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Challenges & The Role of Rooftop Gardening for Urban Environmental Sustainability: A Focus on Rooftop Gardening in Banasree Residential Area

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Abstract: This paper depicted the significant challenges and hindrances to promote Green Roofs (Roof-Top gardening) along with the role of green roofs in urban environmental sustainability. Urban environmental sustainability will be the biggest challenge of next 21st century as it has already been estimated that by 2050, more than two-thirds of the world's population will live in cities, up from about 54 percent today, along with the climate change impact. Rooftop gardening can reduce the climate change impact to a significant level. But there are many challenges and hindrances in promoting RTG in Bangladesh due to a lack of awareness, a lack of incentives, and a lack of other facilities. However, this paper reported a critical review of the existing body of knowledge of researchers related to rooftop gardening. These common themes are the concept of green roofs, the benefits of building with green roofs compared to conventional buildings, and various challenges to making green roofs. It is found that the existing studies have predominantly focused on the environmental aspect of green roofs. Other dimensions of the green roof, especially the challenges and current situation, are largely overlooked.

Keywords: Green Roofs, Rooftop Gardening, Urban Environmental Sustainability, Climate Change, Urbanization, Bangladesh, Environmental Benefits, Challenges and Hindrances, Awareness and Incentives

INTRODUCTION

This is the introductory chapter of the research which covered the basic components of a research proposal, like the statement of the problem, research questions & objectives, research methodology, and research significance. Most importantly, this chapter has been provided a basic idea about the research that is what issues I exactly want to cover with my research and what is the contribution of my research in the existing body of knowledge.

STATEMENT OF THE PROBLEM

The world is now facing the most pressing problem, which is global warming. And as a result of global warming world temperature is rising day by day. Climate change is the most dangerous effect of global warming. Many developing countries like Bangladesh will be the most sufferers for the effect of global warming as the effect of sea level will raise most of the low land area will be gone under water. So these countries that are at future risk should take steps to face the future challenges of global warming. And of course, environmental sustainability is a key reason behind this. In that case, they should make their cities green through more and more tree plantations. As most developing countries are going for more urbanization and industrialization, they should make their cities sustainable. And of course, green roofs will be one of the possible solutions in making cities more sustainable. So this research is a present demand to meet the future challenges. The other researchers provide more information, deep thinking, and knowledge to them. However, it may be more helpful and can give instructions to policymakers to make advanced Policy. According to the World Health Organization (WHO), there should be 9 sq. meters of green space per city dweller to ensure a better life. The scenarios in developed countries are better than developing countries, normally, they have more trees (more than 20 sq. meters of green space per city dweller) to meet the ecological balance for human well-being. For example, most of the cities of China have 6.52 square meters of green coverage per person. If we now look at the capital city of Bangladesh, Dhaka, which is one of the fastest-growing megacities in the world. This metropolitan city has an area of 131 sq. kilometers with more than 15 million.

Already, unplanned urbanization has caused serious ecological imbalances in the city. FAO (2008) pointed out that Dhaka city has 21.57% open space, of which city parks occupy 0.89%, urban forestry 0.02%, gardens 0.90%, and 12.12% belongs to agriculture. The green space has reduced gradually, while the number of buildings has increased without considering environmental protection. According to the Chief Town Planner of Dhaka City Corporation (2003), an ideal city needs 20% area covered by trees, but there is only 8% vegetation in the city. At present, almost 15 million dwellers of Dhaka city are enjoying limited ecological services from Ramna Udyan, Sohrawardy Udyan, Dhaka University campus, National Parliament Bhaban complex, Usmani Udyan, Botanical Garden, and National Zoo etc. Hence, green space in Dhaka city is

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now questionable in the context of the global standard. Inadequate tree coverage in Dhaka city is resulting in many environmental disabilities as well as human health-related problems. In such a case, green roofs can play a vital role in increasing the green space in Dhaka city as well as making Dhaka a suitable and livable city for the inhabitants.

RESEARCH QUESTIONS & OBJECTIVES

- What is the current status and nature of green roofs?
- What are the associated public policies for green roofs & what do the main stakeholders think about the policies?
- What are the main challenges and problems in promoting GR (Green Roofs)?
- What are the main roles of green roofs in urban environmental sustainability?

The study will be guided by both general and specific objectives. The general objective is to Explore Current status, Challenges & Policies related to rooftop gardening: a case study in South City Corporation of Dhaka

Specific objectives are:

- To find out the current status & nature of GR (Green Roof).
- To explore the associated public policies for Green Roofs & what the main stakeholders think about the policies.
- To identify what are the main challenges and problems in promoting Green Roofs.
- To explore the main roles of green roofs in urban environmental sustainability.

RESEARCH METHODOLOGY

The whole research has been conducted with a special focus on the qualitative method.

Methods of data collection

a) Secondary Literature Survey:

The ground idea of this thesis has come from the secondary literature review. It has been constructed the basic structure of the thesis has been constructed. Secondary literature includes various prominent articles, journals, newspapers, and other research papers related to the research topic. The literature review has also given the idea of methodology, techniques, and other ideas. The most important thing is that the literature review has given an idea about the research gap of the thesis or the contribution of the research to the existing body of knowledge.

b) Questionnaire Survey:

A questionnaire is a research instrument consisting of a series of questions (or other types of prompts) for the purpose of gathering information from respondents. For my research information, a questionnaire survey has been conducted within the study area (Banasree Residential Area). It has been carried out by a semi-structured questionnaire to collect information from the stakeholders about the current status, challenges, and problems in promoting Green Roofs or Roof-Top gardening.

c) Interview:

An interview is a verbal conversation between two people with the objective of collecting relevant information for the purpose of research. The interview has been taken from the chairman of the Banasree Welfare Union and the members of the Welfare Union. I have also interviewed 20 house owners of Banasree Residential Area. Additionally, I have also talked with the other renters of that house, as their perception has given me a new insight into my research.

Research Significance

The global population pressure has increased in urban areas day by day in search of a better life. According to the UN Population Division, about 44% of the total population in developing countries lives in urban areas. But this urbanization will have a significant impact on the ecology, economy, and society at the local, regional, and global levels. However, the great impact has been observed in the urban green spaces, including urban forestry, parks, playgrounds, domestic gardens, roadside open spaces, and urban vegetation. Many prominent pieces of research, along with scientific experiments, have already been done on the topic of green roofs and their role in urban Sustainability. These common themes are the definition and scope of green building, quantification of benefits of green buildings compared to conventional buildings. It is found that the existing studies placed an important focus on the environmental aspect of green building. Other dimensions of sustainability of the green building, especially the current status and challenges of implementing green roofs strategies, are largely overlooked. This research will help the policy-maker to take steps for promoting Green Roofs as it will provide field level response to the challenges and hindrances.

Limitations of the study

Every researcher has to face some limitations while conducting the research in a meaningful and manageable way in certain aspects of the study. It may be that the time, money, labor, and other limitations of necessary resources have been observed throughout the study:

- The study was confined to a small area, namely Banasree under Rampura thana, where there were many respondents in the study area, but only the respondents who were building inhabitants were considered for this study.
- For time constraints and networking limitations, I could not reach all stakeholders and conduct their

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interviews.

- For the collection of information, the researcher had to depend on the data furnished by the respondents during their interview.
- Major information, facts, and figures supplied by the respondents were applicable to the situation prevailing in the locality during the year 2017-2018.

Structure of the Report

This report has been prepared based on the following method and is composed of four chapters with a number of sections and sub-sections and appendices.

1. Chapter one outlines the overview of the statement of the problem, research questions, and objectives, as well as the methodology, research significance, and structure of the report.
2. Chapter Two is divided into two sections. The first section provides an understanding of the key concepts and the second section provides a brief description of associated policies and, current status of rooftop gardening.
3. Chapter three presents the most important part which is the selected findings & observations from the field.
4. Chapter four draws a conclusion with the research findings and a brief recommendation for possible immediate actions in the areas of policy, research, and action to combat the situation towards sustainable promotion and management of green roofs on the basis of the research findings.
5. Chapter five provides the reference to all articles, newspapers, journal's and research papers cited in the thesis.

In addition to the above-mentioned chapters, additional information is provided in the appendices.

STUDY AREA

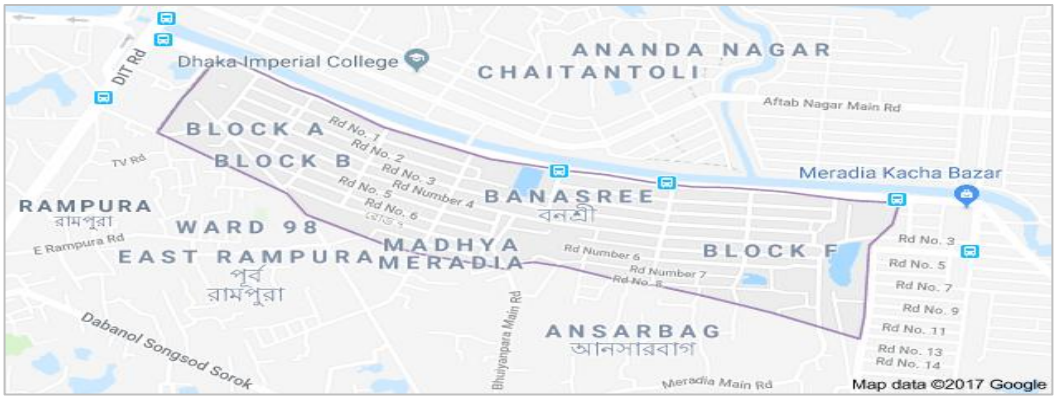

Figure 1: A map showing the Banasree area under Rampura Thana of Dhaka city.

A CONCEPTUAL & POLICY REVIEW

This chapter will explain the key concepts of the topic (The role of green roofs for urban environmental sustainability). In this chapter, I will explain what exactly I mean by the key concepts in my thesis. The key concepts are urbanization, sustainability, and greening. Also, this chapter will contain a review of the literature on the selected topic those studies that have already been done. At the end of this chapter, I will discuss the relevant policies on urban greening.

Key Concepts

Urbanization

Urbanization can be defined as the shifting of people from rural areas to urban areas. Urbanization can also be defined as a process through which towns and cities are formed and become larger as more people begin living and working in central areas.

Figure 2: The urbanization process
Source: www.scholarsglobe.org

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By 2050, it is estimated that more than two-thirds of the world's population will live in cities, up from about 54 percent today. And in developing countries, urbanization is excessively high due to several factors like rural-urban migration, rapid industrialization, in search of employment, and technological development. The scientist has estimated that by 2050, about 64% of the developing world and 86% of the developed world will be urbanized.

Over the Past half century seems to have been excessively high levels of concentration of population in very large cities of developing countries. Like other developing countries, rapid urbanization happens in the case of Bangladesh. Bangladesh is developing day by day through rapid industrialization, which triggers rural-urban migration. But the urbanization is much unplanned and puts the urban environment at risk. So, in that case, the urban environment becomes vulnerable. And urban environmental sustainability becomes an issue of concern to meet the future challenges of global warming as well as climate change.

Table 1: Projected Growth in Urban and Rural Population in Bangladesh, 1950-2030

Year	Population (millions)		Share of Incremental Population (millions)		Percentage of the Total	
	Rural	Urban	Rural	Urban	Rural	Urban
1950	40.0	1.8	-	-	95.7	4.3
1960	48.8	2.7	8.9	0.9	94.8	5.2
1970	61.4	5.1	12.5	2.4	92.3	7.7
1980	72.7	12.7	11.3	7.6	85.1	14.9
1990	88.3	21.8	10.6	9.1	80.3	19.8
2000	103.1	34.4	14.8	12.6	75.0	25.0
2010	115.7	52.2	12.6	17.8	68.9	31.1
2020	123.2	74.4	7.5	22.2	62.3	37.7
2030	124.1	98.6	0.9	24.2	55.8	44.3

Source: Computed from UN 2002: Tables 3 and 4. Cited in ESCAP 2003:2

Sustainability

Sustainability can be defined in many ways, but the simplest and most fundamental is: "the ability to sustain" or, put another way, "the capacity to endure." The most often quoted definition comes from the UN World Commission on Environment and Development: "Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainability is defined as a requirement of our generation to manage the resource base such that the average quality of life that we ensure can potentially be shared by all future generations. Development is sustainable if it involves a non-decreasing average quality of life. [Geir B. Asheim, "Sustainability, "The World Bank, 1994]

Sustainability is all about the well-being of our future generations This means whatever development at present we are doing at ourselves will also be good for our future generations.

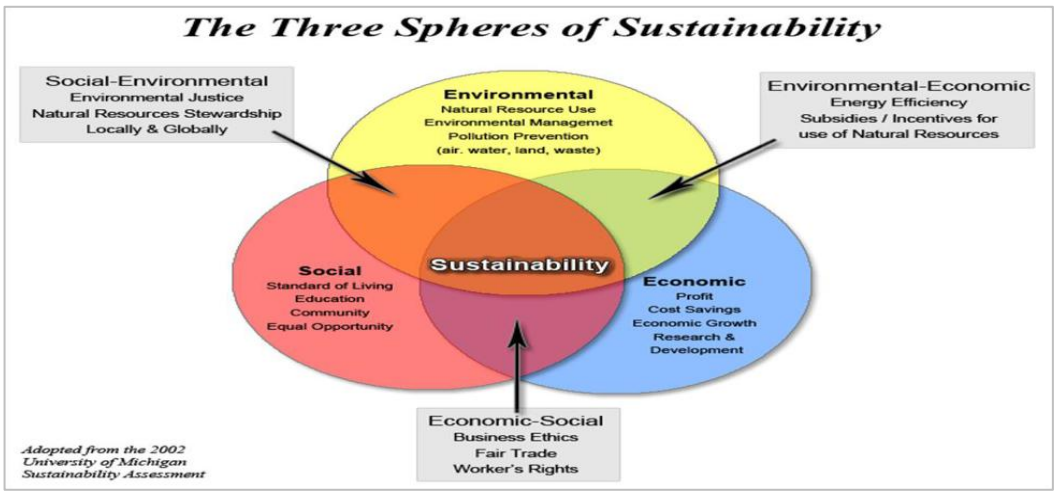

Figure 3: The three spheres of sustainability
Source: University of Michigan Sustainability Assessment 2002

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Rooftop gardening

A roof covered with vegetation, designed for its aesthetic value and to optimize energy conservation. [*Collins English Dictionary*]

However, in this thesis, the researcher defines rooftop garden as a garden on the roof that is covered by any kind of green trees like vegetable plants, medicinal plants, flower plants, fruit plants, and so on. The purpose may be gardening or maybe for aesthetic value.

Figure 4: Rooftop garden for aesthetic value.
Source: http://www.secretgardens.com.au/portfolio/city-rooftop-garden

Figure 5: Rooftop garden for vegetable cultivation.
Source: saigoneer.com

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Figure 6: Rooftop garden for fruit cultivation.
Source: www.dailystar.com.

A focus on relevant Policies

Singapore

To reach the ambitious goal of 50 hectares of new Skyrise Greenery Areas by the year 2030, Singapore has agreed on a comprehensive program to promote rooftop gardening. The program includes a Gross Floor Incentive Scheme for roofs and municipal allotment gardens, and financial subsidies for sustainable landscaping of existing buildings along with technical consultation.

Portland

Considering the advantages of sustainable rainwater management, Portland, in the Northwest of the United States, promotes green roofs predominantly through introducing a Floor Area Ratio bonus and public events for the green roof.

Copenhagen

The Danish capital Copenhagen has just started to develop a green roof through the successful establishment of the municipal program as well as a comprehensive information campaign.

Munich

Some essential measures have also been taken by the Bavarian regional capital, Munich (Germany), to promote green roofs, including regulations in urban land-use plans, grants for voluntary installation of green roofs, and a reduction in stormwater fees.

Bangladesh

"Clean Air and Sustainable Environment Project (DCC Component)":

A five-year-long 71.2 million US dollars clean air project formally begins today to improve air quality in the capital and five other divisional cities. State Minister for Environment and Forest Hassan Mahmud will inaugurate the Clean Air and Sustainable Environment (CASE) project at a city hotel. The aim of the project is to improve air quality and safe mobility through better management of transport and application of clean technology in brick-making industries. If people's exposure to polluted air in Dhaka could be reduced by 20-80 percent, it would save health costs of 170-500 US dollars every year, Dr Mohammad Nasiruddin, project director of the Case, said at a session on the project at a city hotel. The environment and forest ministry, and the World Bank, Dhaka office, jointly organized the session. The project also will improve the capacity of the department of environment (DoE) to monitor air quality and undertake 25 brick kiln projects with cleaner technologies to reduce air pollutions as well as carry out awareness campaign toward the issue through mass media, said Maria Sarraf, CASE project task team leader of the World Bank. [October 04, 2009, Daily Star] (Shobuj Dhaka to award roof gardeners)

An organization called Shobuj Dhaka announced an award titled "Shobuj Dhaka Green Award" for roof gardeners in Dhaka on Monday. Roof gardeners from any part of Dhaka city can participate in this competition by submitting pictures and detailed information on their garden. After a thorough vetting process, Shobuj Dhaka will announce 10 winners. Each winner will receive saplings, pots, fertilizer and year-long gardening services equivalent to Tk1 lakh. (Dhaka Tribune **November 28, 2016)**

Current status of green roofs

Dhaka, the capital and the most populated city of Bangladesh, is now a member of the "megacity"

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family of the world. Due to rapid and unplanned urbanization, commercial development, along with population pressure, the overall city environment is being seriously worsened day by day. But once Dhaka City was known for its serenity, beautiful parks, clean roads, and lush greenery, and the places within the present Dhaka city boundary were forested, but at present, that tree cover is almost transformed to urban habitats to accommodate excessive population due to ha igh rate of rural–urban migration. In addition, industrialization in the urban fringe areas and transformation of different land use within the city, as well as the surrounding urban fringes, led to the depletion of existing tree cover so rapidly during the last half century. The depletion process of green resources got impetus, as the government 2 had no long-term planning to keep the city green, except establishment of a few parks and roadside plantations under the city beautification programme. In some instances, the government acted as the clearing agent of the greeneries. On the other hand, people in general are not properly aware of the importance of tree cover‟ existence in and around their living premises. Moreover, the absence of the lantation process of trees in the past sites is also another important reason to remain the diminishing state of the existing tree cover in the city. Nowadays, very few green spots exist within city boundaries as the remnant of past green glory (Islam, 2002). As the city is, however, in a stage of transition, struggling with the challenges of urban expansion, over population, poverty alleviation and improve the quality of life and environment, all these fact raise the question about the future planning and managing strategies for UPFG in Dhaka city within multiple and rapidly changing urban demands and particularly, what opportunities exist for the development of UPFG and what challenges should be overcome in the future for enhancing the overall urban green resource in and around Dhaka City. [Mohammad Nayeem Aziz Ansari, may 2008]

Role of Green Roofs (Rooftop gardening) for urban environmental sustainability

Green roofs can reduce the energy consumption of urban buildings through various mechanisms. Del Barrio (1998) found that green roofs can reduce the energy required for the maintenance of interior climates because vegetation and growing plant media intercept and dissipate solar radiation. Other potential benefits include green-space amenity, habitat for wildlife, air-quality improvement, and reduction of the urban heat-island effect (Getter and Rowe 2006). Green-roofs provide urban ecosystem services mainly from three aspects-storm-water management, energy conservation, and urban habitat provision. Del Barrio (1998) and Theodosiou (2003) found that during warm weather, green roofs reduce the amount of heat transferred through the roof; thereby lowering the energy demands of the building s cooling system. A study in Madrid showed that a green roof reduced the cooling load on an eight-story residential building by 6% during the summer (Saiz et al. 2006). Green roofs also make a great contribution to conserving the local habitat. Coffman and Davis (2005) found that green roofs are commonly inhabited by various insects, including beetles, ants, bugs, flies, bees, spiders, and leafhoppers. Green roofs also improve the quality of urban air through offsetting carbon emissions from the city. With the development of green infrastructure, urban environmental challenges can be mitigated as it helps in improving the urban ecosystem. The authors (Nataša Pichler-Milanovič and Mojca Foški) investigated how “community capital in specific inner-city urban areas can be used to pro-actively enhance the development of green infrastructure through resiliency planning towards urban sustainability.” Urban green policy is increasingly used as a tool to enhance urban resilience and sustainability, supporting biodiversity and ecosystem services (Simmons et al., 2008). The authors give examples of Tabor and other neighbourhoods in Ljubljana, as many urban revitalizations and green infrastructure policies have been adopted in these two cities for experimentation with new methods of cooperation and networking between economic, social, and cultural actors and new forms of territorial governance. Some of these projects are becoming the innovative backbone of economic, social, and environmental resiliency in European cities today. Due to rapid urbanization and development pressure urban environment has become more vulnerable to face climate change. Urban greening is a possible solution to this problem. (Byrne et al. 2015) emphasize that green infrastructure has considerable potential to adapt cities to some emerging climate change impacts such as heat islands, increased flooding, higher wind speeds, and more episodic rainfall. Many investigations have shown how green infrastructure can help reduce negative effects (Emmanuel & Loconsdale, 2015; Bowler et al., 2010; Roy et al., 2012). Research in Glasgow noted that a 20% increase of green cover in urban areas could reduce the temperature by 2°C by 2050 (Emmanuel & Loconsdale, 2015). Northon et. al. (2015) point out that the green infrastructure is becoming a more and more important aspect of spatial planning.The authors (Ines Hrdalo, Dora Tomić, and Petra Pereković) use a case study of Dubrovnik town.The town’s economy is based mainly on tourism. It is therefore under enormous development pressure. Non-strategic urban development has degraded the urban space and caused many environmental problems (Ines Hrdalo, Dora Tomić, and Petra Pereković). The authors explained that floods, soil erosion,and urban heat, as side effects of climate change, can be linked with the reduction in green spaces in Dubrovnik. Their purpose was to find solutions to green space fragmentation and the concomitant climate change-related problems. They also try to develop a framework for using Urban Green Infrastructure to mitigate climate change effects. A five-step framework is proposed to prioritize urban public open space to satisfy the relevant principles. The findings could show how planners can frame the problems of climate change and adaptive responses. Recognizing the

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benefits of the urban green infrastructure is an important stage in developing the spatial potential for mitigating climate-change problems. This study suggests that the rapid development of built areas has worsened the situation, because flooding (which can be considered the worst climate change problem) has been more frequent over the last few years. This can be attributed to the loss of many absorptive surfaces (green surface) in the process of intensive construction. This research has therefore focused on identifying critical areas in the study area (map of ecologically problematic zones). In most cases, the urbanization is unplanned and puts the urban environment at risk. So, in that case urban environment becomes vulnerable. And urban environmental sustainability becomes an issue of concern to meet the future challenges of global warming as well as climate change. Green infrastructure is the obvious solution to this problem. Mell (2012) defines it as either an investment in green space or as an infrastructure with sustainable objectives. In case of Central and Eastern European countries, green infrastructures are the suggested possible solution by scholars to face the impact of environmental degradation as well as climate change. The authors bring the Ljubljana case study of the inner-city neighborhood of Tabor, described by Pichler Milanovic and Foški (2015) as a good example of the collaborative planning and community participation activities (both top-down and bottom-up) towards developing GI. And of course, on the other hand, the policy-making structures or decision makers should consider the GI (Green Infrastructures) as an important part of the policy agenda.

SELECTED FINDINGS & OBSERVATIONS FROM THE FIELD

This chapter will provide the knowledge from the field which means what the current status is in the field. The practical knowledge about the research objectives will be collected through a questionnaire survey, interviews and other tools of data collection. This chapter will cover the research questions and objectives through observing the practical situation in the field.

A brief description of the study area

Banasree is solely a residential area in the eastern part of the capital, Dhaka, under 22nd ward of Rampura Thana, which is situated behind the Bangladesh Television Center in Rampura. The area is divided into fourteen blocks (Blocks A-N), and each block has almost 20 housing apartments. A 170 feet wide pristine lake runs through the area a which adds appeal, serenity, and tranquility to the area is effectively and efficiently run by a governing body named "Banasree Kolyan Shomiti," which is elected by the vote of the local resident owners. The “Banasree Kolyan Shomiti" offers services by being actively involved in the development and maintenance work of the entire area by collecting funds annually from both landowners and apartment owners of Banasree.

I preferred Banasree as my study area for the following reasons:

a) Banasree is a new & under-construction residential area. There are some buildings with rooftop gardens. So, the researcher chose this area because I can take the opinion of both participants who have a rooftop garden or hasn’t.
b) Besides, the area is also near my residence and the researcher had access to the respondents.
c) The area is so systematic with a block system, that why it was easy to collect information from the respondent in a systematic way.

However, as the area is divided into fourteen blocks (Blocks A-N) and each block has almost 20 housing apartments so, the total estimated housing apartments is 240. In my survey, I tried to cover at least 10 blocks. I conducted the interview and questionnaire survey of a total of 25 respondents, among them 10 respondents having a rooftop garde,n and another 10 respondents don't have. Another 5 respondents were the rental of the apartment which has limited scope to make a rooftop garden.

Current Status of Roof-top Gardening in Banasree Residential Area

The area is divided into fourteen blocks (Blocks A-N), and each block has almost 20 housing apartments so the total estimated housing apartments is 240. In each block there are only 3 or 4 apartment buildings with rooftop gardens. So the average number of rooftop gardens in 240 apartment buildings is 42. And the calculated percentage is only 17.5%.

Most of them took the initiative of rooftop gardening from their personal interest.

A gardener in Dhaka s Banasree residential area said he started gardening five years ago by planting grapes in the garden. His grapes produced a good, high-quality harvest, which was equal to that of imported produce.

Opinion of the Stakeholders

Before describing the opinion of the stakeholders, the researcher has divided all the stakeholders involved with RTG according to the following:

The Opinion of the house owner (who has rooftop gardens)

Actually, the researcher found different cases and responses from the different stakeholders. As the researcher selected 10 respondents who have a rooftop garden on their roofs and another 10 respondents who do not have a rooftop garden on their roofs. The researcher interviewed both of them so that the researcher could connect and find the challenges and problems in promoting rooftop gardening.

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However, in the case of the respondent who has a rooftop garden on their roof, most of them make the garden their hobby. Among 10 respondents, 8 said so. But the other 2 respondents said that they made it from environmental consciousness as well as economic health consciousness, as they can produce herbal medicine from herbs like Tulsi, Mint, and so on.

They also shared some challenges they face and recommended some measures they expect. For example, one respondent said that she doesn't know the treatment of plants when it attacked by insects or any diseases. In that time, she really felt very helpless.

Another respondent said that he bought some baby plants from the market, but they did not give good results as the seeds of the plant were of low quality. He doesn't know where he can get plants produced from healthy seeds.

They can't get proper suggestions or any other assistance from government agencies or other groups. They claim that if they get proper guidance and assistance, they will be further motivated to promote rooftop gardening extensively.

In some cities DAE (Department of Agricultural Extension) has taken various initiatives to promote rooftop gardening.

The Opinion of the house owner (who doesn't have a rooftop garden)

The researcher also took another 10 respondents who don't have a rooftop garden so that the researcher could learn the demotivating factors of rooftop gardening. Those who don't have a rooftop garden report different reason for it. One respondent said that he doesn't have enough time to look after the garden after serving in the office. From 9 am to 5 pm. Another respondent, Ayesha Akter, who is a housewife wife said that - "I don't have enough gardening knowledge, even though I don't know about any treatment of the plants & more importantly, soil collection for the plant in Dhaka city is a tough work for me."

The researcher found some respondents who are very eager to make a garden, but they don't know about any facilities of DAE (Department of Agricultural Extension) and other organizations like Green Savers, Shobuj Dhaka, and Green Dhaka, which provide various supportive services for promoting rooftop gardens.

The Opinion of the President of Banasree Kolyan Shomiti

Though "Banasree Kolyan Shomiti" offers services by being actively involved in the development and maintenance work of the entire area by collecting funds annually from both landowners and apartment owners of Banasree, they don't have any policies for promoting rooftop gardens, said the President of Banasree Kolyan Shomiti. Even NGOs or government bodies don't come forward to operate with them for promoting rooftop gardening. All who have a rooftop garden made from their personal interest or initiative.

Challenges & Problems in Promoting Green Roofs

All information about challenges & problems in promoting rooftop gardening from the respondent through the questionnaire survey and interview can be divided into the following categories:

Ownership problem

While interviewing or conducting a questionnaire survey, a common problem in promoting rooftop gardening is the ownership problem. In an apartment building, most of the apartment inhabitants are renters. As a result in despite having the eagerness, they can't take the decision to make a roof garden. In many cases, the homeowner has lived abroad and has no concern about this. A respondent said that she has a great eagerness to make rooftop gardening, but she doesn't have the authority to make the decision. So this is the common view that a rooftop garden, in most cases, is made by the house owners.

Time constraint

Many respondents said that they don't have enough time to take care of a rooftop garden. The urban dwellers are so busy with their work. They have to maintain a very tight work schedule. Apart from this tough work schedule, they don't get enough time for gardening. One respondent said that he had had the hobby of gardening since his childhood, but he couldn't do this because of time constraints. In many houses, both husband and wife are service holders; that's why they have to become busy with their work. They had no time after doing their service from 9 am to 5 pm. Some exceptional cases were also observed. While conducting the survey,y the researcher found some respondents who made a rooftop garden to pass their leisure time as they are retired persons. It indicates that time is really an important factor.

Lack of incentives

Incentives can play a vital role in promoting RTG, where the researcher found a huge lack of incentives after observing the field experience. There is very little incentive for the city dwellers to promote RTG. Most respondents think that RTG is a matter of a hobby as they don't get any incentives for it. Those who make RTG a hobby are the important incentives for them. Even one respondent said that he thinks it is a waste of money because he has to spend money on the maintenance.

Lack of awareness

While conducting the survey, the researcher found that many respondents are not aware of the benefits of rooftop gardening. Even some of them said that they did not make a rooftop garden as they are afraid

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of the possible damage to the roof surface due to rooftop gardening. It is totally a wrong conception that the roof garden may hamper the roof surface because many people have already proved this by making a roof garden over many years. A city dweller, Osman Goni in Mirpur area of Dhaka city, made his roof garden just after the liberation war in 1976. Till then, he is taking care of his garden, but no damage occurs to his roof.

CONCLUSION

In the conclusion, the researcher can recap the whole thesis in a brief description. The topic was Challenges & The role of rooftop gardening for urban environmental sustainability: A focus on rooftop gardening in Banasree residential area. The main focus of this research was to find out the challenges and problems faced by the inhabitants in the Banasree residential area for promoting rooftop gardens. Through reviewing the previous literature about rooftop gardening, this paper tried to depict the significant role of green roofs or rooftop gardening, such as reduction of energy consumption, constructing an urban ecosystem, and conservation of biodiversity for urban environmental sustainability. This paper also discusses the associated policies for rooftop gardening in Europe and other continents. Later, the researcher provides empirical findings from the field experience through a questionnaire survey & interview. The researcher also discussed the relevant policies of rooftop gardening in the contemporary European and Asian continents. So, the summary of the thesis is that the researcher tried to focus on the important role of rooftop gardening for urban environmental sustainability in the era of climate change impact and rapid urbanization. And rooftop gardening is the most viable and possible solution for fighting the climate change impact, like urban heat island, especially in a third-world country like Bangladesh. Because we can use the existing roof space for gardening. But for promoting rooftop gardening in a broader aspect, first, we need to find out the challenges. As far as the researcher found, the main challenges for promoting rooftop gardening are ownership problems, time constraints, lack of knowledge, lack of training facilities, lack of incentives, and lack of networking between government authorities and house owners. All these problems have only been found in the study area (Banasree Residential Area). The limitation of the study is that the pictures of other areas may vary from those. So, further research studies in different areas are required to find more insightful information that may help policymakers and other researchers.

RECOMMENDATIONS

The following recommendations have been made based on the findings of the study and practical knowledge:

- The Department of Agricultural Extension can arrange training facilities for the urban inhabitants so that they can acquire basic knowledge about rooftop gardening.
- DAE can also arrange an awareness campaign as well as a fair for the rooftop gardeners to encourage other house owners to promote rooftop gardening.
- City Corporation authority can take various incentive mechanisms, like tax (holding-tax) abatement incentives for the house owners who make a rooftop garden.
- In co-operation with the government. RAJUK can take an initiative, but without the commitment to make rooftop gardens, no one will allow it to be built.

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