

Green Building Approach Towards Achieving Sustainability in Nepal

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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

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 CO₂ 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 to 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 air quality, thermal comfort, and access to sunshine are all advantages of green buildings that may increase tenants' quality of life. This may then result in higher productivity, better health, as well as less stress. Additionally, energy

expenditures for individuals and companies may be minimized and made cheaper with the aid of green buildings. Additionally, construction and maintenance companies will benefit from the development of green buildings by generating employment, which would help the green economy grow. Nepal's Climate Change Policy (2011) [1] aggressively encourages the implementation of low-carbon development and adaptation programs to address the urgent need for carbon-resilient development. Green buildings are used in this to lessen the effects of global warming. The program encourages the use of green building practices by offering financial support and tax breaks to companies and individuals that want to take part in greener building projects. The standards and guidelines also encourage the development of green building certification schemes, which can help ensure that green building projects are completed successfully and sustainably [1].

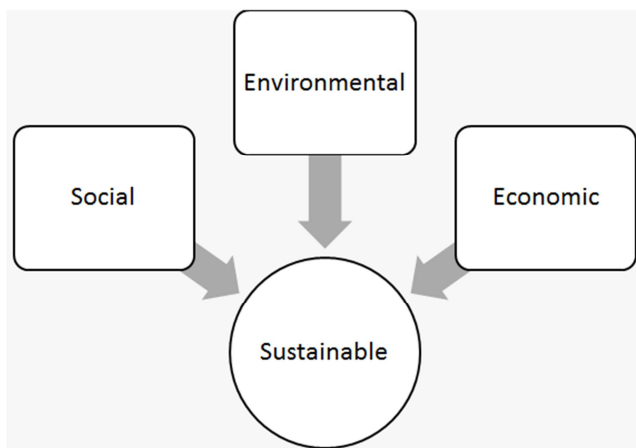


Figure 1. The Concept of sustainability (Balancing economic, environmental and societal benefits).

To achieve UN's goals for sustainable development, the building industry is crucial. This is because of the significant long-term economic, environmental, and social benefits and effects of building supplies, structures, and infrastructure. The International Green Building Council is in favor of the UN Sustainable Development Goals, which aim to boost economic development while protecting the planet from the effects of climate change. We can advance knowledge, provide job opportunities, strengthen communities, enhance health and wellbeing, and reduce carbon emissions by putting advanced green building technology to use. We can also conserve energy, water, and other resources.

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. Price risk

must also be considered because construction projects must consider all the legal, financial, political, technological, environmental, and other factors that may occur. Finally, green buildings offer a viable answer to present difficulties in Nepalese cities, as well as a means of ensuring sustainable growth and adaptation to the effects of climate change [2].

Energy shortages of the seventies had a major impact on the construction industry because it compelled architects and builders to find alternatives to using fossil fuels to power their structures. The term "green building" had not yet gained traction, and sustainable building techniques were still in their infancy. Builders and designers thus had to work hard to come up with fresh strategies for lowering energy usage and utilizing sources of renewable energy like solar energy and wind power. Since then, there has been a considerable increase in worldwide competitiveness, which has prompted businesses to review their procedures and processes. Focusing on sustainability issues is one of the best ways to obtain an advantage in the building sector. Concerns about climate change and global warming, as well as a desire to lessen the environmental impact of the building sector, have fueled the sharp rise of an environmentally friendly construction trend in recent years.

Sustainable building approaches offer various advantages. They contribute to energy consumption reduction, which may cut energy prices and diminish dependency on fossil fuels. They also tend to utilize less resources and generate fewer pollutants, which may aid minimize the environmental influence of building projects. Finally, since they are often healthier and more pleasant, they may also assist in increasing the quality of life for individuals who dwell in and work in the buildings. Making sustainable construction approaches the 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 ecologically friendly solutions. This might include tax incentives for enterprises that adopt sustainable materials and processes, as well as subsidies for renewable energy sources. Furthermore, extra 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 (GHGs). In fact, researchers anticipate that worldwide carbon emissions from buildings would reach 42.4 billion tons by 2035. Because the construction company 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. 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 accomplish this. Governments and construction enterprises must work to ensure that buildings are planned in a manner that decreases the consumption of energy and natural resources, as well as the quantity of garbage created, in addition to enhancing energy efficiency. This may be done by employing recycled materials in construction, as well as by

using renewable energy sources for building operations. Furthermore, governments should give incentives for construction enterprises to utilize sustainable building techniques, such as granting tax exemptions or subsidies for those that use renewable energy sources. Finally, governments must also endeavor to guarantee that structures are dismantled in an ecologically sustainable way. Deconstruction of buildings may produce a lot of garbage, which can be hazardous to the environment. To prevent this waste, governments can give incentives for deconstruction businesses to utilize ecologically friendly procedures, such as recycling or reusing materials [4].



Figure 2. The proposed Green Building [5].

1.1. Green Building in Nepal

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 in Nepal. These projects incorporate natural features like sunshine and trees to boost energy efficiency, as well as 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 climate change and promote sustainable development. Green buildings combine technologies such as energy efficiency, 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 of energy use and water usage helps to lessen the impact on the environment. Additionally, the usage of renewable energy sources helps to minimize the dependency on fossil fuels. The implementation of green construction principles helps to promote a better environment for the people of Nepal. By minimizing energy use and water usage, green buildings assist in preventing air and water pollution. Furthermore, green buildings are built to maximize natural light, which helps to 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 assist in minimizing energy expenses. Additionally, green buildings generally utilize local materials and labor, helping to support the local economy [6].

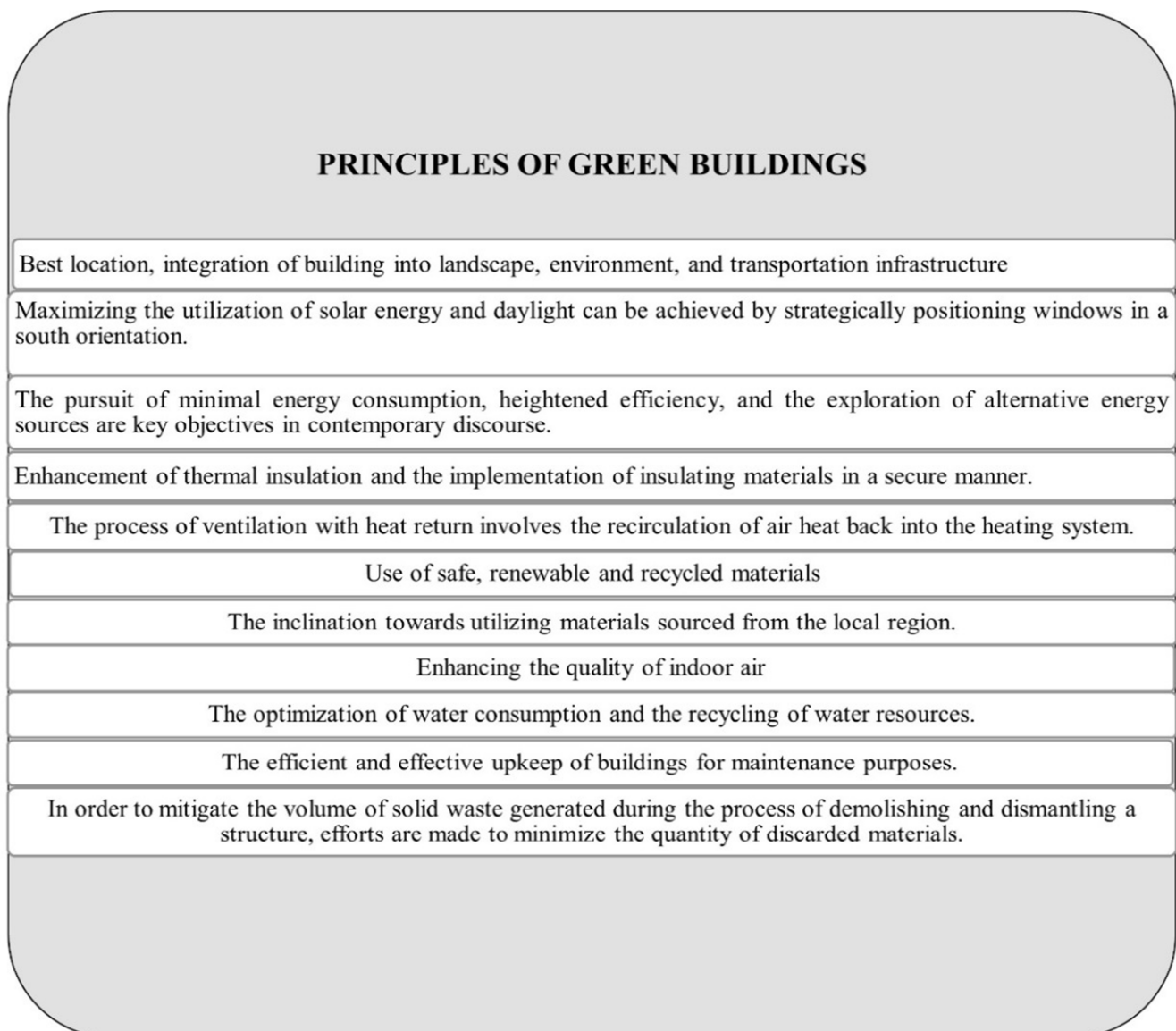


Figure 3. Principle of Green Buildings.

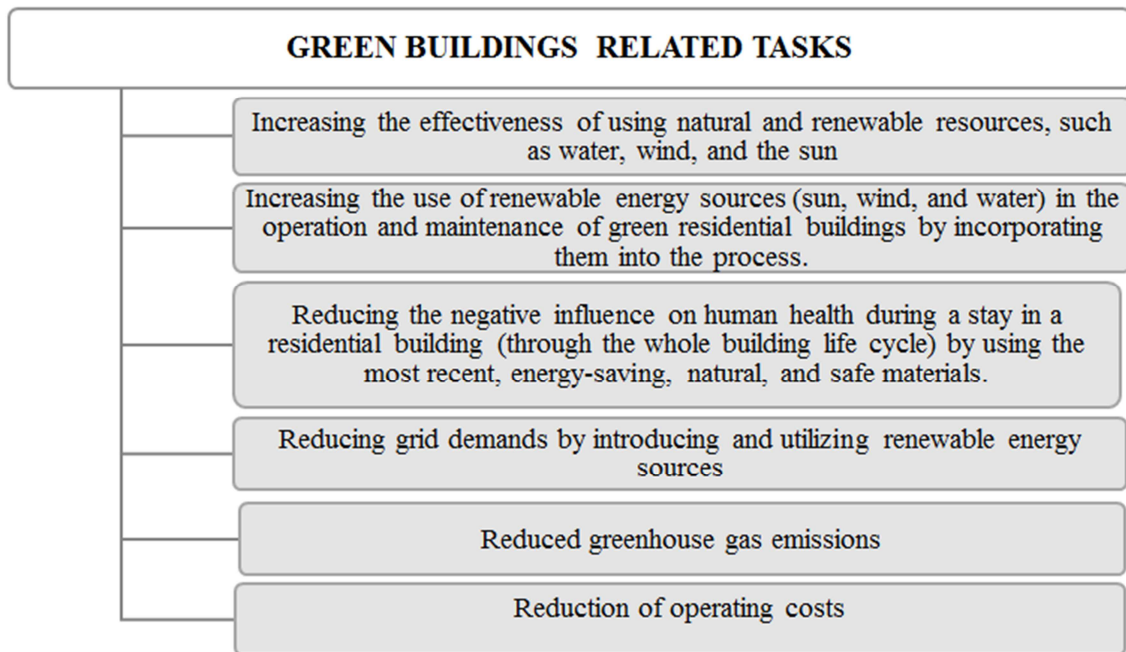


Figure 4. The Main task of Green Buildings.

1.2. The Significance of the Study

In recent years, green buildings have become an increasingly essential part of sustainable development. Green construction is the technique of constructing buildings with a focus on energy efficiency, resource conservation, and the use of sustainable materials. Its aims are to lessen the environmental effect of buildings, produce healthier living areas, and reduce energy expenses. It is an important aspect of the transition to a green economy and can produce green employment that help eliminate poverty.

In Nepal, green building is still in its early phases of development, although there is a rising interest in the potential advantages of green construction. The Nepalese government is starting to understand the relevance of green construction in fostering sustainable development and is taking initiatives to encourage the use of eco-friendly building materials and practices. The government is also supporting the use of local resources in the building of eco-friendly dwellings. This is a great step towards lowering the environmental effect of buildings and encouraging the use of sustainable materials. Green construction offers various benefits. It decreases the environmental effect of buildings since it utilizes less resources and creates less waste. It also provides healthier living areas since it lowers the usage of toxic chemicals and materials. Additionally, green buildings may cut energy expenses, since it is meant to be energy efficient. The present condition of green building in Nepal is still in its early phases, however there is a rising interest in the potential advantages of green construction. There is a rising demand for green construction materials, and the government is taking initiatives to encourage the use of eco-friendly building materials and practices. Additionally, there is a rising understanding of the necessity of green building in

encouraging sustainable growth. The possibilities for green development in Nepal are high. As the government continues to push the use of green building materials and processes, the demand for these goods and services will continue to expand. Additionally, as the Nepalese economy converts to a green economy, green building will play an increasingly vital role in eliminating poverty and fostering sustainable development.

To decide whether Nepal uses eco-friendly home goods and technology to fight poverty by encouraging the creation of eco-friendly jobs and a shift in the nation's economic system. In addition to giving suggestions to the proper officials, we will create a framework for growth policies that support eco-friendly living. To encourage the use of local products in the building of eco-friendly houses.

2. Literature Review

The Bird Island Project in Malaysia is a green construction that implements the Zero Energy Home Concept. Green Buildings in Malaysia are made utilizing ecologically friendly components such as bamboo frames and sustainably produced silicon glass cloth. Green technology is also employed in the building of Green Buildings, such as energy- and water-efficient appliances, grey water recycling systems, and solar thermal systems. The energy utilized by the tenants of the Green Buildings on Bird Island is produced by solar roof tiles. However, developers in Malaysia confront various hurdles while creating green structures. One of the challenges is the shortage of eco-friendly technology and materials in Malaysia. This makes it more costly to develop a green building since most of the resources need to be imported. Another difficulty is the low degree of homeowner acceptance of and reactions to green buildings. Many Malaysian building owners are not aware of green buildings or their advantages,

and they are unwilling to acquire them since they are more costly than ordinary structures. Despite these challenges, the Bird Island Project is a significant step forward in the 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 [7].

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 in 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 [8].

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 [9].

The number of housing projects attempting to incorporate green components has drastically expanded during the past five years. One of the first fully realized green construction projects in the US was built in Austin, Texas. To better understand why homeowners pick eco-friendly features, their level of devotion to the program, and associated expenses, this program was investigated and analyzed. A database of registered green buildings built in the Austin region between 1998 and 2002 was used to select the study population. The

frequency of use, price, and value per star of 122 green buildings were discovered and graded. The study's findings suggested that price was the main determinant of how frequently products were utilized, with producers selecting the most affordable features. It is crucial to inform the public about the long-term advantages of green buildings to persuade more builders to use them. This instruction must cover the financial advantages of green buildings as well as the advantages to human health and the environment that come from utilizing environmentally friendly construction materials and methods [10].

South Korea is taking action to make a greener economy a fundamental development strategy. By turning industrial facilities into eco-friendly surroundings with lower carbon dioxide emissions, South Korea is leading the way in green construction technologies. To promote green construction, both governments and private businesses must come together to form strategic strategies. To do this, recent international trends in green buildings must be taken into consideration. Fifteen cutting-edge, green construction technologies proposed by South Korea have strategic value and could help the country achieve its green economic goals. These technologies include green building materials, energy-efficient technologies, and green building management systems. By utilizing these technologies, South Korea can reduce carbon dioxide emissions and create a more sustainable environment. To ensure that green construction is successful, the construction industry must collaborate with other industries to form a government-industry partnership. This partnership can help to solve environmental and economic issues with the green economy. It is also essential that the government and private enterprises come together to create incentives for green construction, such as tax breaks and subsidies [11].

The research methodology employed in this study was comprehensive and multi-faceted. It began with a review of relevant literature to ensure that the study objectives were met. Afterward, we consulted experts in the field to gain a better understanding of the research objectives and to ensure that we conducted the research in accordance with the best practices. Once the research objectives were established, the next step was to analyze the relevant data. This involved collecting data from various sources and then analyzing it to determine its relevance to research objectives. Finally, surveys were conducted based on the data collected to gain further insight into research objectives. The literature review was an important phase in the study process. It provided a thorough evaluation of the state of the research in the field, which assisted us in identifying knowledge gaps that needed to be filled. By speaking with experts in the field, we were able to better understand the research's objectives and ensure that it was conducted in an ethical and responsible manner. Data analysis was a critical phase in the research process. Data was collected from several sources and analyzed to establish the connection to the study's objectives. Statistical techniques such as regression analysis and correlation were utilized to detect patterns and trends in the data. The outcomes of

analysis were then used to make decisions on the study's objectives.

Finally, surveys were conducted based on the data collected. This enabled us to gain further insight into the research objectives and to identify any potential areas of improvement. Surveys were designed to be comprehensive and to ensure that all relevant information was collected. The results of the surveys were then used to draw conclusions about research

objectives and to make recommendations for further research.

Overall, the research methodology employed in this study was comprehensive and multi-faceted. We conducted surveys based on the data collected, following a review of pertinent research. The literature review provided a comprehensive overview of the research environment in the field, enabling us to identify knowledge gaps and draw conclusions regarding the research objectives.

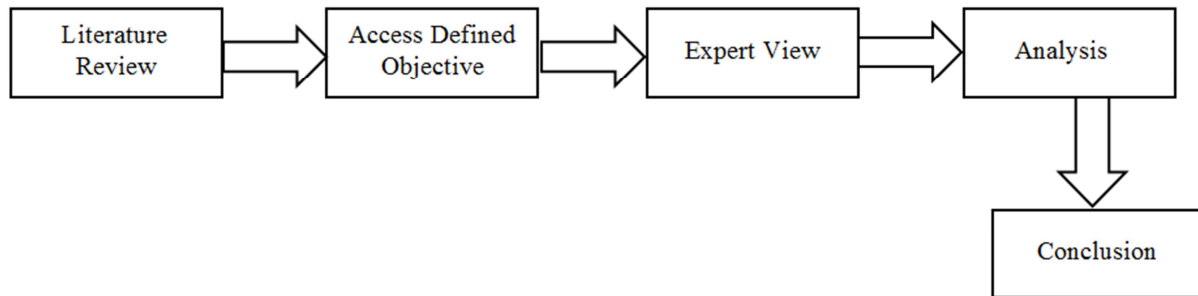


Figure 5. Methodology involved.

Table 1. Comparison of Traditional Construction and Green Construction.

Indicators	Green Constructions	Traditional Construction
Electricity consumption	Low	High
Indoor environmental quality	Very Low	High
Emission level	Low	High
Waste management system	Highly effective	Effective
Building materials,	Environment friendly	Environment friendly
Design practices	Complex	Normal

3. 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 [12]. 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 towns 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 of developing 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 [13]. The Dharan Sub-Metropolitan City has already taken efforts to promote this project by granting a 50% reduction on fees for green building plan approvals and designs, while the Lalitpur Metropolitan City has subsidized various key services. The Kathmandu Valley's 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 [14].

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, the

development of initiatives to stimulate the construction industry, the improvement of professional expertise among construction specialists, the advancement of scientific research in support of green construction, the inclusion of a green building course in an educational curriculum, the establishment of protocols for designing and constructing environmentally and energy-efficient buildings and structures [15]. These activities can entail developing and putting into effect programs that encourage ecologically responsible consumer behavior and raise consumer knowledge of environmental problems.

4. Conclusion

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 buildings in Nepal.

5. Recommendation

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 the attainment of vital objectives, including the judicious consumption of energy resources, the curtailment of ecological damage, and the augmentation of living standards. With the fundamental objective of reducing energy and material consumption, environmental building spans all stages of a structure's life cycle, from site selection to design, construction, maintenance, repair, and demolition. 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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