



An Innovation approach towards transforming a city Park to a sustainable Park

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Abstract: This Most humans have a need to connect with nature. Being in nature, or even viewing scenes of nature, reduces anger, fear, and stress and increases pleasant feelings. The presence of green space is particularly necessary in areas where people are more divorced from natural ecosystems, such as cities. Today, a significant part of urban green space is created in the parks. City parks contribute to a higher quality of life by offering both social and psychological benefits. As the urbanization is a growing challenge in the world today with every society battling its consequences therefore high energy consumption, poor air and water quality, insufficient water availability is exacerbated by the increasing population density and demands of urban environments. To face these problems of urban areas, Sustainable development is a widely accepted strategic framework in city planning and city parks play an important role in it. In addition, they have a crucial role in improving the environment and landscape conditions that result in green spaces which have become an essential part of cities due to their strategic importance for the quality of life. Although the lack of an appropriate design and mismanagement system has resulted in an unpleasant quality of the environment and a decrease in the number of urban parks. The objective of this paper is to analyse and understand the benefits of urban parks and the significant need towards improve these spaces to develop the city and achieve sustainability. The paper will also focus on some design strategies of urban parks to improve and enhance the quality of life in order to reach a sustainable development. The study is mainly a literature-based study but both the qualitative and quantitative data are used wherever necessary. The Ramna Park, Dhaka has been selected for this analysis. Primary data was collected from field visit and observation and Interview. International Case study has been analysing to generate sustainable parameters. The analysis confirms that suitable design and management of urban parks, are the most important factor for achieving sustainable development and it also plays a substantial role to enhance the quality of life of citizens. Therefore, some design strategies have recommended generating the park suitable for people's needs and contribute the sustainability. The outcome of the study is expected to make the authorities and people aware of the importance of the urban park and they have specific responsibilities to protect and maintain this area. It will also raise awareness on the settlement of sustainable urban development among architects & planners.

IndexTerms - Urban park, Sustainable development, quality of life, design strategies

I. INTRODUCTION

Urbanization and urban development are considered one of the most important phenomena of recent times (Hesamiyan, 1998). Most of the cities are getting congested. Green spaces like urban parks are getting diminishing due to rapid unplanned urbanization. In case of Dhaka city which is also known as densely populated urban areas in the world where urban parks are fewer than what it needs. Only Ramna and Chandrima Uddyan can be considered as big park where people can go. According to experts, a city needs to devote 25 per cent of its area for greeneries and parks. But the Dhaka city has less than 10 per cent. There are about 54 registered parks under Dhaka City Corporation (DCC). But these parks make up only an average of 14.5% of the total land area (17% in north and central part and 12% in old town) where as any city requires 25% for fresh environment and to maintain a sustainable land ecosystem. At present the local planning experts recommend that there should be at least 1 acre of

parks or open spaces per 1000 population for cities of Bangladesh. If, this standard is to be applied in Dhaka, then the city needs approximately 6 sq. miles of area for recreation purpose (Chowdhury 2004). Most of the areas of Dhaka city are so unplanned that there is very little scope for creating a new park or open space to meet the needs of the growing population. In this case it is inevitable that the existing parks need to be improved or developed therefore. Dhaka needs a huge stock of open spaces for urban sustainability as well as improving citizen physical and mental health.

Ramna Park is one of the largest parks in Dhaka and the location of this park is in middle of the city. This park is one of the most beautiful parks with lot of natural resources like trees, lakes, birds, squirrels, insects, etc. It's serving as a leisure area of surrounding habitats. People of surrounding residential, commercial areas, office zone are used to visit this park. 70% visitors of this park usually visit in the morning time for walking and exercise. Designing, and management of urban parks are important issues since these parks are one of the main spaces of urban life, especially with the rapid population growth in recent years.

II. AIM & OBJECTIVES

The aim of this paper is to evaluate the sustainable design strategies of urban park through analyzing the sustainable principles and strategies from international case studies and literature review. A set of strategies / recommendations for application of sustainable development in Ramna park have also been evaluated.

The specific objectives of this research are:

- To develop some design strategies for sustainable development in Ramna park.
- To identify the eco-sustainability gaps in Ramna park and suggest improvements

This paper will search the answer to the questions –

- What are the relevant strategies in the global, regional and national levels to measure eco-sustainability in the study area?
- Which eco-system does exist in the study area at present?
- What could be possible strategies to reduce the gap or improve the situation?.

III. METHODOLOGY

Primary data was collected from field visit, observation and questionnaire. A literature review was carried on theoretical context and case studies were conducted to understand the design strategies of sustainable development in urban park. Google image, maps, relevant papers were also considered as the key source for secondary data.

3.1 Data collection and Research Approach

To achieve the aim of this research, objectives and research questions were set for evaluation as follows:

Table 1: Formulations of research questions under specific objectives

Objectives	Research Questions	Data sources
To develop some design strategies for sustainable development in Ramna park.	What are the relevant strategies in the global, regional and national levels to measure eco-sustainability in the study area?	<ul style="list-style-type: none"> • Literature review • Case studies
To identify the sustainability gaps in Ramna park and suggest improvements	Which eco-system does exist in the study area at present? What could be possible strategies to reduce the gap	<ul style="list-style-type: none"> • Field observations • Questionnaire survey • Relevant paper review

	or improve the situation?	
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3.2 Study area selection

Dhaka is the most populated and congested urban area of Bangladesh. Due to unplanned urbanization urban parks are getting diminishing. It is high time to improve the quality of existing urban park as per sustainable development of Dhaka as they act like lung for the city. Ramna Park has been selected for this study. Ramna Park is a huge open space located at the center of Dhaka city. In 1908, this area was developed as a park with 68.5 acres of land around the Ramna lake. However, the park has been swallowed partly by different buildings along its periphery. At present the open green area of 58 acres, including the lake and the nursery. The huge park is organic in its shape taking the form of a lung of a human body. Except the west side, it is surrounded by vehicular roads. The entry is controlled by seven defined gates from the surrounding roads. Inside, the park is crisscrossed by pedestrian walkways. The lake in its natural shape covers almost one fourth of the area. This vast green area with the water body works as the lungs of the city for its environmental and ecological balance. The land uses of the surrounding areas are residential and institutional in use and are in general low-density built-up areas. (Majid and Alam 2000). Two main leisure activities are taking place in Ramna Park area; those are Recreation and Physical Exercise. In addition to these regular activities, occasional festivals like the traditional Bangla New Year program of Pahela Baishak at Ashathmul [previously known as Batamul]; and various cultural and commercial fairs take place in Ramna Park. During these seasonal and occasional programs thousands of people from all cross-section of the life participate.



Figure 1: satellite image of Ramna park with surrounding area; Source: Google map

IV. LITERATURE REVIEW

4.1 Benefits of sustainable urban park: Creating sustainable cities is much about addressing quality of life in them. Increasing prosperity and life spans brought more free time to many people, increasing the need for leisure facilities and green spaces. (Sassi, 2006). Parks in a city can play a significant role to enhance the quality of life of citizens. They provide important environmental services like air purification and noise filtering. A sustainable urban park can promote human health, environment and economic strength. It's also a place where natural resources are protected, wildlife habitat is improved and where human recreational uses and maintenance practices do not conflict with the environment but rather enhance by it. Planning, designing and management of sustainable urban park is meaningful for urban sustainable development. Sustainable park has significant impact on ecological, social and economic functions of a city.

4.1.1 Urban parks and direct and indirect health effects: Nature and green spaces contribute directly to public health by reducing stress and mental disorders (Ward Thompson et al., 2012; Annerstedt et al., 2012), increasing the effect of physical activity (Mitchell, 2012), reducing health inequalities (Mitchell and Popham, 2008), and increasing perception of life quality and self-reported general health (Maas et al., 2006; Stigsdotter et al., 2010). Indirect health effects are conveyed by providing arenas and opportunities for physical activity (Coombes et al., 2010), increasing satisfaction of living environment and social

interactions (Björk et al., 2008; Maas et al., 2009), and by different modes of recreation (Weber and Anderson, 2010). All these indicators correspond well to the definition of health established by the World Health Organization (WHO) (1946), including both physical, mental, and social components in the health concept. In addition, the definition of public health (Winslow, 1920) even further emphasizes the efforts by society and communities for promoting health and preventing diseases. Thus, to support and improve public health varied actions are required by local administrators and policy makers. Within this field creating healthy urban environments is an important contribution. Considering the high level of global urbanization urban parks are imperative for maintaining and improving public health.

4.1.2 Environmental value: Urban parks play a vital role to improve the quality of urban environment by stabilizing microclimate and preserving natural resources. Urban parks mitigate urban heat, where the heat can radiate out at night and cool the city following hot weather. It can be act as a space of large canopy trees to grow and provide shade. Presence of permeable surface which hold the moisture and cool the environment. Trees may help filter about 75% of particulate air pollutants such as dust, dust pollen, smoke, odors and fumes, making the air healthful. They are usually cooler and more humid than surroundings as a consequence, mainly, to the transpiration activity of vegetation (Mowla, 2005). Urban parks can sequester carbon dioxide emission and reduce noise, protect soil and water and maintain biodiversity. Researchers of United Nations Environment Programme (UNEP 2012) have stated that urban parks, due to their often-high levels of habitat diversity and microhabitat heterogeneity, can constitute particularly important hotspots for biodiversity in the cityscape (Cornelis and Hermy, 2004). Parks often have higher species richness than other types of urban green space.

4.1.3 Social value: Green spaces have a direct impact on the urban environment and general physical, mental and social health of the urban dwellers. Parks contribute to physical health by providing opportunities for exercise, jogging walking. Parks contribute to mental health by providing restorative effects of nature (Forsyth, 2007). Parks can contribute to social sustainability by making citizens lives liveable, providing social, emotional and physical well-being and "providing people with satisfactory living conditions so that they can identify positively with their values and environment." (Moser, 2009)

4.1.4 Economic value: Parks economic value involves with air purification by trees that reduce costs of pollution prevention, promotion of city as a tourist destination and commercial event, as well as increasing property values and tax revenues. Also, urban parks can serve as a main factor in the location of new business and neighbourhood economics through attracting tourists and investments to the area. Consequently, this could provide employment opportunities for people who develop, manage and maintain the sites (Nandy, 2016)

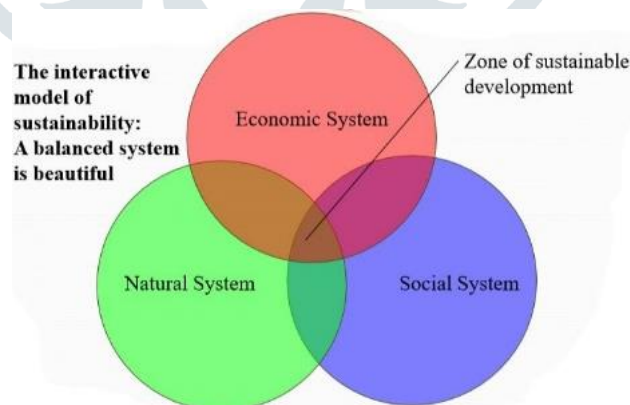


Figure 2: Sustainability Model; Source: Sustainable urban development in Bangladesh

4.2 The role of Urban park in achieving a sustainable city: Urban park is one of the most important components for sustainable development, environmental conservation and urban planning process of a city. Generally, to make the city liveable, pleasant and attractive for its citizens, some aspects such as “amount of public green spaces per inhabitant”, “public parks” and “recreation areas” are often mentioned as important factors (Hajmirsadeghi, 2012). It is strongly believed that developing more sustainable cities is not just about improving the abiotic and biotic aspects of urban life, it is also about the social aspects of city life, that is—among others—about people’s satisfaction, experiences and perceptions of the quality of their everyday environments

(Beer, 1994). The relation between urban parks and city sustainability is addressed the value of urban nature as provider of social services that is essential to the quality of human life, which in turn is a key component of sustainable development.

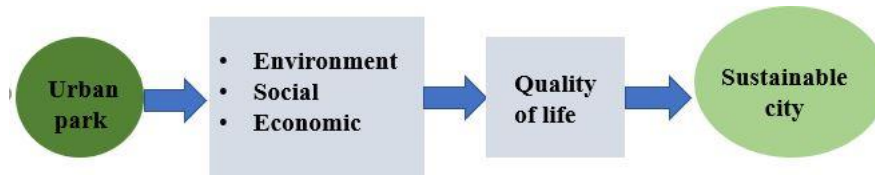


Figure 3: The relation between urban park and sustainability

4.3 Case studies: Application of sustainable development strategies

4.3.1 Sustainable planning practice within New York Central park (NYC park): Central Park is an urban park in New York City located between the Upper West and Upper East Sides of Manhattan. It is the fifth-largest park in the city by area, covering 843 acres.



Figure 4: Aerial view of New York Central park; Source: Google image

The sustainability strategies of NYC park are-

- Designing capital projects using long-lasting materials and plants that are easy to maintain.
- Conserving and restoring natural areas to protect biodiversity
- Reducing carbon emission by making fleet and buildings more energy efficient.
- Reducing the impact of climate change by ensuring our parks can withstand flooding and capture storm water.
- Engaging new workers in the stewardship and care of their parks.

Sustainable Parks’ Mission:

- Advance initiatives related to 21st century park design and construction, innovative natural resource management, and the strategic reduction of agency fuel, energy, and materials consumption
- Create awareness about employees’ and the public’s impact of their daily actions on the environment through training and education
- Quantify sustainable efforts at Parks to identify impacts
- Promote and share progress and best practices around sustainability



Figure 5: Sustainable Parks’ Mission structure; Source: NYC parks, sustainable parks

4.3.2 Xochimilico Sustainable Park (New Mexico, Mexico): Xochimilico sustainable park is considered to be the “poster-child” of the ecological park” movement”. It is cited by ecological park proponents as a demonstrable example from which to learn, winning numerous urban design and park planning and the Waterfront Centre Design Award in addition to many others. This park is located on the outskirts of Mexico City (Nady 2016).

Sustainable planning principles of Xochimilico park are-

- The restoration plan of this park aimed at repairing the broken hydrological cycle between the park zone and Mexico City.
- The arid quality of the landscape in the presence of large quantities of brushes and medium grade of ground cover, which are both home for birds, mammals and reptiles.
- Increasing the rate of maintenance of landscape for aesthetics purpose could result in decreasing bio-diversity rates, therefore few areas are left untouched to develop according natural process.
- Fertilizers and pesticides are not being used at all, not only because they contaminate the landscape but also because their usage makes a conflict with the desire to promote species diversity and general ecology.
- The park is characterized by developing the environmental program to enhance both natural and cultural ecologies landscape.
- This park serves as awareness catalyst to the sustainable conscious that is connected to the Chinampas region.
- The park activities include more functional and more dynamic relationship withing the city.
- This park provides job opportunity, tourism development, agricultural and recreational activities.

This park is act like main ling for the city as a whole.

V. KEY PERIMETERS IDENTIFIED FROM CASE STUDIES AND LITERATURE REVIEW

This study intentions to identifying the role that architects play in environmental justice and ecosystem support. Study on different designed urban park shows that conserving green spaces and water bodies, generating electricity using sustainable/renewable resources, using green technology, cutting water consumption and waste, recycling, reusing and recovering waste, enhancing the sustainable condition. Case studies and literature reviews show the possible evaluation parameters to measure sustainability of an urban park can be: (table – 2)

Table 2: Sustainable development Parameters:

Perimeter	Checklist
1.Environmental Analysis	Habitat protection, Native vegetation, Sustainable energy use, Air quality, Waste recycling.
2.Social Analysis	Pedagogy, Environmental stewardship, Fulfil the visitor's needs
3.Economical Analysis	Develop the capital base for funding, Maintenance and operation, Economic sustainability

VI. ANALYSING SUSTAINABLE DEVELOPMENT PARAMETERS OF RAMNA PARK

6.1 Environmental Analysis: Environmental analysis of Ramna park is conducted under some selected checklist and available information are given below :(Table-3)

Checklist	Available Data
Habitat Protection	<p>Land: the land consists of indigenous plants also found no grass grew under the shaded tree like Bakul tree (it's a natural process). Alien trees have a bad impact on the soil and the environment, which does not support local flora and fauna for the ecological cycle.</p> <p>Water: there have a beautiful lake in Ramna park. People play boats, take bath in the lake therefore it is polluted by man himself. The different types of waste material like plastic bottles, poly bags, papers are found flowing in the lake water. The fish and aqua cannot sustain because the use of the soap and detergent when people take bathing and washing. For a sustainable lake, environment species of food chain and</p>

	various trophic levels need careful considerations (Kabir 2009).
Native vegetation	The park has huge collection of trees and plants. Apart from the surrounding street and the pavement, the surface area is covered by grass and abundant tree. Ramna Park now grows 71 species of flowering trees <u>shrubs</u> , perennials, and annuals, 36 species fruit bearing plant, 33 species medicinal plant and 41 species of forestry and 11 other species.
Sustainable energy use	There have no processes of energy saving practice in the park. There is no usage of renewable energy sources.
Air Quality	As the park is surrounded by road therefore the peripheral area of this park is affected by Transport pollutant gases (CO ₂) and other greenhouse gases like methane (CH ₄), nitrous oxide (N ₂ O), and hydrofluorocarbons (HFCs)
Waste recycling	There is no such thing as waste in nature. People move all day long in Ramna and produce waste like polybags, packets of dry foods. plastic bottles, papers etc. The dropped leaves of trees are collected by the lower income group of the society for cooking foods by burning the dry leaves. Waste recycling management is not practise in the park.



Figure 6: lake and plants; Source: Field Survey,2020

6.2 Social Analysis: Social analysis of Ramna park is conducted under some selected checklist and available information are given below :(Table-4)

Checklist	Available data
Pedagogy	The park has few labelling for plants and flower. There also have some signage for visitors but not in proper way.
Environmental Stewardship	There is a lack of social programs and public education how to use urban park.
Fulfil the visitor’s needs	There have different features like play instrument, exercise equipment, resting furniture for different age group visitors. The presence of toilet, restaurant also and various platform fulfil the needs of visitors.



Figure 7: Few labelling, non-sustainable bin and haven’t any provision of segregation wastage; Source: Field survey,2020

6.3 Economic Analysis: Economic analysis of Ramna park is conducted under some selected checklist and available information are given below :(Table-5)

Checklist	Available Data
Develop the capital base for funding	Since the park is under govt. observation the entry fees are free, only the restaurant has minimum income source.
Maintenance and operation	The landscape is maintained to maximize the human usage. Unfortunately, fertilizers are being used in the park.
Economic sustainability	Since the park is located in the middle of the city therefore the most important traffic roads surrounded by the park. Commercial area has been developed around the park.

VII. DESIGN GUIDELINES FOR TRANSFORMING RAMNA PARK INTO SUSTAINABLE URBAN PARK

According to the Sustainable development Parameters as well as the existing condition of Ramna park, therefore some possible design guideline for transforming Ramna park into sustainable urban park is being proposed. Following the parameters of sustainable development, the design guidelines application can be the prime objectives of transforming the Ramna park into sustainable urban park. An urban park with its sustainable features can enhance a city to achieve suitability.



Figure 8: Urban park and Sustainability

The design guidelines/strategies and the way of their implication are given below: (table-6)

Design strategies	The way of application
Location, shape and size	As per location the Ramna park can be considered as the city central park of Dhaka. Ramna Park now protects an area of 68.50 acres (277,200 m ²), of which the lake covers 8.76 acres (35,500 m ²). The location of sustainable park can be anywhere but with consideration to the orientation to the prevailing winds of the area to seize its benefits. It can be any shape and any size, organizing geometrics may be rectilinear, curvilinear or naturalistic, since it is not its look that matters so much as its biological functioning (Nady 2016). Presence of waterbody as a lake which is one of the most attractive features for visitors. Walkways inside park have been widened and five new gates built for entry from different sides. According to its size, shape, presence of natural features of this park have made it more suitable for transforming as sustainable park.
Self sufficiency	It is important to minimize the local environmental impacts and encourage the use of local available materials. Ramna park is rich in many native and regional plants. Medical herbs are also found in this park. Presence of flower and medical herbs provide habitat for birds, insect, bees etc.
Improve the water quality of the existing lake	For a sustainable lake, environment species of food chain and various trophic levels need careful considerations. Ipil- Ipil, Water Lily, and Lotus are aquatic species of plants that may be recommended in lake, because these plants have extensive root system with rapid growth and a very good capacity for nutrient absorption. This will protect the lake from eutrophication. Besides this Ipil-Ipil is a good fish feed. Among the fish varieties, Ruhi, Silver Curp, Grass Crop eats upper-level food and purifies water. Sarpuly and Rajpmy are

	environment friendly species because they eat wastage in water like rotten leaves, insect and organic materials. However, Nilotica, Kalabaus, Magur, Mrigal, common carp type of omnivorous species should be restricted (Mowla,2005)
Vehicular & pedestrian circulation	There has pedestrian pavement in the park but they need to be more permeable. The car parking facilities are already minimised here but use of organic materials is absence here. Few visitors use this park for walking and exercise after the office time (from 7-8 PM) therefore, using night lighting from solar collector generator need to address. As for pedestrian pathways, they are different with softer more organic materials than of the parking lots, for example, crushed gravel is being preferable to cement. The centre of a pathway may be paved to accommodate bicycling and wheel chairs but its edges may use combinations of crushed gravel or wood timber for aesthetic benefits. Well-marked and well lighted crosswalks work well. Lighting can be powered by solar collectors and wind generators that are installed in the parks to generate electricity with no pollution and forever ((Nady 2016).
Maximize the usage of renewable energy	The park has great opportunity to implement solar, wind, biomass renewable energy in the park. Leaf composition should be taken in concern. The leaves that blanket park's lawns each fall are full of nutrients that over time can break down and nourish the soil if they are properly mulched. However, without mulching, leaves can suffocate the lawn below.
Landscape elements	The existing benches, play instrument, exercise equipment need to improve and well design to feel comfort for visitors.it is a continuous attention to people's health through encouraging fitness and sports in sustainable parks. Recycle materials can be use as landscape element. Ideally, a well-designed landscape incorporates a balance between the two elements. Hardscape is the hard stuff in your yard: concrete, bricks, and stone. Softscape is the soft, growing stuff, like perennial flowers, shrubs, succulents, and trees. Softscape is living; hardscape is not.
Habitat protection in Lake water	The lake considered as the habitat of many different spices of organisms. For the restoration and revitalization of the plantation and lake, it needs to take care that no linkage of surface drainage discharging storm water into the lake nor any alien trees are planted. Otherwise, we cannot ensure the sustainable habitat for the organisms in lake water and park around. (Kabir 2009)
Waste management strategy	Separate garbage bins have to be placed in the park. Even these bins can be made from recycled plastic components. It needs to ensure that the recycling bins are strategically placed to make monitoring and collection as easy as possible for maintenance staff. Educate the public about waste management, proper recycling techniques and about the importance of reducing litter in parks is essential to execute.
Public and visitor's awareness	Several program should perform to engage Parks employees and the public through sustainability education and outreach. Instructive program for sustainability, cultural event, exhibition should be held in the park to encourage people about sustainable development.
Heritage preservation	Preserving cultural heritage among park is one of the most important features for sustainability. Ramna aprk have great value for our cultural heritage since it has Banyan tree, every year Pohela Boishak program has held in this park. Preserving and well maintain of this Banyan tree need to take in account.

VIII. CONCLUSION

The purpose of this paper is to understand the inevitability of urban park development according to sustainable considerations and present some guidelines to understand the sustainable parameters which can be applied in Ramna park.

Sustainable development means changes in economic structures, organization and activity of an economic ecological system that are directed towards maximum welfare and which can be sustained by available resources. Achieving the goals of sustainable development involves changes in attitude towards life and patterns of consumption, identifying environmental problems from people's perspective, and regeneration of traditional or folk wisdom to protect environment.

Today, sustainability is an overarching concept or framework through which one can view the rational, reasonable consumption of the world's resources. Sustainable practices support infrastructure and governance mechanisms that respond to long-term human and ecological needs. Although study found that there is not much concrete international model for sustainable park. The study attempts to establish some design guidelines of sustainable urban park development in context of Dhaka city.

The selected Ramna park have rich values for its history, locations, size and presence of natural resources. If urban parks can evolve from their current, primarily recreational role, into a new role as a catalyst for community development and enhancement, sustainable park will be an essential component in transforming and enriching the cities.

Implementing sustainable design successfully is not only achieved through smart design, but through the appropriate maintenance and care. Therefore, there is a need to educate park users on sustainable design technique. Parks and open space fortify the social, economic, and environmental landscape in Dhaka City, contributing to a better quality of life for future generations.

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