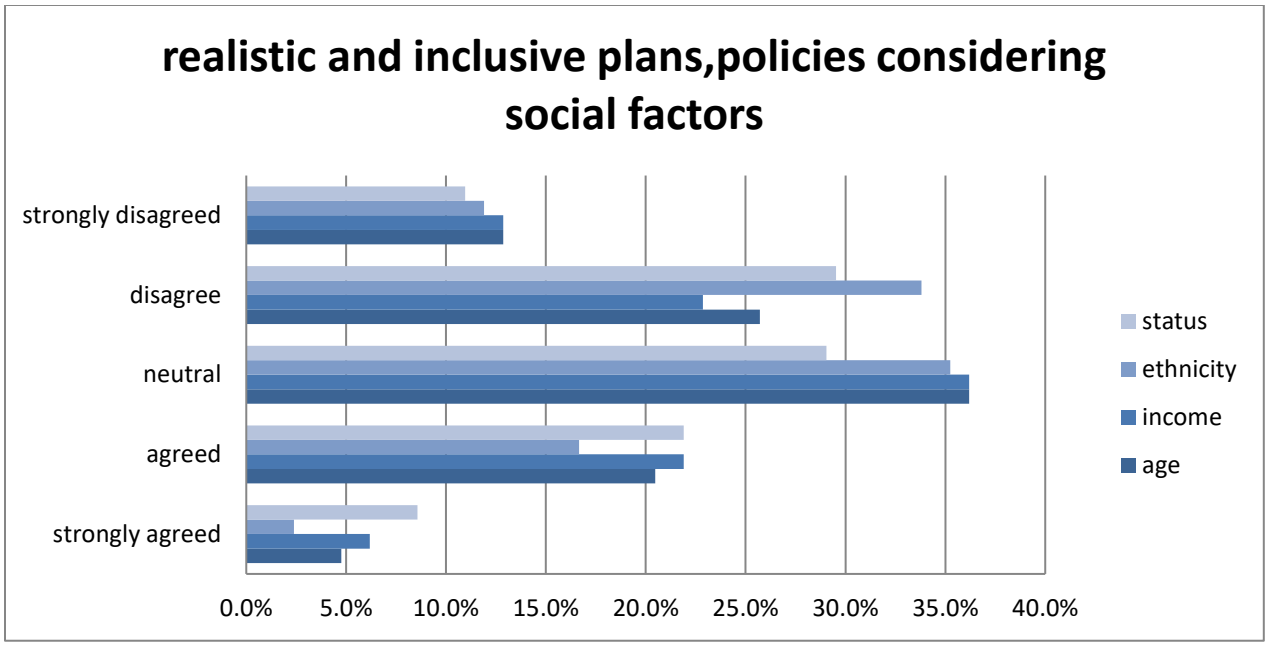

Figure 4.4.7 Results of realistic and inclusive plans, policies considering social factors

From the above figure it is clear that in terms of status 11% of the respondents strongly disagreed whereas 8.6% strongly agreed and 29% of the people remained neutral. Similarly in terms of ethnicity 11.9% of the respondents strongly disagreed whereas 2.4% strongly agree and 35.2% of the people remained neutral. In terms of income 12.9% of the respondents strongly disagreed whereas 6.2% strongly agreed and 36.2% of the people remained neutral. In terms of age 12.9% of the respondents strongly disagreed whereas 4.8% strongly agreed and 36.2% of the people remained neutral.

4.4.8 Detrimental Effects Faced By Society Due To Hazard:

This indicator would help in analyzing the public perception Detrimental effects faced by society due to hazard. The questions asked in this regard were related to perception of detrimental effects faced due to hazard like damages to health, financial problems and loss of life. Figure 4.4.8 depicts the results.

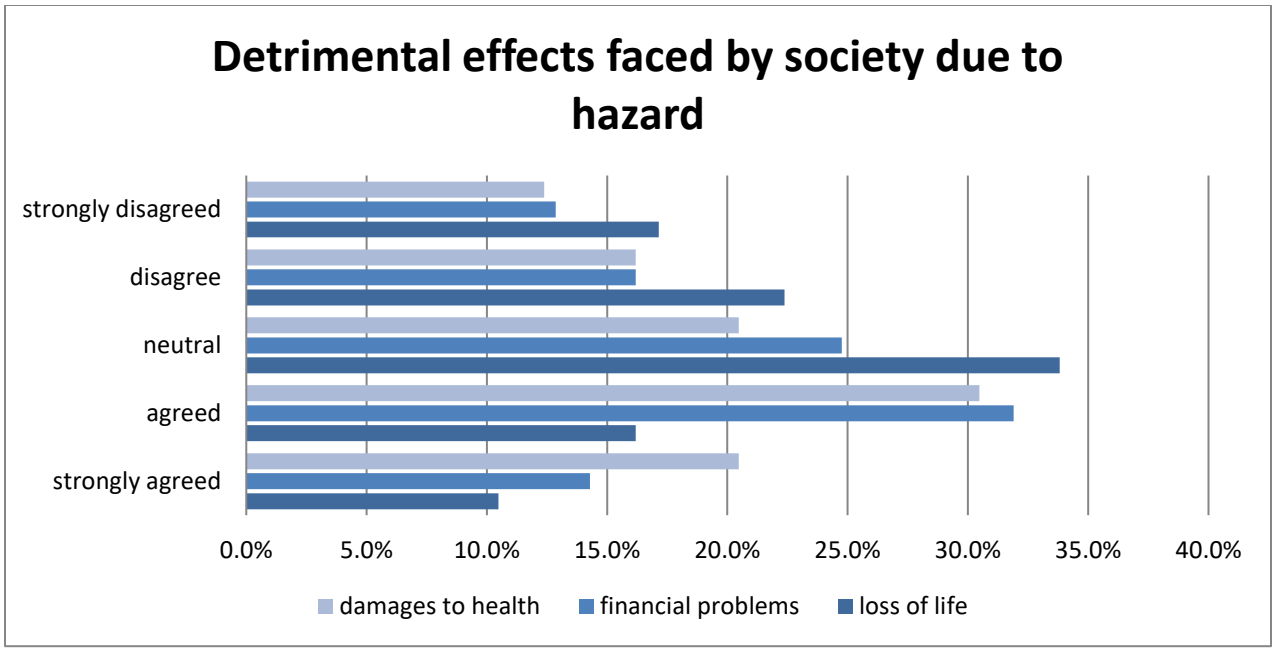

Figure 4.4.8 Results of Detrimental effects faced by society due to hazard

From the above figure it is clear that in terms of damages to health 12.4% of the respondents strongly disagreed whereas 20.5% strongly agreed and 20.5% of the people remained neutral. Similarly in terms of financial problems 12.9% of the respondents strongly disagreed whereas 14.3% strongly agreed and 24.8% of the people remained neutral. In terms of loss of life 17.1% of the respondents strongly disagreed whereas 10.5% strongly agreed and 33.8% of the people remained neutral.

4.5 Institutional challenges faced in implementation of environmental justice in urban resilience planning:

4.5.1. Respondent's profile

Ten representatives from the government sectors were interviewed to identify the institutional challenges in enhancing urban resilience through environmental justice in cities of Rawalpindi and Islamabad.. The government departments that were interviewed included the National Disaster Risk Management Fund (NDRMF), Islamabad Capital Territory Administration (ICTA), Parks &

Horticulture Authority (PHA), Rawalpindi Development Authority (RDA), and the Capital Development Authority (CDA) . Table 1 provides detailed profiles of the respondents who were interviewed.

The respondents were asked about the current challenges and issues faced by public institutions in Rawalpindi and Islamabad. In addition to highlighting these challenges, the respondents also provided suggestions for overcoming them.

Table 4.5.1: Profile of key informants

Respondent	Official Designation	Education	Profession	Institution
1	Director-Engineering	MS (Civil),MS(PM)	Civil Engineer	Parks & Horticulture Authority
2	Deputy Director Engineering	BSc Civil Engineering	Civil Engineer	Parks & Horticulture Authority
3	Deputy Director	M.Sc. Environmental Engineering	Environmental Engineer	Rawalpindi development Authority
4	Assistant Director	BSc Civil Engineering	Civil Engineer	Rawalpindi development Authority
5	Assistant Manager DRR	Mphil	DRR practitioner	National Disaster Risk Management Fund
6	Manager DRR	MS Urban Planning	DRR practitioner	National Disaster Risk Management Fund
7	Deputy director development	MSc Hons agriculture	Civil servant	Islamabad Capital Territory administration
8	Assistant Engineer	B tech hons	Engineer	Islamabad Capital Territory administration
9	Regional Head	MS Urban Planning	Urban Planner	Capital Development Authority
10	Chief Executive Officer	BS Urban Planning	Urban Planner	Capital Development Authority

Source: Field survey, 2022

4.5.2 Institutional challenges:

The expert interviews conducted for this study provided valuable insights into the challenges and problems faced by institutions and the local community in Rawalpindi & Islamabad when it comes to enhancing urban resilience and adapting to climate change (Figure 4.5.2). As highlighted by the experts, the institutional challenges are discussed in detail below.

Figure 4.5.2 Institutional Challenges

4.5.2.1 Lack of Awareness:

Environmental justice being a relatively new approach is not a very common phenomenon in Pakistan. Most of the people are unaware of its benefits and consequences they can face if this concept is not implemented properly. Ironically a country which is the most affected by climate induced disasters and environmental change should be the most vigilant and in search of new solutions. However unfortunately people in Pakistan are not much serious in this regard and the same behavior is reflected in the institutions as well. The concerned institutions which are responsible for the policy making are not aware of the benefits of environmental justice and its potential to be used to enhance urban resilience. If this situation prevails, policy makers would not be able to formulate such plans and policies which are resilient enough to deal with environmental hazards.

"Urban resilience must be a top agenda. Environmental justice will help to achieve the resilient infrastructure" (Respondent-6)

4.5.2.2 Insufficient Funds and financial resources:

In order to solve a problem it is necessary that all the sufficient resources must be available to avoid any kind of inconveniences. One of the most important resources to solve any problem are the funds and financial resources. Most of the institutions in our country are allocated funds through government and others generate funds for themselves. Now in the case of governance institutions, it is necessary that they receive sufficient amount of financial resources in order to allocate necessary amounts required to solve their daily issues. However things are different in reality. Most of the policy making institutions either receive a substantial amount for their projects or they don't manage these funds effectively to cater for the preventive measures to deal with the environmental hazards.

"PSDP schemes should be allocated separate funds for climate change adaptation and post disaster rehabilitation and resettlement." (Respondent-4)

4.5.2.3 Lack of policy making:

As explained earlier, environmental justice is a relatively new concept and is slowly progressing, thus one of the most significant challenge faced by the institutions was the lack of adequate policies and regulations. The policy makers and concerned individuals in Pakistan are still struggling to come up with effective strategies to cope with the ever changing environment and to prevent its detrimental effects on urban systems. In such circumstances it is the need of hour to incorporate the concept of environmental justice in policy making and formulate such comprehensive plans, rules and regulations which would cover all the important factors and would ensure justice in its implications as well.

"Policies should be clearly formed and implemented through sufficient financial and human resources." (Respondent-8)

"Policy guidelines and SOP may be devised for the effective implementation of environmental projects."(Respondent-7)

4.5.2.4 Lack of Implementation framework:

Another most important challenge faced by the institutions is the lack of implementation framework. Any policy, plan, rule, regulation or strategy could not be effective until it is implemented properly. In Pakistan a lot of research ass been done on minimizing the impacts of climate change and to suggest policies for that but in all of these studies hardly anyone would have focused on exploring the potential of environmental justice on how it can be utilized to enhance urban resilience. Due to this very few studies are available on this topic suggesting policy measures and even those studies lack mention of any effective implementation strategy. Thus nobody has bothered in the concerned institutions either to think about this specific matter.

4.5.2.5 Political Support:

One of the most thought-provoking challenge faced by the institutions is the lack of political support. As mentioned earlier as well environmental justice is not widely popular in context of

Pakistan's institutional framework, therefore it is important to highlight the significance of this concept on national level at all available forums. Thus the most important medium in this regard are the politicians. If the concept of environmental justice is highlighted by the politicians and lawmakers more effectively in the legislative assembly, there are higher chances of legislations to be approved by the government providing guidelines to the institutions to govern the urban systems more efficiently and effectively.

4.5.2.6 Environmental Governance:

Another challenge faced by the institution is the lack of environmental governance. Most of the development projects in Pakistan fail to comprehend the effects it would have on the surroundings and environment. Although these projects are meant for the advancement of the society but most of the institutions executing these projects don't cater for the detrimental effects it would have on the environment. Therefore a strong governance framework must be implemented by the government while granting the approval of development schemes must ensure that EIA (environmental impact assessment) must be carried out in order to check for any disadvantageous implications it might have on the surroundings to ensure the well-being of people.

4.5.2.7 Capacity building:

In order to incorporate he concept of environmental justice effectively in the policy making scenario of urban governance, it is necessary to have properly trained individuals and resources. It is authoritative to mention that without the appropriate staff who is well equipped with the knowledge of environmental hazards and its implications on the urban systems it would be impossible to formulate effective plans and policies. Furthermore we need to equip our institutions with the requisite financial resources and logistic support as well in order to facilitate the smooth functioning of institutions in order to ensure environmental justice in urban governance to enhance urban resilience.

4.6 Framework:

Following is the framework providing guidelines on how to enhance urban resilience through environmental justice

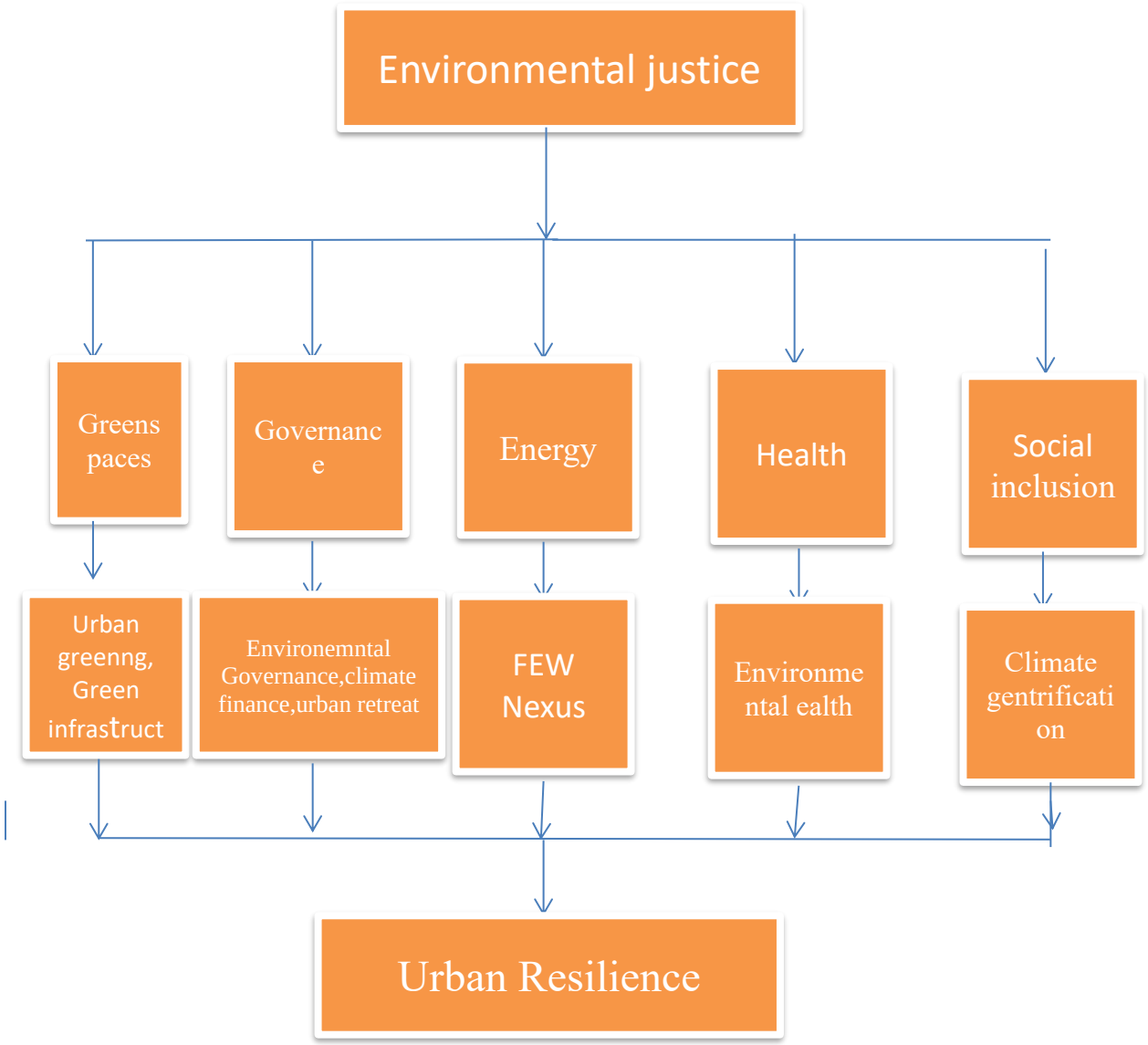

Figure 4.6 Framework

Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion:

This chapter presents the conclusion of this research. It is divided into three parts. In the first part, social inequalities in terms of environmental justice are discussed and in the second part, public perception and institutional challenges are discussed. In the last and third part of this chapter, recommendations and suggestions for future research are presented.

For the social inequalities, a composite index was constructed using indicators extracted from rigorous and extensive literature review. SPSS was used for its analysis. Using Slovin's sampling formula, a total of 210 samples were collected. In totality people of Rawalpindi and Islamabad region suffered higher inequality as per the results of inequality index. Furthermore, people suffered higher inequality in terms of health benefits provided by green spaces, education and energy whereas a lower trend of inequality was observed in terms of location based hazard and gentrification.

Descriptive statistics were used to analyze the public perceptions and attitudes regarding environmental justice. The results revealed that public was aware of the environmental threats and the concept of environmental injustice. Similarly there was higher perception regarding the intensity of damages both these phenomenon could cause. In order to minimize these damages one must be equipped with proper resources and government should work on making their policies better in order to provide maximum relief to public in case of a hazard. However, this study shows that public had mixed perception regarding the actions of government and their capabilities to deal with an environmental hazard and ensure environmental justice.

Qualitative analysis was used to determine challenges faced by institutions in implementing environmental justice as a tool to enhance urban resilience. The data for this analysis collected through interviews of professionals working in different organizations working in the planning and development sector. Among all of the challenges, lack of policy making, political support and environmental governance were highlighted as more significant by the experts.

5.2 Recommendations:

Following are some recommendations based on the findings of this study:

- Local government, NGO's and public should collectively work on promoting greening in all parts of the society.
- Government should endorse the use of green infrastructure to prevent negative effects of climate change
- Policy making institutions and other governing bodies should focus on increasing participation and inclusion in the planning of policies and regulations to ensure justice in governance.
- Government should ensure equality in distribution of aid provided for environmental protection to avoid injustice and inequality.
- The governing bodies should uphold justice in the FEW(Food, Energy, Water) sector in the society
- Government and governing bodies should encourage sustainable ways of the disposal of pollutants in the environment to ensure environmental justice
- Government should condemn gentrification in the name of climate change and work on formulation of SOP's and guidelines to ensure effective implementation.

5.3 Future Research:

In this section we will be deliberating upon some suggestions for future research. Environmental justice is a multi-dimensional phenomenon with implications in different disciplines. This study analyzed the role of environmental justice in enhancing urban resilience and focused on quantifying inequalities and understanding public perceptions and challenges faced in the way. However in order to explore the full potential of environmental justice as a tool to enhance urban resilience, future research should be focused on analyzing the influence of gender on quantifying social inequalities, conducting comparative case studies of different cities that have implemented environmental justice policies and initiatives to enhance their resilience to analyze the effectiveness of these policies, examining the role of community engagement in building resilient societies.

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APPENDIX

HOUSE HOLD SURVEY QUESTIONNAIRE

DEPARTMENT OF URBAN AND REGIONAL PLANNING
National University of Sciences & Technology

Enhancing urban resilience through environmental and climate justice: A case study of Rawalpindi and Islamabad,

This questionnaire is meant for data collection that will be used only for research purpose. No personally identifiable information will be collected. Please feel free to not answer if you are not comfortable. Thank you.

Pakistan

Sr No: ----- Housing Scheme Name: _____

Your Age: _____ Gender: Male ☐ Female ☐

Income: _____ Education: _____ Household Size (No of people living in the house); _____

1	What is the minimum distance between your house and the nearest school? _____ (in kms)	5	Type of social events held and how often do you attend those events? In this section select both options i.e (type of events and how often do you visit it) Seminars ☐ Awareness campaigns ☐ Monthly ☐ Quarterly ☐	
2	How many persons in your house have acquired professional degree? 2 or more ☐ 3 or more ☐ 4 or more ☐	6	Do you use social media? (you may select multiple options) WhatsApp Yes ☐ No ☐ Facebook Yes ☐ No ☐ Instagram Yes ☐ No ☐ Twitter Yes ☐ No ☐ Any other _____	
3	What is the qualification of breadwinners of the family? Graduation ☐ Bacheors ☐ Masters ☐ Uneducated ☐	7	Is there a group/page or forum of your society on social media? Yes ☐ No ☐	
4	Type of social gatherings held and how often do you attend those gatherings? In this section select both options i.e (type of gathering and how often do you visit it)	8	If yes then what is your participation in these groups? Regular activity(posting and sharing information) ☐	9. How well do you know your neighbors? Their name ☐ Their family ☐ Their job ☐

	Meetings ☐ Parties ☐ Weddings ☐ Monthly ☐ Quarterly ☐		Normal activity(checking for updates) ☐ Dormant activity(No activity at all) ☐	

10	Would you help out your neighbor in case of emergency? Yes ☐ No ☐	12	Is there any discrimination in your society on the basis of cast, income, ethnicity etc? Yes ☐ No ☐
11	How would you rate the engagement/bonding of your society (closely knitted etc.)? Strong Association ☐ Weak Association ☐	13	If yes then how do you deal with it and what measures should be taken to avoid it? _____
14	Do you face any difficulty due to your status in the society? (discrimination in the access to facilities, benefits etc)? Yes ☐ No ☐		
15	In case of an emergency/disaster would you help your neighbors out? Yes ☐ No ☐	16	Do you think your neighbors would do the same for you? Yes ☐ No ☐
17	Generally in case of a disaster if it has happened in your society before what was the community's response? _____	18	Do you understand the intensity of different environmental threats like earthquake, floods, heat waves etc.? Yes ☐ No ☐
19	Are you aware of the damages caused by these events? Yes ☐ No ☐	20	Are you aware of the concept of environmental injustice(inequitable distribution of effects of environmental event in a city)? Yes ☐ No ☐
21	Are you aware of the damages caused by environmental injustice? Yes ☐ No ☐	22	Are you satisfied with the current policies, procedures adopted by the concerned institutions regarding environmental protection? Yes ☐ No ☐
23	In your opinion how often should these policies/regulations be revised and updated? After 5 years ☐ 10 years ☐ 15 years ☐		

5-Point Likert Scale means 1. Strongly Agreed 2. Agreed 3. Neutral 4. Disagree 5. Strongly Disagreed	1	2	3	4	5

24	How much are you satisfied with the aid provided by the government in case of a disaster or for environmental protection?					
25	To what extent do you agree these aids are distributed on an equitable basis?					
26	To what extent do you agree the relative plans, policies for environmental protection are realistically formulated considering age)?					
27	To what extent do you agree the relative plans, policies for environmental protection are realistically formulated considering income)?					
28	To what extent do you agree the relative plans, policies for environmental protection are realistically formulated considering ethnicity)?					
29	To what extent do you agree the relative plans, policies for environmental protection are realistically formulated considering status)?					
30	How much are you satisfied with the type of resources(relative equipment) available to deal with emergency situations?					
31	How much are you satisfied with the type of resources(personnel)available to deal with emergency situations?					
32	How much are you satisfied with the type of resources(financial resources) available to deal with emergency situations?					
33	How much do you consider the performance of your government satisfactory?					
34	How much do you consider the development schemes, projects carried out by the government necessary? Would these be profitable or not?					
35	How much do you suffer damages like (loss of life) as a result of these environmental hazards?					
36	How much do you suffer damages like (financial problems) as a result of these environmental hazards?					
37	How much do you suffer damages like (Damages to health) as a result of these environmental hazards?					
38	Do you think the duration of hazard effects the intensity of damages on the society or not? Yes ☐ No ☐					
39	Do you think you are exposed to environmental hazards due to the location of your home, work place etc? Yes ☐ No ☐					
40	Do you think that risks and benefits of development projects are equally distributed in the society? Yes ☐ No ☐					
41	Do you have provision of green space in your house? Yes ☐ No ☐					
42	Does your society have adequate green spaces (parks, street trees)? Yes ☐ No ☐					

43	Is there any park or open space near your house? Yes ☐ No ☐
44	If yes then how often do you visit it? Daily ☐ Weekly ☐ Monthly ☐
45	What is the minimum distance form you house to the parks/ open spaces? _____
46	Does these parks/open spaces have positive effect on your health? Yes ☐ No ☐
47	Are temperatures in your area higher than the surrounding area? Yes ☐ No ☐
48	Based on your daily routine, do you have more heat exposure than others? Yes ☐ No ☐
49	Are there any medical facilities (hospitals, clinics, basic health units etc)near your house? Yes ☐ No ☐
50	Are these facilities equipped with requisite equipment, medicines, personnel etc to provide health care in case of emergencies? Yes ☐ No ☐
51	Do you face any problem in the access of health care facilities? Yes ☐ No ☐
52	Have you ever relocated on the basis of development in the name of environmental protection? Yes ☐ No ☐
53	Do you know about anyone in the society who has gone through this procedure? Yes ☐ No ☐
54	Do you face any discrimination on the basis of your ethnicity in terms of benefits of environmental protection? Yes ☐ No ☐
55	Does your area face electricity shortage? Yes ☐ No ☐
56	What is the loadshedding schedule of your area? _____
57	Do you have access to clean water? Yes ☐ No ☐
58	Does your area face water shortage as compared to other areas? Yes ☐ No ☐
59	What are your views regarding urban development (infrastructure, housing etc) in your area? _____
60	Do you think urban development in your area has a negative effect on environment? Yes ☐ No ☐

61	Are there any zoning laws applicable in your society? Yes ☐ No ☐
62	Do people follow these laws? Yes ☐ No ☐
63	Are there any illegal land uses in your society? Yes ☐ No ☐
64	Do you own the house you currently live in? Yes ☐ No ☐
65	How old is the house you are currently living in? _____
66	Do you have access to print/electronic/social media facilities? Yes ☐ No ☐
67	If yes is it useful or not? Yes ☐ No ☐
	Remarks/Suggestions

Institutional Survey Questionnaire

DEPARTMENT OF URBAN AND REGIONAL PLANNING
National University of Sciences & Technology

Enhancing urban resilience through environmental and climate justice: A case study of Rawalpindi and Islamabad,

This questionnaire is meant for data collection that will be used only for research purpose. No personally identifiable information will be collected. Please feel free to not answer if you are not comfortable. Thank you.

Pakistan

Sr No: ----- Institution Name: _____

Designation: _____ Job responsibility: _____

Professional education: _____

Your Age: _____ Gender: Male ☐ Female ☐

1	Do you consider climate change a serious threat to environment? Yes ☐ No ☐	5	Are there any SOPs/policy guidelines to assign roles and responsibilities within Department to deal with environmental hazards? _____	
2	If yes then does your department have SOP's/guidelines to deal with it? _____	6	What sort of changes are made within the department policies keeping in view the international treaties like SFDRR, SDGs, COP 21 (Paris Agreement)? Have you incorporated latest concepts in your policy documents, such as climate change risks/adaptation? _____	
3	Are you aware of the concept of environmental injustice(inequitable distribution of effects of environmental event in a city)? Yes ☐ No ☐	7	How many trainings for capacity building of the stakeholders (of relevant departments)were conducted in the last year? Please provide details of such trainings? _____	
4	Do you think it can have detrimental effects on society? Yes ☐ No ☐	8	How often department conduct community trainings/awareness/drills for the public? Please provide details of such activities? _____	9. Do you face any issues in receiving annual financial funds from the concerned authorities? Yes ☐ No ☐

5-Point Likert Scale means 1. Strongly Agreed 2. Agreed 3. Neutral 4. Disagree 5. Strongly Disagreed	1	2	3	4	5

1	How much are you satisfied with the aid provided by the government in case of a disaster or for environmental protection?					
2	To what extent do you agree these aids are distributed on an equitable basis?					
3	To what extent do you agree age is considered while formulating the relative plans, policies for environmental protection?					
4	To what extent do you agree income is considered while formulating the relative plans, policies for environmental protection ?					
5	To what extent do you agree ethnicity is considered while formulating the relative plans, policies for environmental protection ?					
6	To what extent do you agree status is considered while formulating the relative plans, policies for environmental protection ?					
7	How much are you satisfied with the type of resources(relative equipment) available to deal with emergency situations?					
8	How much are you satisfied with the type of resources(personnel)available to deal with emergency situations?					
9	How much are you satisfied with the type of resources(financial resources) available to deal with emergency situations?					
10	To what extent do you consider the performance of government satisfactory?					
11	How much do you consider the development schemes, projects carried out by the government necessary? Would these be profitable or not?					
12	Does your organization updates policies/regulations related to environmental protection? Yes ☐ No ☐					
13	If yes then In your opinion how often should these policies/regulations be revised and updated? After 5 years ☐ 10 years ☐ 15 years ☐					
	Remarks/Suggestions					