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Carbon Neutral Initiatives: A Case Study of Kunaria Village, Gujarat

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ABSTRACT: This paper explores the area of carbon offsets and carbon neutrality within the context of a village. Climate change and global warming are internationally recognized as current issues, having negative effects on humanity and being mainly caused by GHG emissions generated both from industrial activities and from other anthropogenic activities. Restoring the ecological balance requires urgent action to reduce GHG emissions. In this respect, the European Union and several scientists have concluded that we must limit global warming to 1.5 degrees Celsius by 2050, which is one of the sustainable goals. Climate change is a trending study all over the world, and each country is eager to search for various mitigation strategies for stabilizing climate change action. Here It is stated that all these interventions have been linked to carbon emissions. The paper examines the current methodologies and approaches developed to estimate carbon footprints by various factors, the studies existing in the literature review about the application, and other new approaches proposed by some authors.

KEYWORDS : Carbon Neutrality, Catastrophic Climate Change, Carbon footprint.

I. INTRODUCTION

Carbon emissions are one of the factors contributing to climate change. When the amount of carbon in the atmosphere increases, this will cause the temperature to rise, and thus global warming will occur. Many scientists have done studies on the possibility of catastrophic climate change. an appropriate regulatory response requires understanding what contributes to climate change, the likelihood and magnitude of the harm it will cause, and the emissions reductions necessary to reduce the risk of those harms. Here we focus more on anthropogenic activity than natural factors; humans are directly or indirectly responsible for these issues.

If researchers could clarify the extent to which specific human activities affect global ecosystems, they would be in a much better position to suggest strategies for mitigating against the worst disturbances. The main reasons are combustion of fossil fuels, deforestation, burning of firewood, energy demand, and vehicle use. The study basically means, to interrogate the village's carbon footprint, and all the initiatives that has taken for sustainable environment. the carbon footprint is the amount of greenhouse gases (GHGs) which are accountable for discharging into the atmosphere. GHGs like carbon dioxide (CO₂), methylene (CH₄), and nitrous oxide (N₂O) and the industrial gases like sulphur hexafluoride (SF₆), nitrogen tri fluoride (NF₃), hydro fluorocarbons (HFCs), and per fluorocarbons (PFCs) are also responsible for global warming.

GHGs include carbon dioxide, methane, water vapor, ozone, and nitrous oxide. These gases are needed in the atmosphere at their natural levels to regulate the earth's temperature and maintain life on our planet. We know that climatic balance is essential for all living beings and the stability of environmental cycles. If it is altered, it will have an impact on many aspects, including growth, metabolism, and development, potentially leading to the extinction of flora and fauna, including humans. So the world woke up in shock and started to plan and implement mitigation measures. The study also discuss the carbon emissions and various mitigation strategies taken for its reduction.

II. REVIEW OF LITERATURE

2.1] The impact of GHGs emission on global climate

Although nature can play a significant role in carbon sequestration, it cannot keep up with the rate at which we consume fossil fuels. The natural methods for absorbing carbon dioxide are not keeping up with the growing pace of emissions, according to recent studies. GHGs build up in the atmosphere as a result of this .Burning fuel results in the

production of energy from three of main energy sources: coal, natural gas, and petroleum.. This is why our carbon footprint is significantly influenced by the amount of energy we use. Activities performed in the home that use electricity, such as lighting, heating, and cooling, leave a carbon footprint(Agsci ,Origion state university).

The Earth's surface heats up more than it would naturally due to certain gases in the atmosphere, most notably water vapor, carbon dioxide, and methane. This phenomenon is known as the greenhouse effect, and it keeps the world's average temperature warm enough to sustain life as we know it.Since there are numerous distinct types of GHGs, most carbon calculators convert all GHGs to carbon dioxide equivalents (CO₂e), or the quantity of CO₂ that would affect the environment in the same way as the other GHGs.When the levels of carbon dioxide and other trace gases in the atmosphere rise over their natural levels, the greenhouse effect is intensified, resulting in global warming, also known as global climate change.

2.2] Carbon neutral community

According to the definition of the Intergovernmental Panel on Climate Change (IPCC), carbon neutrality, or net zero CO₂ emissions, refers only to carbon dioxide emissions and is a state of balance between the CO₂ emitted into the atmosphere and the CO₂ removed from the atmosphere. Currently, the entire world is looking for the adoption of carbon neutrality in all sectors. In order to demonstrate that the technical wing is conducting research into "how to limit carbon emissions," they have added it as an additional objective. The idea of "Carbon Neutral Communities" promotes zero-carbon development, preservation of the environment, self-sufficiency in food and energy, economic prosperity, and regional growth. Through the suggested activities of the resource center, it gives hope for supporting the Carbon Neutral Project.

If the GHGs (greenhouse gases) released into the atmosphere continue, this will lead to climate change action. The topic of climate change is a broad one, and the definition given by Nasa for climate change is: "It is a long-term change in the average weather patterns that have come to define Earth's local, regional, and global climates. These changes have a broad range of observed effects that are synonymous with the term". Human activities, especially the burning of fossil fuels, which raises the concentrations of heat-trapping greenhouse gasses in Earth's atmosphere and thus increases the planet's average surface temperature, are to blame for the climate changes that have been observed since the middle of the 20th century. Internal variability is one example of a natural process that can cause climate change but has been overpowered by human activity. There are some basic activities that would help us reduce carbon emissions.

2.3] Study Area (Kunaria village)

Kunariya village is 22 miles from Bhuj and belongs to Bhuj Block. With three villages included, the Kunariya Gram Panchayat has a total area of 95 square kilometers. The Kunariya Gram Panchayat is a Juth (group) Panchayat. It consists of the three villages of Le. Nokhania, Kunariya, and Rudramata, where the Rudramata Kunarlya Gram Panchayat settlement was founded in 1961. Since the creation of the Gram Panchayat in 1961, the Samras village's leaders have chosen the Sarpanch in accordance with their collective will.

However, with the help of young women, old people, and other villagers in general, the Gram Panchayat was able to build trust and claim their stakes in the Panchayat's activities. They also made some insightful suggestions for the village's well-being. The village has already taken part in many initiatives; they have planted 1.6 lakh trees in the past five years, and they will plant 40,000 more by the end of this year, which shows their strong determination for achieving their goals. They aim at achieving 17 goals by 2030; of the 17 goals mentioned, Kunariya Gram Panchayat is working on 13 of them with an aim to deal with behavioral changes among people.

The soil profile of the Kunaria is sandy loam. So the soil has poor water-holding capacity, and agricultural practices for a variant crop are difficult for them. The groundwater is also not suitable for drinking purposes due to the high deposition of inorganic salt and organic matter. The TDS value ranges from 800 to 2000 (mg/l), but in some areas it can reach 6000 (mg/l), which is frightening. So they well cannot be used. Additionally, Kutch is a region with little rainfall, which results in a lack of water for drinking, growing crops, etc. Due to the region's vulnerability to earthquakes, anything might disappear in an instant.

On the other hand, the post-earthquake period has given some benefits to the village: it got recognition at the national level, its houses changed from kachha to pakka, the living standards of the people rose, and the village underwent controlled development,. as per latest data TDS [total dissolved solids] levels of ground water has reduced from 4000 to 1500 (mg/l) .The indigenous knowledge system that the Kutch people possess has allowed them to survive in this environment. They coexisted with nature, and nature coexisted with them.

2.4] Drought

The Kutch region is a drought-prone area. So there is nothing much to say about Kunaria. The soil varies from sandy soil to sandy loam soil, which is poor in texture and has low nutrients. This soil is having poor water-holding capacity,



so water demanding species is quite challenging for cultivation. Salinity of soil is also high . Due to dry climate and sun light the water will easily get evaporated or water will be percolate easily through soil due to less water-holding capacity. The upper layer of the earth can be seen cracked, which indicates drought at its peak. So this will affect the groundwater, and the village will begin to suffer from water needs in the future.

III. RESEARCH METHODOLOGIES

An exploratory research design is adopted in the study. Here are the quantitative and qualitative research methods used for data analysis..the primary methodologies held by directly first hand source including the method like reconnaissance survey ,observation, interviews and discussion conducted with preparation of well structured questionnaires. The secondary methodologies for this study is derived from published works ,including academic journal articles , conference papers , textbooks and internet materials.

3.1] Data collection

3.1.1] Transact walk

The transaction walk conducted ,to develop an outline of the community or project and understand how residents are taking part in each initiative to carry out a carbon-neutral project. The transact walk helped to collect the information to understand structure of the village, crops that are grown in the village , soil type , land use pattern, species undertaken for plantation, watershed management program , indigenous and exotic species of the village , initiatives taken to create a carbon neutral village and mitigation done to reduce carbon emissions.

3.1.2] Semi structured interview

A semi-structured interview was conducted with various stakeholders in the village, including the anganawadi teacher and village sarpanch, who shared their baseline data about the village. The interviews were informal and conversational but carefully controlled. Here they also shared their local histories, related to crops, culture, development, epidemics, etc., and how things changed.

A series of guided questions (not structured questionnaires) were used. By discussing themes that interest the locals, important information was generated.

3.1.3] Village resource map

A pra tool that aids in our understanding of a community's resource base is the village resource map. The main goal is to gather meaningful data regarding local views of resources, not to create an exact map.

To understand how the locals view the natural resources that are available to them and how they are exploited.

3.2] Data analysis

1. Microsoft Office are used for the examination of various data.

2. SWOT analysis is used to understand and analyze the data obtained from site observation and reconnaissance surveys. it is used to identify the internal and external factor .



IV. RESULT AND DISCUSSION

4.1] General particular of the respondents

4.1.1] Human capital

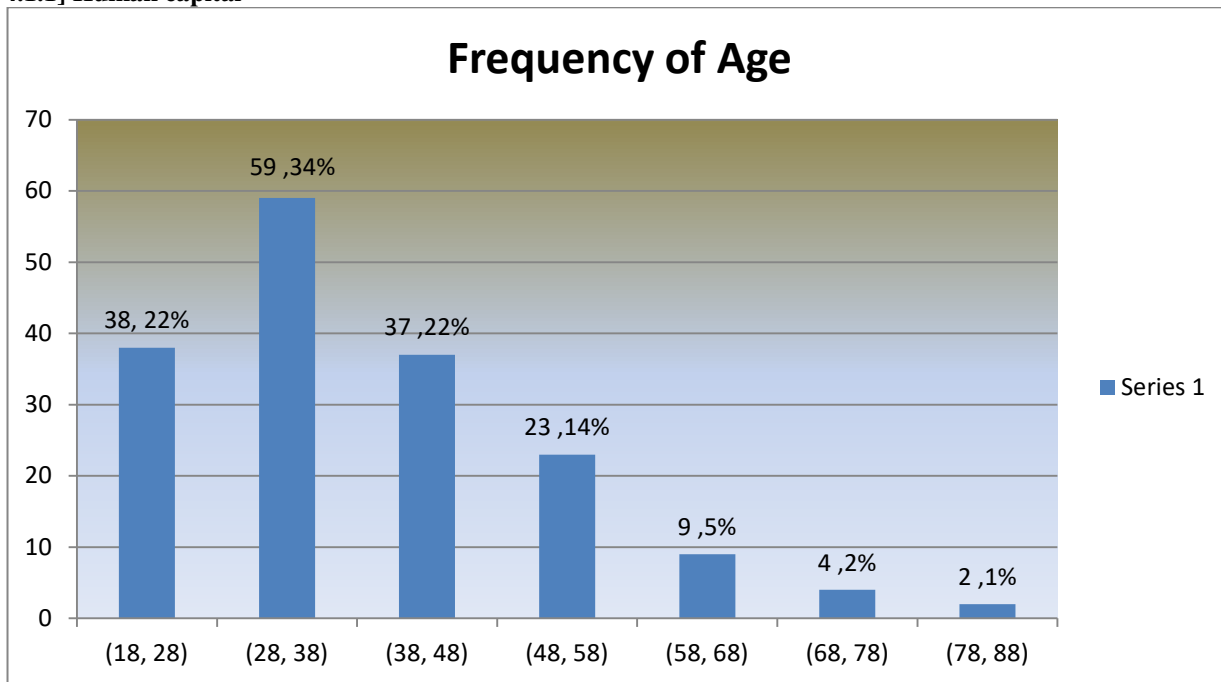


Fig 1.1 Age distribution of respondents

Fig 1.1 describes the age profile of the respondents, 22% of the respondents were between 18 to 28, 34% were between 28 and 38, 22% of the respondents were between 38 to 48, 14% were between 48 to 58, 5% were between 58 to 68, 2% were between 68 to 78 years old and 1% were above 78 years old. The observation clearly shows most of the respondents were between 28 to 38.

4.1.2] Education of the respondents

The study reveals that out of 172 respondents 4% studied up to diploma, 5% graduation, 47% up to higher secondary, 11% up to primary school, 31% up to SSLC, 22% were uneducated. The observation clearly says that most of the respondents studied up to SSLC. The observation shows that majority of the respondents is acquired basic education.

Education	Frequency	Percentage
Diploma	6	4%
Graduation	8	5%
Higher secondary	47	27%
primary school	19	11%
SSLC	54	31%
Uneducated	38	22%

Table 1.1 Literacy status of respondents



4.1.3] Income

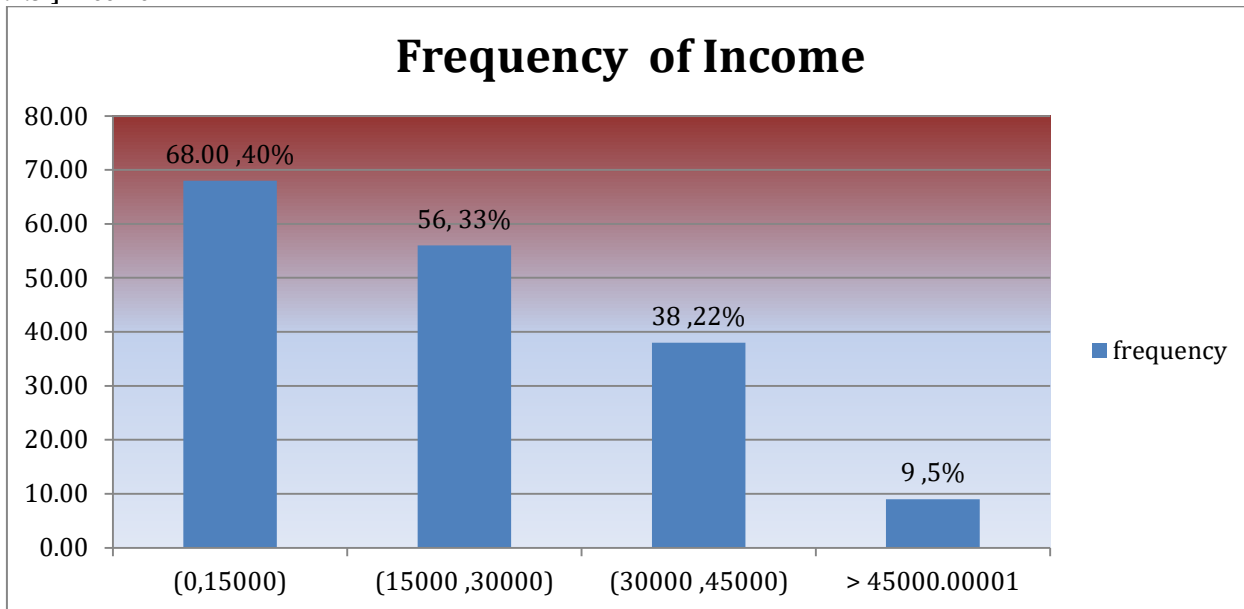


Fig 1. 2 Income distribution of respondents

Fig 1.2 shows that most of the respondents (40 %) were earning a maximum of 15000rs /per annum and only 5% of the respondents earned more than 450000rs/year. This data clearly states the low economic condition of the panchayat.

4.2] SWOT ANALYSIS

4.2.1] SWOT analysis on smokeless stove

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • support carbon neutrality by reducing CO₂e • reduce fuel wood into half • reduce indoor air pollution • more fuel efficiency about 35% -40% • reduce forest logging in the village • portable • no recurring cost • health benefits 	<ul style="list-style-type: none"> • 251 house still refused to install • cooking time is almost same • time consuming for wood collection and preparation • maintenance • women are mostly involved in fuel wood collection
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • new intervention for to achieve carbon neutrality • expensive costs of fuel alternatives • environment pressure on wood usage 	<ul style="list-style-type: none"> • maintenance • heavy • expensive

Table 1.2 SWOT analysis on smokeless stove



4.2.2] SWOT analysis on waste management

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • door to door collection of waste • panchayat active participation • implemented vermin bed ,compost pit and biogas plant • supports carbon neutrality • villager follow tradition method ,reduces food waste • community dust bin constructed • distributed dustbin for individual households (600) • limited E - waste 	<ul style="list-style-type: none"> • lack of knowledge about waste segregation • cost effectiveness of waste processing • poor awareness by villagers • absence of active landfills and recycling units • biogas plant is not fully efficient and temperature sensitive
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • organic manure production and income generate • supports farmers in the village • shift to cotton bag usage • barren land for waste treatment • exploration and expansion of green consciousness in resident • excess amount of biodegradable waste can used for vermin bed and compost pit 	<ul style="list-style-type: none"> • burning of waste • excess plastic bag usage • house garden produces excess waste • health risks • mixed fraction of waste affects

Table 1.3 SWOT analysis on waste management

4.2.3] SWOT analysis of plantation

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • carbon sequestration ability • active participation by villagers 	<ul style="list-style-type: none"> • water demanding species cannot be grown • limitation on species diversity



<ul style="list-style-type: none"> • stabilize the climate • reforestation and afforestation ease to achieve carbon neutral village • utilization barren land for plantation • Miyawaki plantation done to expand green cover of village • stabilize soil texture and land • advanced technology used • free from frost risk • better sunshine 	<ul style="list-style-type: none"> • ground water cannot suitable for irrigation(high TDS) • extra burden for soil preparation • limited precipitation • over exploitation of land from natural cover • sandy and sandy loam soil with less water holding capacity
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • exploitation of drip irrigation and water meters • road side plantation (aesthetic view and dust) • eco tourism spot • resting site for migratory birds [Australian crane (<i>Grus rubicunda</i>)] • employment generation • poverty elimination 	<ul style="list-style-type: none"> • arid climate • drought prone area • water scarcity • wild animal attack [nilgai (<i>Boselaphus tragocamelus</i>)] • poor soil texture • uneven distribution of rain

Table 1.4 SWOT analysis on plantation

V. CONCLUSION

Climate change is one of the main challenges that have been faced all over the world. We know that without climate stabilization, it is difficult for all living organisms to perform their functions, such as metabolism, growth, and development. A favorable environment and climate are two of the basic needs of living beings. Carbon emissions were one of the reasons for climate change, as per data from May 2022; the current CO2 concentration in the atmosphere was 421 ppm, which is so scary. CO2, along with other GHG gases, is the reason behind temperature rises and global warming. As the IPCC report states, limiting warming to around 1.5°C (2.7°F) requires global greenhouse gas emissions to peak before 2025 at the latest and be reduced by 43% by 2030. It should be controlled only by various mitigation strategies. To reduce our carbon footprint, we have to look for sustainable practices like waste management, water management, shifting to renewable energy for better efficiency, green infrastructure, afforestation, and reforestation. For carbon sequestration, water and air quality retention also have to be done. The ICICI Foundation and Kunaria Gram Panchayat have already gone through it. The people of the village are also very supportive, which is a positive sign for achieving carbon neutrality in the village in the future.

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