

**PROJECT REPORT ON**  
**GREEN BUILDING APPROACH**  
**TOWARDS**  
**ACHIEVING SUSTAINABILITY IN NEPAL**

Submitted as a partial fulfillment of requirements of the degree of  
Bachelor of  
Civil Engineering under Pokhara University



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We are doing this project not only for marks but also to increase our knowledge.

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## **ACRONYMS**

1. UWTC = United World Trade Center
2. PAHS = Patan Academy of Health Science
3. ICIMOD= The International Center for Integrated Mountain Development
4. GTC = Green Technology Center

## ABSTRACT

This research paper investigates the concept of green buildings as an efficient technique for achieving sustainability in Nepal despite quick urbanization and environmental issues. Green buildings are built, constructed, and maintained with environmental concerns, the use of green technology, sustainable ingredients, and eco-friendly activities to minimize natural resource use and carbon emissions. The application of green building strategies no longer only benefits the environment but also boosts human happiness, social justice, and the development of a green economy. This research examines the relevance of sustainable building approaches, highlighting energy performance, solid waste management, and water conservation. It assesses the present condition of green building techniques in Nepal and the policy steps done by the government to encourage eco-friendly development. Through a thorough literature investigation and information analysis, the study demonstrates the potential advantages of green buildings in terms of decreased electricity intake, lower environmental effects, and increased living standards. It also addresses problem experienced by developers in implementing green construction principles, such as financial limits and lack of knowledge among the customers. The analysis shows that green buildings are ideal throughout Nepal, and government policies and incentives are important to facilitate their adoption. Recommendations include the need for precise and explicit sustainable building policies at all levels of government and the promotion of green building techniques via education and awareness initiatives.

**Keywords:** Green Building, Sustainability, Urbanization, Environmental Challenges, Sustainable Construction Methods

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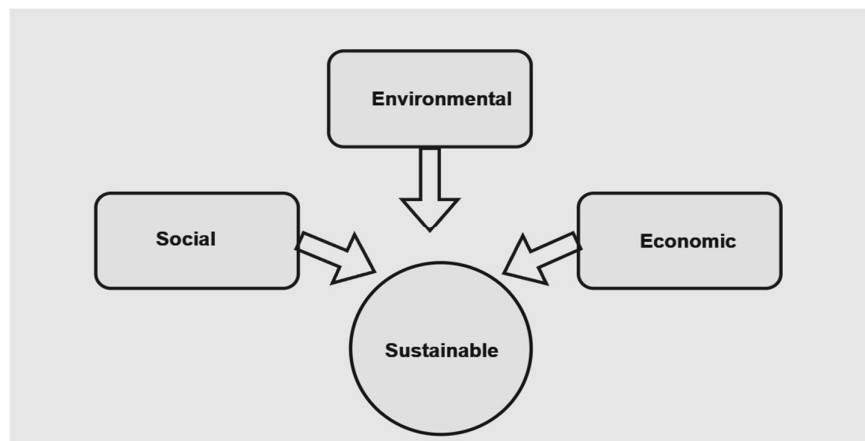
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# CHAPTER 1

## INTRODUCTION

Rapid urbanization resulting from rural migration has grown progressively more urgent in many regions of the world. This population change offers a tremendous challenge to natural resources, particularly in big cities, which typically encounter environmental challenges such as water shortages, water pollution, and groundwater depletion. To address these concerns, it is necessary to act today at communal and individual levels. One viable way is to implement "green building" solutions, which entail the installation of housing systems that minimize demand for natural resources and carbon emissions. A "green building" is a structure planned, constructed, and maintained with the environment in mind. This involves the use of energy-efficient technology, sustainable materials, and other actions that decrease the use of natural resources and CO<sub>2</sub> emissions. A great example of this is rainwater harvesting, where rainwater is gathered for different chores such as gardening and cleaning. This helps lower the quantity of water extracted from natural sources, therefore reducing environmental effects. In addition, water and wastewater recycling technologies may be employed to decrease water wastage, and high-efficiency facilities may need less energy run. A green construction strategy's execution not only helps the environment, but also human welfare, social justice, and the establishment of a green economy. For instance, greater quality, thermal comfort, and access to sunshine are advantages of green buildings that may increase tenant quality of life. This may then result in higher productivity better health, as well as less stress.



*Figure 1 Concept of Sustainability*

In Nepalese cities, drought, rubbish disposal, and pollution are all major problems, and it is expected that climate change will put even more burden on municipal services. Sustainable building is suggested as a potential remedy for these problems. Sustainable building aims to lessen the consumption of natural resources while also enhancing human welfare, advancing social justice, and maintaining a green economy. To ensure success, energy-efficient construction, technology, and environmentally friendly methods for water and wastewater management system maintenance must be used. Sustainable building approaches offer various advantages. They contribute to energy consumption reduction, which in turn cuts energy prices and diminishes dependency on fossil fuel. They also tend to utilize less resources and generate few pollutants, which may help minimize the environmental influence of building projects. Finally, since they are healthier and more pleasant, they may also assist in increasing the quality of life for individuals who dwell in and work in buildings. Making sustainable construction approaches norm rather than the exception is the present issue. To achieve this, governments and industry must work to develop incentives for builders and designers to utilize ecological friendly solutions. This might include tax incentives for enterprises that adopt sustainable materials and processes, well as subsidies for renewable energy sources. Further research and development is necessary to produce current technologies and materials that are more energy efficient and sustainable than those now available. The construction sector has a considerable influence on global energy usage. Buildings absorb 40% of overall energy usage, according to the World Business Council for Sustainable Development [3]. This indicates that the construction sector is a significant contributor to global warming since buildings release Green House Gases (GHG). In fact, researchers anticipate that worldwide carbon emissions from buildings would reach 42.4 billion tons by 2035. Because the construction industry requires natural resources and energy, which might result in sound and other forms of environmental pollution as well as the waste generation following building deconstruction, this is a big problem for all countries with restricted territory. The construction sector is a significant cause of environmental harm, and it is necessary that actions be made to minimize energy usage and GHG emissions in order to safeguard the environment. American Journal of Modern Energy 2023; 9(2): 27-35. One of the most efficient methods to achieve this is to encourage energy efficiency in buildings. Energy-efficient buildings consume less energy to function, lowering the amount of energy that has to be generated and, in turn, reducing GHG emissions. Energy, energy-efficient appliances, insulation, lighting, and the usage of renewable energy sources like solar



and wind may all be utilized to using renewable energy sources for building operation. Furthermore, governments should give incentives construction enterprises to utilize sustainable building techniques, such as granting tax exemptions or subsidies those that use renewable energy sources.

## **1.1 Background of The Study**

Changes in the economy and improvements in people's quality of life are both results of development. The expansion of the nation's physical infrastructure has reached new heights. Humankind has created everything easier and more comfortable for himself, from a little hut to a large building, in order to live and exist and continuous focus in construction has drawn attention to reduce, reuse, recycle and rethink for maintaining green through lean construction approach (Mishra AK, Aithal PS, 2022 Sharma et al, 2022). People in Big city have a strong preference for living in high-rise buildings and are willing to pay a premium for the privilege (Mishra and Aithal, 2021). These days, shopping malls, restaurants, movie theaters are all in fierce competition with one another, they all want to be distinctive and original in comparison to one another. As a result, enormous structures are developed on a massive scale, requiring enormous investments and taking up acres of land. One thing that nobody pays any attention to is the neighborhood and the natural nature in which they dwell. They do a great deal of direct and indirect damage to the natural nature around them. The environment of being environmentally friendly is often disregarded by many large corporations (Mishra and Rai, 2017). A "green" building is a form of building that, in its design, construction, or operation, avoids or eliminates negative impacts and may have beneficial impacts on our climate and environment. Green buildings are also known as environmentally friendly buildings. The preservation of the environment and the conservation of natural resources are both accomplished through green buildings, which also increase the quality of life. Housing demand , needs and low costing housing have been focused in Nepal through government , INGOs, NGOs and peoples but no much focus on Green Building yet. The term "green building" refers to a vast array of practices, methods, abilities that aim to reduce and, eventually, eliminate the negative effects that buildings have on both the surrounding environment and human health. One of the options that may be used to reduce the significant negative impacts that the existing building stock has on the environment, society, economy is green building. On the other hand, there hasn't been any kind of comprehensive review done on all of these different studies, which is

something that's really necessary for the ongoing work. In the most recent few decades, there has been a remarkable development in the number of studies on environmentally green building. In this study, we conduct an analysis of a critical review of the existing body of knowledge about investigations linked to green building (Mishra and Rai, 2017: Mishra AK, Shah SK, 2018: Shah SK, Mishra AK. 2018: Mishra AK. 2019: Anjay Kumar Mishra, Aithal PS. Hamid Saremi 2020 Mishra AK, Thing R, 2009).



Figure 2: The Proposed of Green Building

## **1.2 Statement of the Problem**

The prior research that has been done on this subject has uncovered a gap in knowledge, the goal for this study is to fill that gap. The purpose of this research paper is to demonstrate care for the natural world, promote the idea of green buildings, raise knowledge about the benefits of having a green structure, investigate the effect that having a green structure has on the surrounding environment of any building. The concept of “green building” is becoming more popular, particularly in India. This is largely accepted by the business sector since it has been shown to be excellent, efficient, successful.

## **1.3 Objectives of the Study**

Green building are designed to reduce the overall impact of the built environment on human health and the natural environmental by :

- ❖ Efficiently using energy, water and other resources.
- ❖ Protecting occupant health and improving employee productivity.
- ❖ Reducing waste, pollution and environment degradation.
- ❖ Using energy, water and other resources efficiently.
- ❖ By reducing waste, pollution, and environmental degradation.
- ❖ To design a residentially viable Green Building including maximum open space with cost effective design and materials.
- ❖ Improve indoor air quality by orientation natural ventilation design.
- ❖ Implementing Rain Water Harvesting system with Ground Water Recharge as an attempt to improve regional Ground water table.
- ❖ Using eco-friendly and regionally available construction materials.

## 1.4 Scope of the Study

Eco-friendly structures are becoming more popular in Nepal as a technique to lessen environmental effects and foster sustainable practices. Green buildings are designed, built, and maintained sustainably to reduce environmental repercussions and encourage sustainable activities. The Ministry of Environment, Science, and Technology, The National Water and Sewerage Corporation, and the Nepal Institute of Engineering are all examples of green buildings Nepal. These projects incorporate natural features like sunshine and trees to boost energy efficiency, as well sustainable energy sources like solar power or other alternative forms. Furthermore, the National Shelter Policy (2012) emphasizes the importance of incorporating renewable and energy-efficient technologies for low-carbon home construction operations. The use of green construction concepts in Nepal needs to mitigate the negative impacts of efficient design, the use of renewable energy, and water resource conservation. These gadgets help to decrease energy use, and waste. Nepal is taking a crucial step toward minimizing its environmental impact and fostering sustainable development by adopting green building techniques. Green buildings in Nepal are aimed to limit energy consumption and water use, while also generating a healthy interior climate. The usage of natural ventilation, effective lighting, and the use of recyclable materials in construction are some of the measures employed. Additionally, green buildings commonly employ solar panels to create their own electricity and use rainwater collection systems to minimize water usage. By employing green construction principles, Nepal is taking strides towards a more sustainable future. The decrease energy use and water usage helps to lessen the impact on environment. Additionally, the usage of renewable energy promote a better environment for the people of Nepal. By minimizing energy use and water usage, green buildings as in preventing air and water pollution. Furthermore, green buildings are built to maximize natural light, which helps lower the risk of health concerns such as eye strain and headaches. Green buildings are also good for the economy. By minimizing energy use and water usage, green buildings as in minimizing energy expenses. Additionally, green building generally utilize local materials and labor, helping to supply the local economy [5].

## 1.6 Limitations

Although these studies need to be done nationwide, due to constraints of time, money, and resources, the study may consist of the following limitations.

The majority of our experts do not look at going green as something that limits a homeowner. 65% of our experts believe there are an equal number of eco-alternatives for any home project. Some even went as far to say that green options offer new opportunities, rather than hinder existing options. These experts believe manufacturers are creating eco-alternatives at a fast pace, so there should be no limitations on what green options homeowners can use in their homes. Some manufacturers are even creating new possibilities as they uncover more sustainable ways to build and maintain our homes. “In the past, going green meant sacrificing design, function and price,” explained Jennifer Dusina of freedom Rail closet solutions. “But today builders are reacting to the new demands of home buyers for greener choices. They’re working towards making green homes more obtainable for the masses.” One of the main concerns our experts have is that the phrase “going green” is becoming trendy, and, as a result, devaluing the reasons for joining the green movement in the first place. A few experts even claimed the term “green” should be eliminated from homeowners’ vocabulary.” The term green should seriously be banished; we’re far too into the mixed messaging for society to ever get on the same page,” said Kelly Fall is, interior designer and owner of Remote Stylist, a website offering online interior design services. Regardless of how the terminology evolves, most of our experts think going green is here to stay. Some even said sustainability has been around for centuries, but it was in the form of reusing pass-alongs and hand-me-downs. The “newness” associated with the green movement has to do with the fact that manufacturers are catching on and starting to make new products that are sustainable. “Saving the planet is no longer thought of as a fringe movement, but rather a way of life for all of us,” said Valorie Hart of the interior design blog Visual Vamp.

### The Expert Opinion: Going Green Imposes Limitations

Among the 35% of responses that indicated going green requires a sacrifice from the homeowner, there was a predominant theme in what exactly was considered a limitation. Though some experts said there were limitations when it comes to choices and availability, all of them mentioned price as a restraining factor. “I do believe going green constrains

homeowners, but not because of design or product limitations,” said Chris Rodenius of Tool Rank, a site dedicated to tool reviews. “I believe the constraint has to do with the price of going green. If you want to go 100% green, it is going to cost you big time.

#### Major limitations

1. Cost: Sustainable options will cost more because they cost manufacturers more to produce. Thus, there will always be a large initial investment when choosing a green component for your home.
2. Materials: Sustainable materials are not always as readily available as their less eco-friendly alternatives. Thus, green materials may need to be custom ordered for are modeling project. That is, if a sustainable material is even an option (in terms of both affordability and availability).
3. Options: Some experts believe there are still not enough green alternatives for the end less remodeling possibilities available to homeowners. They see limitations in colors, fixtures, fabrics, and more.
4. Time: Going green usually takes time. Time to pay off the investment, time to redeem tax rebates, time to gather the appropriate materials required.

### 1.7 Principle of Green Buildings

- ❖ Best location , integration of building into landscape, environment and transportation infrastructure
- ❖ Maximizing the utilization of solar energy and daylight can be achieved by strategically positioning windows in a south orientation.
- ❖ The pursuit of minimal energy consumption heightened efficiency, and the exploration of alternative energy sources are key objective in contemporary discourse.
- ❖ Use of safe, renewable and recycled materials.
- ❖ The inclination towards utilizing material sourced from the local region.
- ❖ Enhancing the quality of indoor air.
- ❖ The efficient and effective upkeep of building for maintenance purposes.

## **1.8 Green building related task**

- Increase the effectiveness of using natural and renewable resources, such as water, wind, and the sun.
- Reduction of operating cost.
- Reduced greenhouse gas emissions.
- Reducing the negative influence on human health during a stay in a residential building (through the whole building life cycle) by using the most recent, energy-saving, natural, and safe materials.

## **CHAPTER 2**

### **LITERATURE REVIEW**

The Bird Island Project in Malaysia is a green construct that implements the Zero Energy Home Concept. Green Buildings in Malaysia are made utilizing ecologically friendly components such as bamboo frames and sustainably product silicon glass cloth. Green technology is also employed i n building of Green Buildings, such as energy- a water-efficient appliances, grey water recycling systems, a solar thermal systems. The energy utilized by the tenants the Green Buildings on Bird Island is produced by solar roof tiles. However, developers in Malaysia confront various hurdles while creating green structure s. One of the challenge is the shortage of eco-friendly technology and materials Malaysia. This makes it more costly to develop a green building since most of the resources need to be import. Another difficulty is the low degree of homeowner acceptance of and reactions to green buildings. Many Malaysian build owners are not aware of green buildings or their advantage development of green buildings in Malaysia. It demonstrates that it is possible to construct high-quality, energy-efficient buildings that are also affordable. As more people become aware of the benefits of green buildings, it is likely that the demand for these types of buildings will increase in Malaysia.

The usage of construction materials, including glass, concrete, metals, and ceramics has increased in India because of rapid urbanization, globalization, and economic expansion. To solve the energy problem, green buildings use the least amount of energy possible. The return on investment for modern green buildings i n India has been lowered to between two and seven years thanks to the LEED (Leadership in Energy and Environmental Design) rating system used by the Indian Green Building Commission. The biggest barriers to their development in India are a lack of knowledge about the benefits of green buildings, sustainable materials, and cutting-edge technologies. CIIGBC and other specialists are working to resolve these problems so that developers can continue to operate effectively.

Third-party inspections and energy efficiency tests are essential to project success. For more than a decade, governments have paid commercial developers to conduct inspections and tests. Studies have shown that these guidelines are most effective when implemented

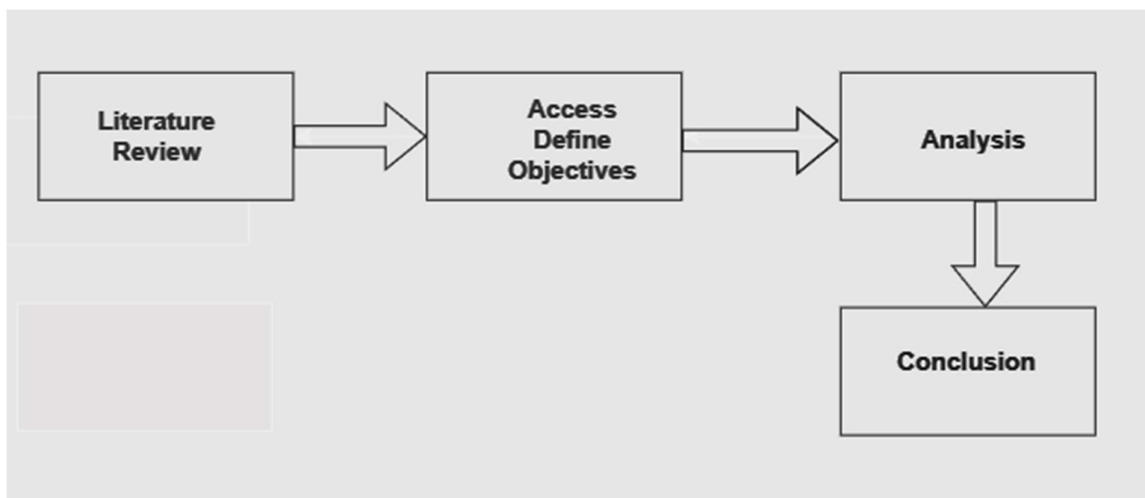


at the community level in construction projects and in commercial projects at all levels of government. Furthermore, green incentive measures have the greatest impact two to three years after their implementation. The benefits of third-party energy efficiency inspections and testing are numerous. Perhaps the most significant is the cost savings that can be achieved. By ensuring that energy-efficient systems are installed correctly, businesses and individuals can save money in the long-term. Additionally, third-party inspections and testing can help to reduce environmental damage, as energy-efficient systems are more sustainable and help to reduce carbon emissions. Furthermore, third-party inspections and testing can help to ensure that the safety of the public is not compromised. By ensuring that energy-efficient systems are installed correctly, businesses and individuals can rest assured that their safety is not at risk. Additionally, third-party inspections and testing can help to ensure that the environment is not damaged, as energy-efficient systems are more sustainable and help to reduce carbon emissions.

## CHAPTER 3

### METHODOLOGY

The research methodology employed a systematic approach centered on a thorough literature review. Initially, the focus was on scanning abstracts and titles to identify articles aligning with the research's primary goals. Subsequently, a deeper analysis was conducted by examining the introductions to understand the background and objectives of each study. This step provided crucial context for evaluating the relevance of the selected sources. Furthermore, the researchers scrutinized the authors' interpretations in the discussion sections to comprehend the implications of the findings. Lastly, conclusions were evaluated in conjunction with the presented findings to assess their validity and contribution to the field. This method ensured a comprehensive understanding of existing research, guiding the formulation and direction of the current study.



*Figure 3 Methodology Involved*

### 3.1 Comparison of Traditional and Green Construction:

Indicators	Green Construction	Traditional Construction
Electricity consumption	Low	High
Indoor Environmental Quality	Very low	High
Emission level	Low	High
Waste Management system	Highly effective	Effective
Building Materials	Environmental Friendly	Environment Friendly
Design Practices	Complex	Normal

### 3.2 Application

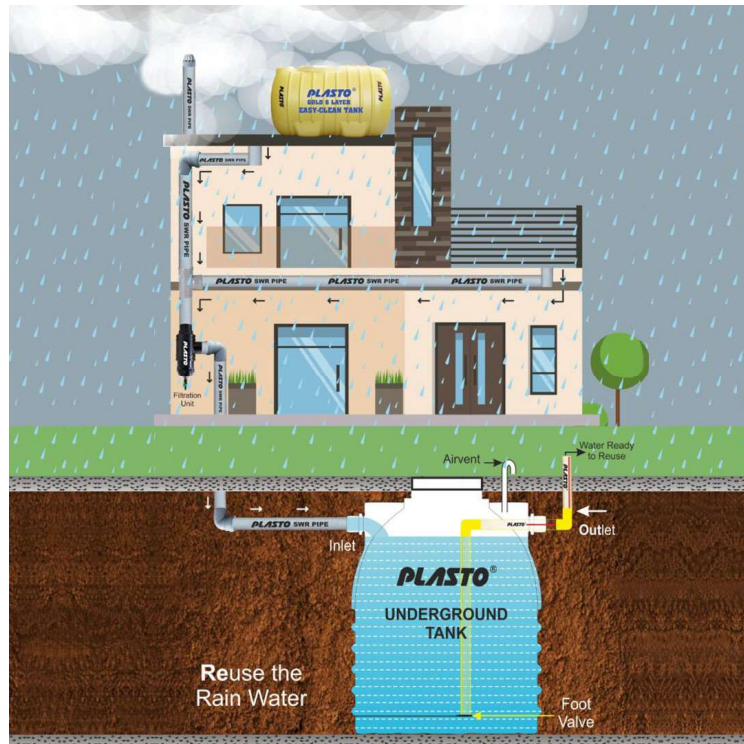


Figure 4 Rain Water Harvesting



*Figure 5: Bayalpata Hospital in Accham with rammed Earth Technology*

## **CHAPTER 4**

### **DATA COLLECTION, DISCUSSION AND ANALYSIS**

Green building and green construction are crucial to sustainable development. This approach advocates for the use of sustainable, locally obtained resources like minerals, sand, and stone, as well as natural construction materials like greenery, flora, hay, bamboo, lumber, and natural sunshine. The ecological, social, and economic consequences of the building stock may be mitigated via green construction. Many municipalities have put incentives and discounts into place to promote green buildings, such as the Pokhara Metropolitan Authority, which pays huge rewards and discounts to people who design ecologically friendly structures.

Energy efficiency is a vital component in building eco-friendly constructions. Consequently, less energy is needed to complete the same task. For instance, a compact bright bulb needs a lot less energy to generate the same amount of light as a standard regular bulb, making it a more efficient alternative. Another key component of environmentally responsible building is solid waste management, which encompasses trash collection, transportation, treatment, or waste reduction, as well as waste inspection. Water conservation is a key factor when planning green buildings. Policies, plans, and activities should be put in place to fulfill the current and future human demand, secure the hydrosphere from depletion, and manage fresh water as a natural resource sustainably. Open green space should be given priority in the Kathmandu Valley's 20-year strategic development master plan as it is crucial to resilient cities. To resist the existing and future tendencies of urbanization, green open space is necessary.

In general, green construction is vital for establishing ecologically friendly and resilient cities. Green construction should be a top priority for those wishing to increase their green credentials because it is a terrific technique to minimize the financial, social, and environmental repercussions of their current structures. The Pokhara Metropolitan Authority has set an ambitious aim to develop Pokhara into a metropolis of eco-friendly structures within a few short years. To this aim, it has designed a plan to give large incentives and discounts to those who construct green buildings. The Dharan Sub-Metropolitan City has already taken efforts to promote this project, granting a 50% reduction on fees for green building approvals and designs, while the Lalitpur Metropolitan City has subsidized various key services.

The Kathmandu Valley strategic development master plan for the next 20 years should stress the integration of open green spaces as a crucial ingredient for constructing resilient cities. The preservation of natural open spaces is of the highest significance in tackling the issues faced by current and future patterns of urbanization. To develop sustainable construction methods, a variety of techniques must be put into action. These tactics include the imposition of environmental taxes on building materials, development of initiatives to stimulate the construction industry, improvement of professional expertise among construction specialists, advancement of scientific research in support of green construction, inclusion of a green building course in an educational curriculum, establishment of protocols for designing and constructing environmentally and energy-efficient buildings and structures. These activities can entail developing and putting into effect programs that encourage ecologically responsible consumer behavior and raise consumer knowledge of environmental problems.

## **CHAPTER 5 CONCLUSION AND RECOMMENDATION**

The study indicated that green buildings are desirable across Nepal and that government measures are needed to assist green buildings. This is in line with foreign NGOs aiding the Nepalese government to promote green buildings. A literature review and primary data gathering from respected authorities and specialists were used in research. We obtained data using qualitative research approaches. The findings reveal that green buildings relate to the usage of ecologically friendly materials. These resources are available locally and utilized to promote government policy at the municipal, provincial, and national levels. Passive solar buildings will be used to increase energy efficiency, waste management, and water conservation. It has been seen that certain towns have started offering tax advantages to users and some green building guidelines are being created to achieve a green economy in Nepal. The research results should be adopted by relevant departments to promote green construction in Nepal. This is excellent for the environment because green buildings are more energy efficient and consume fewer resources. They help minimize waste and pollution and promote a healthier lifestyle for those who live in them. In conclusion, research shows that green buildings are desirable across Nepal. The study also provides a basis for the implementation of the government's green building policy. This is good for the environment and the local economy. It is essential to point out that the research findings should be put into action by relevant authorities to promote green building in Nepal.

Some Example of Green Building Structure from Nepal are:

1. Kathmandu Eco Hotel
2. UWTC
3. PAHS
4. ICIMOD Headquarters
5. GTC

It is imperative for all levels of government, including local, provincial, and federal, to create policies that cater to the growing need for more detailed and specific recommendations in regard to sustainable buildings. The National Building Codes have initiated provisions for environmentally friendly buildings. To guarantee that sustainable building practices are encouraged, researchers, professionals, investors, and users at the municipal level must incorporate adaptation and mitigation strategies into their planning

and service delivery. The implementation of a state-of-the-art approach called "green building" is crucial for fostering sustainable development and promoting the sustainability of our built environment. Its pragmatic implementation facilitates attainment of vital objectives, including the conservation of energy resources, the curtailment of ecological damage, and the augmentation of living standards. With the fundamental objective of reducing energy and material consumption, green building spans all stages of a structure's life cycle, from site selection to design, construction, maintenance and repair. Unfortunately, our nation is only now starting to embrace sustainable building due to the hefty initial costs required. It is crucial to understand that green building is more than a fad; it is a genuine necessity with significant advantages.



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