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REVIEW OF CARBON FOOTPRINT STRATEGIES

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ABSTRACT

The knowledge of carbon footprint is essential to discussions about sustainability and environmental concern. The need for industries, governments, and individuals to estimate and lesser their carbon footprints is growing on account of the deteriorating effects of climate change. This study was carried out to compare the studies of different disciplines and sectors on carbon footprint in the literature, environmental impacts, methods of measuring carbon footprint and measures to reduce carbon footprint. A carbon footprint is an vital pointer that shows the quantity of carbon dioxide (CO_2) and other greenhouse gas releases that come from normal human actions such as waste managing, transportation, food intake, and energy usage. In literature, it has been observed that the construction sector is the most dominant sector in CO_2 gas releases. Carbon footprint calculations in construction sector are profoundly important, thus the common Life Cycle Assessment (LCA) and the quantity of Life Cycle CO_2 Emissions have been emphasized in material and methods. Some important scientific studies conducted in recent years to reduce the carbon footprint reveals the importance of the construction sector. To sum up, dropping carbon footprints is critical to the fight against climate change. Working organized at the institutional, social, and individual levels is important to accomplishing a sustainable future. The present study, which includes the environmental impacts of carbon footprint, measurement methods and measures to reduce it, will be a guide for researchers in different disciplines studying carbon footprint in the future.

Keywords: Carbon Footprint, Sustainability, CO_2 Emissions.

1. INTRODUCTION

The knowledge of the "carbon footprint" has occurred as a key metrical for calculating the amount of greenhouse gases, specifically CO_2, that persons have formed into the atmosphere. Understanding and recognizing the effects of social activity on climate change then global warming wants this quantity. The idea of the carbon footprint has transformed over the past quite a lot of years from being an industrial figure to a word that is commonly used in ordinary speech. Considerate and lowering one's carbon footprint has developed vital for persons and organizations trying to reduce the environmental significances of climate change and global warming. From specific consumption to industrial manufacture, the carbon footprint is a figure used to calculate, analyze, and look into the environmental properties of social movements. The present world's rising energy demand, transportation advance, urbanization, and altering consumption behaviours have all improved carbon footprints and worsened the harshness of the global climate calamity. Thoughtful environmental difficulties brought on by climate change contain famines, floods, tremendously high temperatures, and biodiversity damage. Due to this, it is now indispensable for both persons and countries to take action to reduce their carbon footprints. But, figuring out the carbon footprint is hard since it contains indirect releases from waste administration, production, and consumption as well as direct releases that are emitted into the air. Furthermore specific efforts, falling the carbon footprint requires a thorough change brought about by collaboration and public understanding at the institutional and social stages. This research comparatively analyses articles in literature that investigate how carbon footprint affects the environment, how it can be measured and what measures can be taken. The influence of numerous strategies on letting down carbon footprints examined in literature have examined, including energy productivity, the shift to renewable energy sources, the help of environmentally friendly styles of transportation, and the usage of new materials.

2. LITERATUR REVIEW

As said by Joachim Schleich et al. [1], a main decrease in greenhouse gas emissions from humans is needed to lessen climate change. Along with behavioral and socioeconomic aspects, this study empirically scrutinizes the linking between carbon literacy and individual carbon footprints.

The relationships "carbon information" and "carbon appointment" are distinguished in the description of carbon literacy. This article's econometric study discovers and elaborates on the mechanisms of whole carbon footprints using large-scale representative investigation data from 1,000 people in Germany. These reasons include carbon footprints from heating, motorized individual transportation, power usage, flying, and food selections.

The research identifies a bad and strong correlation amongst carbon appointment and whole carbon footprint, in addition to with the carbon footprints connected with electricity feasting and nourishment.

Single part rise in the catalogue dazzling carbon appointment links to an approximate 4% reduction in total carbon footprint is given as a specific case study in the paper. In terms of carbon knowledge, the study reveals negative association with the carbon footprint from nourishment.

Additionally, vital relationships are found among carbon footprint, variables for instance gender, oldness, revenue, schooling, ecological likings, and political direction, usually aligning with anticipated patterns but varying crossways happenings. General, the results funding the idea that development carbon engagement is extra operative strategy than merely increasing persons' carbon information when aiming to reduce carbon footprints. Statistics related to carbon footprint are given in Table 1.

Table 1. Statistics related to carbon footprint [1].

Variable	Mean	Standard deviation	Minimum	Maximum
Aggregate footprint	7.05	27.88	0.90	836.88
Aggregate footprint (without aviation and cruises)	4.94	2.33	0.90	30.73
Electricity	0.45	0.47	-1.78	4.46
Heating	1.46	1.42	0.00	14.04
Motorized individual transport	1.43	1.65	0.00	27.08
Aviation	2.02	27.72	0.00	830.25
Cruises	0.09	0.57	0.00	6.42
Diet	1.59	0.30	0.90	2.10

Marinko Skare et al. [2] emphasize that digitalization is single of the main motorists of maintainable advance. This article thoroughly examines the effects of digitalization on the public segment, families, businesses, non-governmental administrations, introduced carbon footprints.

Utilizing digital carbon footprint models, board figures examination is applied toward investigate relationship among digitalisation and maintainable financial development.

The study's findings reveal that digitalisation has optimistic and statistically substantial result on maintainable growth, as restrained by the Sustainable Development Goals (SDGs). Besides, the outcomes funding the theory that improving whole factor efficiency, particularly emphasizing green entire factor production, is serious for achieving the SDGs.

The study finds that environmental footprints vary crossways areas and nations and, at greatest, are not convergence at the rate necessary to happen the 2030 SDGs. So, officials and experts should tactically review sustainability strategies to facilitate business and financial shifts, enhance climate change adaptation, and promote green economic development and maintainable development. The relationships between carbon footprint and the digital economy are shown in Figure 1.

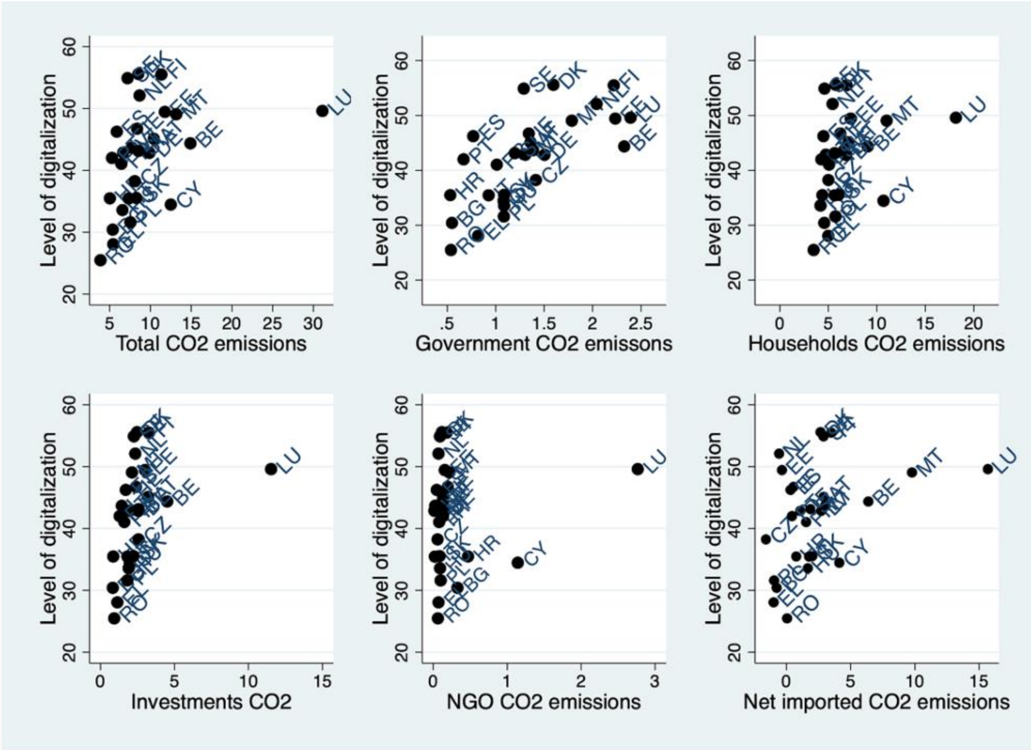

Figure 1. Relationships between carbon footprint and the digital economy [2].

David Castañeda et al. [3] describe lightweight geopolymers as alternative construction materials with low carbon footprints and potential for developing worth-added crops for the building manufacturing, for instance low-density brickwork elements.

This study aims to develop an innovative lightweight wall slab via ordinary pozzolan-founded geopolymer cement, hydrogen peroxide by means of a bubbling manager, and jute filaments by means of reinforcement.

The investigational study enabled the optimisation of the construction procedure and contributed to decisive the optimal hydrogen peroxide content, pozzolan-to-fine aggregate percentages, and the appropriate fiber satisfied to be involved.

The investigational consequences indicate the possibility of producing new brickwork blocks with a reduced bulk density of 1269 kg/m³ and a compressive strength of up to 8.1 MPa after a 28-day curing period. The creation of lightweight geopolymer and mortar examples is shown in Figure 2.

Shaoqing Shi and Jianhua Yin [4] conducted this study as a result of the growing rank of carbon footprint research in the framework of world-wide climate change, which has convert a important topic for numerous areas and researchers. The reason for this study is that no systematic, international literature review has been conducted on the carbon footprint. This study is grounded on a scientometric literature review and investigation of 7,450 papers from the Web of Science Core Collection. Among 1992 and 2019, carbon footprint research focused on areas ranging from biology and flora to world-wide trade, domestic behavior, and other issues. The permanent carbon footprint research focuses on water vapor. The research illustrations a tendency from minor to big, initial from persons and households, expanding to businesses and governments, and before to nations and areas. The year 2008 marked a significant turning point in carbon footprint research. While subsequent studies continued to focus on the classical literature before 2008, research after this year showed considerable diversity and interdisciplinary development. After 2008, there was an explosion of research trends among research institutions and academics in China. However, developing countries like China still allow most international collaborations to occur primarily between North America and European countries. The chief foundation of carbon footprint explore is "Veterinary, Animal, Science," but most research findings are related to "Environment, Toxicology, and Nutrition."

Additionally, carbon footprint research is increasingly merging with economic studies. These trends indicate a significant shift in themes and the development of knowledge in carbon footprint explore. The analysis procedure is publicized in Figure 3.Fabien Delhomme et al. [5] studied hempcrete, a building material composed of a mixture of cement, lime binder, and plant particles, which has a low carbon footprint. Due to its low density and high porosity, hempcrete exhibits perfect isolation, hygrothermal, and audio properties.

However, because of its mechanically weak nature, hempcrete should not be used by way of load-bearing substantial. Among other factors, it has limited mechanical features owing to Interfacial Transition Zone (ITZ) everywhere the unhydrated shiv, which is part of the matrix. The size and characteristics of this ITZ are crucial for improving the mechanical features of such bio-founded materials.

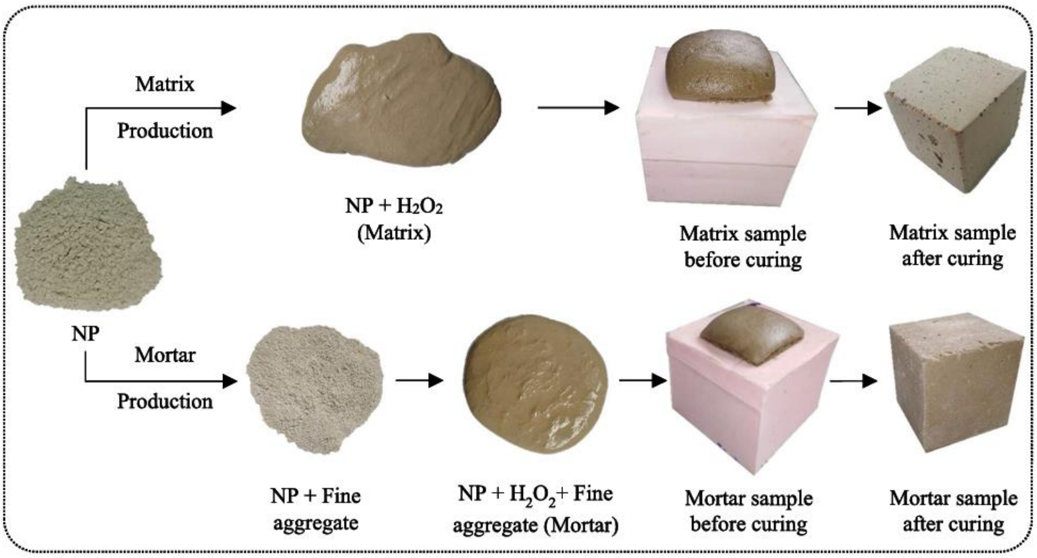

Figure 2. Production of lightweight geopolymer and mortar samples [3].

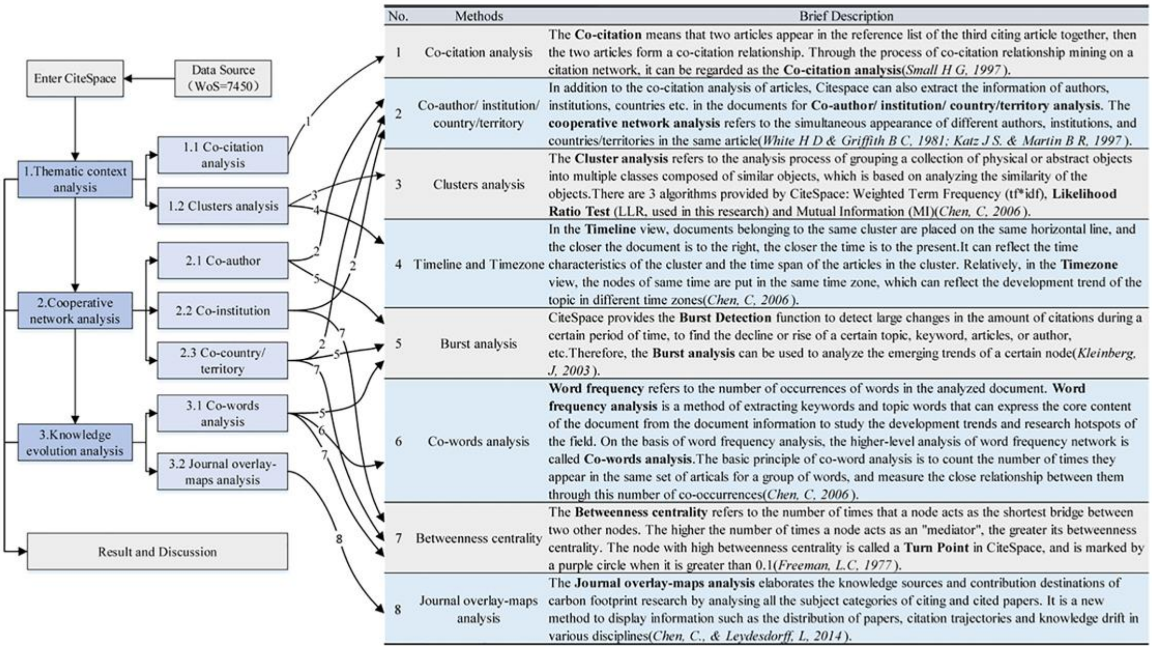

Figure 3. Analysis process [4].

New trial testing procedure based on duplicate analysis has been advanced to obtain consistent pictorial observations of ITZ formation. The leaching of the shiv and excessive water absorption affect the ITZ's strength and form. To learn more about these dehydrated regions around the hemp, a microstructural investigation has also been carried out. This experimental protocol will help identify the mixture parameters affecting ITZ development and assist in selecting the most suitable combination of binder and plant fiber pairs. The water absorbed by hemp is shown in Figure 4.

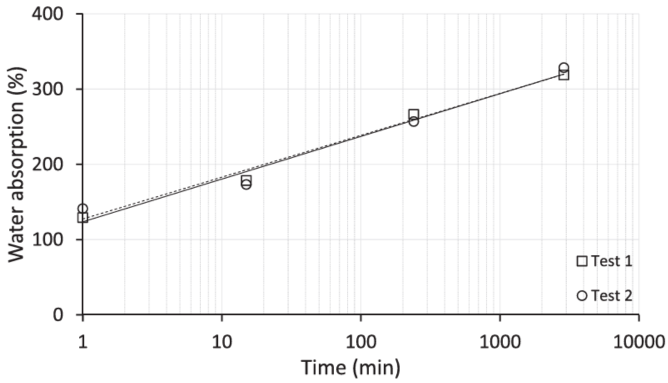

Figure 4. Water absorbed by hemp [5].

Hagar Hammad et al. [6] highlight that the building industry is single of the major suppliers to carbon footprints. High stages of carbon releases happen throughout the entire life cycle of buildings, from structure to operation and discarding. The academics discuss various carbon dioxide emissions and ways to decrease them in order to halt global warming and rising temperatures. This paper examines the numerous foundations of greenhouse gas releases in the structure sector to better recognise their harmful effects. A background was established for the operational

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phase of buildings. This framework enables the measurement of the impacts and physical properties, assisting politicians, investors, and authorities in creation well selections and choices to decrease carbon emissions throughout the operational procedure. The framework is designed to be field-applicable, elastic, easy to practise for investors, and to incorporate response from the initial phases of the procedure. A case study conducted by Nile University was used to test the anticipated framework by calculating the carbon emissions of a medium-sized structure. The flow chart of the study is given in Figure 5.

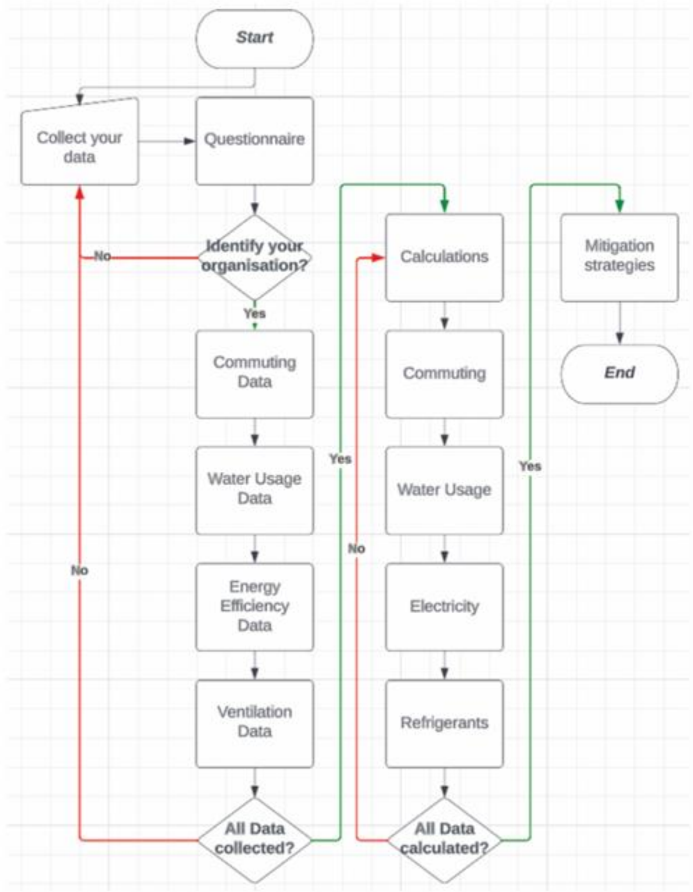

Figure 5. Flow chart of the study [6].

Andreas Wagner and Denise Fischer-Kreer [7] focuses on the part of Chief Executive Officers (CEOs) in corporate carbon emissions research and what they should do in the strategic decision-making processes of organizations. This study provides new insights into how a CEO's controlling attention can influence whether companies decrease carbon footprint. Using controlling attention theory, the paper suggests that two motivational tendencies of CEOs are related to business carbon releases. The study analytically examines S&P 500 companies from 2007 to 2018. The results show that CEOs with a high raise concentration are certainly linked with commercial carbon releases, while CEOs with in elevation inhibition focus are harmfully related with emissions. This relationship weakened due to changes in the industry. The study demonstrates that the intellectual and motivational features of CEOs are crucial for trade carbon administration. Research model is shown in Figure 6.

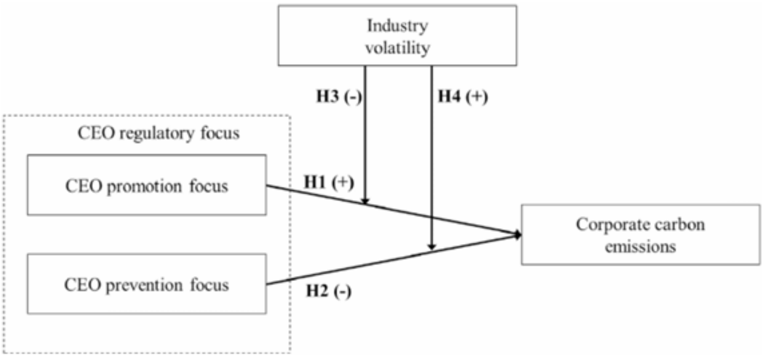

Figure 6. Research model [7].

Víctor Cloquell Ballester et al. [8] note that maritime transportation accounts for 13% of the carriage sector's greenhouse gas (GHG) releases. To improve the environmental performance of this sector, collaboration has taken place among ports, stations, shipping businesses, and other investors. The Spanish Ministry for Ecological Transition and Demographic Challenge advanced a method to measure carbon footprints. Processes covering Scope 1, 2, and 3, carried out by the Port Authority of Valencia, were adapted to this methodology. The results highlight the significant impact of ship traffic within the port (categorized as Scope 3, including containers and cruise ships) on the carbon footprint. Scope 2 is largely influenced by the lighting of buildings managed by the terminals. Scope 1 represents the consumption of gasoline and diesel. Despite a 24% increase in traffic at the port between 2008 and 2016, the carbon footprint remained stable. The results show a 17% reduction in emissions when compared with emissions using the baseline emission factors, which were adjusted to avoid outside issues. Future plans involving self-consumption and renewable energy strategies are the next step for a port with perfect results, although further improvements in Scope 3 activities are necessary. The location of the port of Valencia is shown in Figure 7.

Figure 7. Location of the port of Valencia [8].

Atmaca and Atmaca [9] have analysed the housing and commercial structures worldwide constitute approximately 40% of whole energy consumption. The construction sector contributes around 30% of international greenhouse gas releases. Evaluating the ecological carbon footprint (CFP) of the worldwide construction manufacturing is critical. This study examines relevant research to estimate the CFP of a residential structure built in Türkiye over a 50-year lifecycle, in view of the type of building materials, energy usage patterns, preservation, and demolition phases. The CFP of a residential structure in Türkiye was start to be 48.87 $kgCO_2eq/m^2/year$, with the CFP of materials used throughout the building stage being 6.94 $kgCO_2eq/m^2/year$.

The structural CFP accounts for approximately 14.21% of the total footprint. The operational phase represented the largest contribution, accounting for 64.11% of the CFP. Key strategies reduced CO_2 emissions by 38.05%. Different added studies, this research exposed that the CFP through residents' transportation exceeded that of the construction phase by 6.5%, contributing 15.13% to total emissions. By comparison studies on construction in changed nations demonstrated that CFP meaningfully depends on the selected system boundaries and the behavioral patterns of a country's population. The conclusions highpoint the importance of seeing the impact of transportation in future research. Figure 8 shows emissions by world regions.

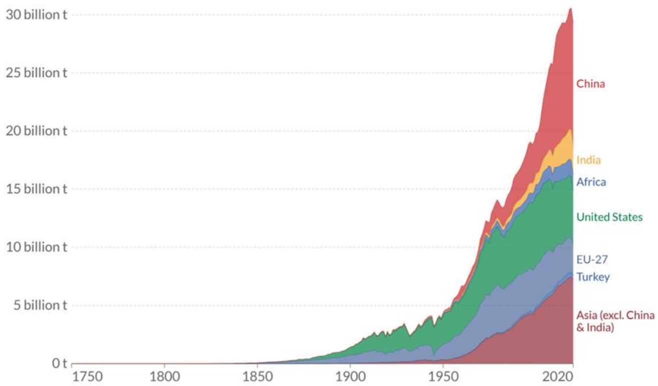

Figure 8. CO_2 emissions by world regions [9].

Aguerata Kabore et al. [10] have investigated on an eco-friendly construction materials known as hemp concrete with a low carbon footprint. This study aimed to evaluate the hygrothermal presentation of hemp material joint into a building cover via the hygrothermal instrument WUFI Pro 6.2. Earlier its application, the replication prototypical was validated by comparing it with existing models. The results of this validation showed a good correlation, providing greater confidence in using the model for additional parametric trainings on structure envelopes in warm climate regions. A hemp concrete wall system was modeled alongside two other wall organizations: compressed earth block walls and cement block walls. The hygrothermal goods of the resources or else wall instruments and occurrence solar radiation were the most significant variables in the simulations. The results demonstrated that hemp concrete exhibits excellent thermal performance and enables effective temperature and moisture control in the structure envelope. The inner exterior temperatures of hemp material walls fluctuated from 22.1 to 24.6°C; superficial temperatures fluctuated from

22.0 to 27.6°C; and outdoor surface temperatures ranged from 21.2 to 28.7°C, while external temperatures varied between 23°C and 45°C. Related to compressed earth slab and cement slab walls, hemp concrete walls maintained consistent interior superficial temperatures among 22.1°C and 24.6°C. Notably, increases in external temperatures had minimal impact on the inner temperature of hemp concrete walls. In decision, hemp concrete proves to be an excellent different material for construction in warm climate regions. The wall mount for corroboration of WUFI Pro 6.2 with Lamalle substantial data is shown in Figure 9.

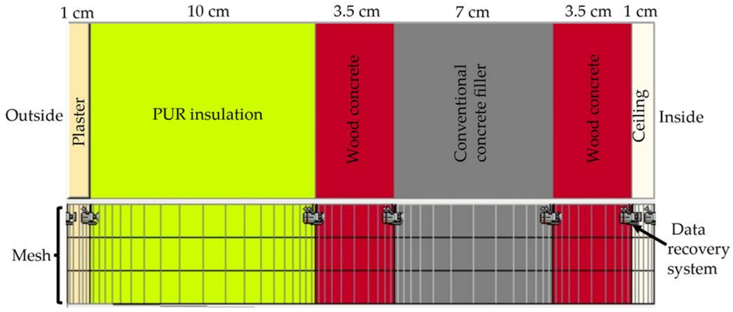

Figure 8. The wall mount for validation of WUFI Pro 6.2 with Lamalle material data [10].

GHG emissions resulting from traditional building techniques has spurred research into construction materials that are also carbon-neutral or carbon-negative in the study of Tarun Jami et al. [11]. Hempcrete, also known as lime hemp concrete (LHC) or else hemp concrete, is one such "green" building material. Hempcrete is typically composed of lime and hemp shives. This article offerings literature review of many studies on hempcrete to recognize its properties, advantages, and disadvantages.

The discussion focuses on hemp as a material, the practice of lime as a binder besides the mechanical, thermal, and hygienic assets of LHC. The article examines the ecological impact of LHC and its attributes, such as mechanical strength, thermal insulation, and environmental health benefits. It has been observed that further research is needed in areas such as the development of mix design principles, improvement of LHC's compressive and flexural strengths, then its possible practice by means of a structural substantial in high-rise buildings. Promising recommendations include exploring cradle-to-grave GHG releases, recyclability, and reusability of hempcrete to ensure sustainable and eco-friendly construction practices. Hemp concrete slab is given away in Figure 9.

Figure 9. Hemp concrete block [11].

A native tree specie laurix principis-rupprechtii, found in Northern China, has been utilized to produce harvested wood products (HWPs) in the study of Fei Lun et al. [12]. This study focuses on approximating and comparison the carbon movements and carbon footprints of numerous HWPs derived from Laurix principis-rupprechtii. The analysis uses a life cycle approach that spans from seedling farming to the final disposal of HWPs. The system boundary is divided into three phases: forestry, production, and usage and disposal. Over one forest rotation period, 26.81 tC/ha of carbon sequestered throughout the life cycle of HWPs is transferred to these products, with 66.2% remaining in HWPs by the finish of the turning period. However, by the 100th year after forest planting, the carbon storage rate of HWPs decreases to 0.25 tC/ha (only 0.9%). Although the production phase contributes to over 90% of the whole HWP carbon footprint, its contribution to carbon storage is less significant. Among various HWP categories, construction products exhibit the most favorable carbon balance, with the lowest carbon footprint and highest carbon storage, compared to furniture and panel products. HWPs contribute to global carbon mitigation by retaining a portion of sequestered carbon for a specific duration. Moreover, there are significant opportunities to further reduce carbon emissions from HWPs through more efficient use of wood fuel and the adoption of cleaner energy sources. The scheme border of the whole life cycle of HWPs through Larix principis-rupprechtii is shown in Figure 10.

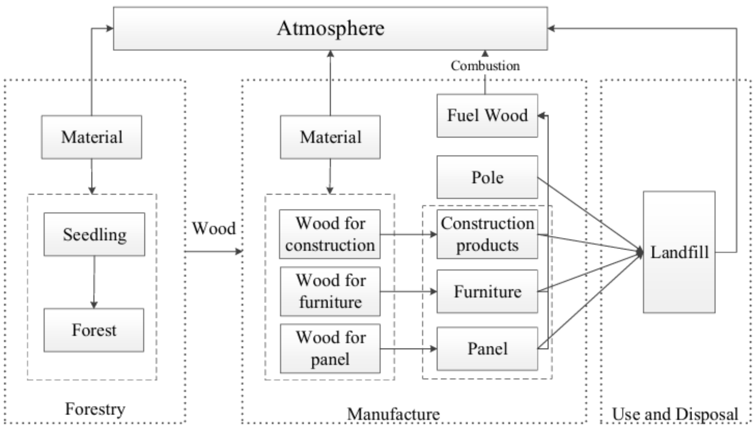

Figure 10. The system border of the whole life cycle of HWPs from Larix principis-rupprechtii [12].

In the study of Luqian Weng et al. [13], alkali-activated slag cement concretes (AASCCs) can be utilized to reduce carbon footprints and meet sustainable development requirements. This article discusses the findings of a modeling study that evaluated the thermo-stress behavior of in-situ cast alkali-triggered slag cement concrete cured in a hot atmosphere to see the circumstances necessary for marine engineering applications. The study reveals that AASCCs exhibit significantly lower heat release compared to traditional concretes. This property makes alkali-activated slag cement concrete an ideal choice for in-situ casting of massive concrete structures in hot climates, even outperforming traditional Portland cement-based concretes in such conditions. Thermal pressures in a cross section of the concrete wall at numerous ages are shown in Figure 11.

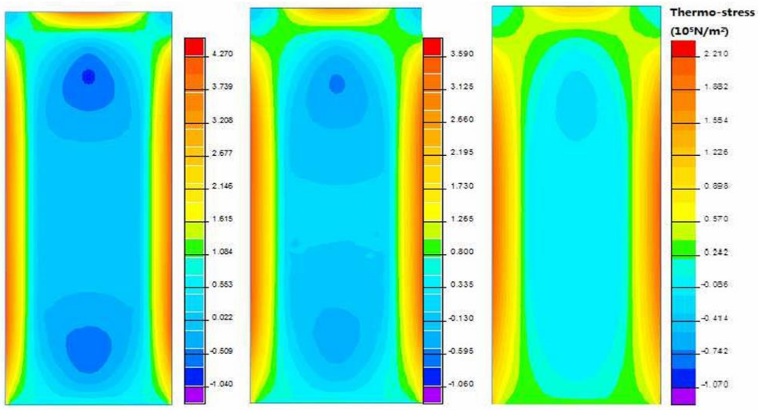

Figure 11. Thermal pressures in a cross section of the concrete wall at numerous ages [13].

Energy efficiency and a low carbon footprint have investigated in the study of Xiang Zhao et al. [14] for architectural design consept. Consequently, the development of new materials and innovative building types are essential. This article introduces notable model projects that utilize ETFE (Ethylene Tetrafluoroethylene) air cushions and outlines the fundamental physical properties of this advanced material. Furthermore, it discusses design strategies that contribute to energy conservation and reduced carbon footprints in buildings, including inactive solar heating, large-length structural systems, ordinary daylighting also cavity airing. These measures highlight the potential of ETFE-based constructions in achieving sustainability goals in modern architecture. ETFE Domes of The Eden Project, UK is shown in Figure 12.

Figure 12. ETFE domes of the Eden project, UK [14].

3. MATERIALS AND METHODS

The analytical approaches used in carbon footprint measurement methods in the literature are used in conjunction with the LCA. PAS 2050, ISO 14040, and ISO 14067 are standards inured determine the carbon footprint in LCA. The process of investigating and calculating the environmental impacts of a product at numerous phases of its life cycle is known as LCA. LCA identifies the environmental burden by taking into account all inputs, such as building materials, water, energy, and waste materials, and may be estimated using the following Equation 1. In the calculation, I matches to the life cycle environmental effect.

$$I = I_{Disposal} + I_{Extraction} + I_{Recycling} + I_{Manufacture} + I_{Demolition} + I_{Onsite} + I_{Operation} \quad (1)$$

For Life Cycle Carbon Dioxide Releases (LCCO$_2$A), the CO_2 emissions released by the system are of serious significant, while for Life Cycle Energy Analysis (LCEA), the energy participations to the system are the important attention. A modest model of LCEA and LCCO$_2$A is given in Figure 8 [15].

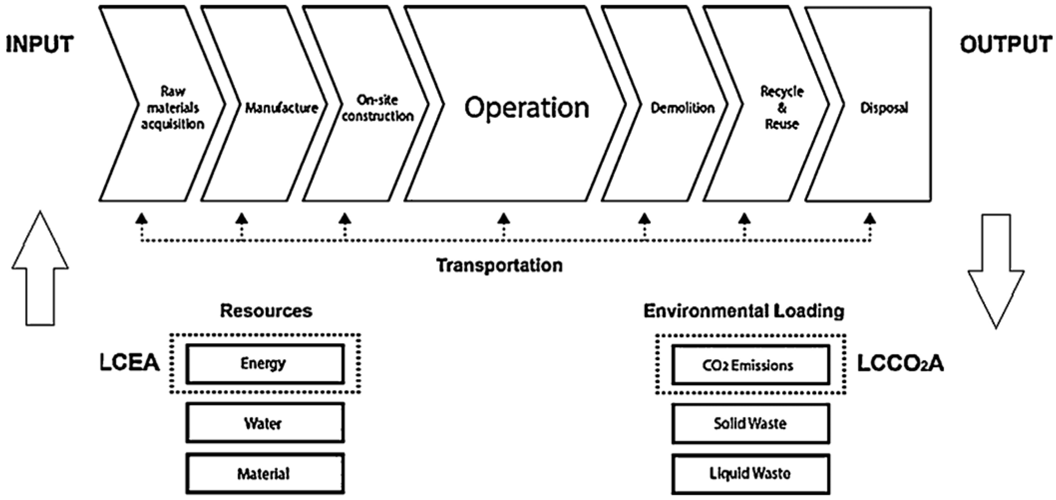

Figure 8. Model of LCEA and LCCO$_2$A [15].

LCEA, the energy consumption is designed by considering completely energy participations. The energy consumption examination takes into account the energy used throughout the production, operation, and demolition stages. The production stage contains the industrial and transportation of construction materials, in addition to any reconstructions to the structure. The operation stage encompasses events within the construction that consume energy through its lifespan, for example heating, cooling, and electricity usage by electronic devices. The demolition stage includes the procedure of dismantling the construction after its beneficial life, including the reprocessing of materials like steel and concrete, or their disposal in landfills. LCEA can be conducted using main energy sources for example coal and fossil fuels, in addition to secondary energy sources like electricity [16].

By rearranging Equation 1 by writing the E term rather than the I term, LCEA can be designed as in Equation 2. In this calculation, the E value corresponds to the whole energy spent by the construction throughout its full life cycle.

$$E = E_{Disposal} + E_{Extraction} + E_{Recycling} + E_{Manufacture} + E_{Demolition} + E_{Onsite} + E_{Operation} \quad (2)$$

The quantity $LCCO_2A$ might be designed by replacing the term "I" with "CO_2" in Equation 1, as shown in Equation 3. In this calculation, CO_2 embodies the whole carbon emissions throughout the entire life cycle. The equivalent carbon emissions released at wholly stages of the structure's life cycle are taken into account.

$$CO_2 = CO_{2_{Disposal}} + CO_{2_{Extraction}} + CO_{2_{Recycling}} + CO_{2_{Manufacture}} + CO_{2_{Demolition}} + CO_{2_{Onsite}} + CO_{2_{Operation}} \quad (3)$$

There are three approaches used in life cycle investigation. The choice of technique meaningfully impacts the correctness and trustworthiness of the life cycle assessment. The first technique is method examination, the subsequent is hybrid analysis, and the last is input-output (I-O) analysis. The process analysis method has some disadvantages because of confusion arising from products and services. The input-output analysis, which is a more general technique and usually used by most researchers, utilizes regular values across completely sectors. Moreover, input-output analysis is frequently mentioned to as a "black box" [17]. The I-O-based hybrid analysis technique combines the information involved in the process, thus avoiding horizontal truncation and downriver exclusion. The data associated the product are obtained through the procedure analysis method. While it is moderately challenging to obtain the inputs vital in the process analysis method, it significantly enhances the reliability and correctness of the analysis. This I-O-based hybrid analysis method is suggested by Treloar [18] and has been combined in life cycle assessment studies [19]. These three approaches has its own benefits besides difficulties. However, when conducting Embodied Energy (EE) analysis, the greatest reliable method is the hybrid analysis approach. PAS 2050, ISO 14040, and ISO 14067 are standards inured determine the carbon footprint in LCA. When conducting an LCA, it is essential to gather accurate and reliable data from buildings.

Energy consumption is influenced by several issues, for instance the types of construction materials and the lifestyles of the occupants. Carbon emission values in buildings consist of two main factors: the first is the direct carbon emissions throughout the building of the structure, and the second is the indirect emissions that occur during production stages, the transportation of resources, and the recycling processes of waste materials. The most critical factor in LCA is a functional unit that provides a reference based on the impact assessment of a system. In this study, a structure with fixed supports was modeled, and the same structure was re-modeled with seismic isolators, reducing the dimensions of the structural elements. Consequently, the quantity of materials used in the construction differed. The total EE and CO_2 values for both the fixed-support and seismic-isolated structures were calculated. The following system boundaries were considered during the LCA: The production phase includes the industrial of structure materials and their carriage. Maintenance of the building throughout its lifespan. Daily activities that consume energy (e.g., heating, cooling). The demolition of the structure and the recycling of construction materials [20]. The stages of the life cycle assessment are shown in Figure 9.

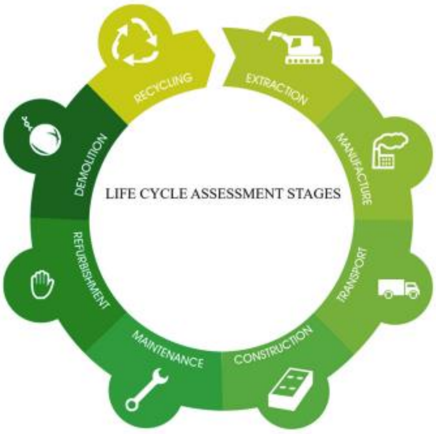

Figure 9. Model of LCEA and $LCCO_2A$ [15].

4- RESULTS AND DISCUSSIONS

The use of LCA and IOA methods in measuring carbon footprints facilitates a better understanding of both direct and indirect emissions. The Hybrid Method, which combines LCA and IOA, yields more detailed and precise results, especially in complex supply chains. Applying these calculation methods is highly beneficial for individuals and organizations to assess their carbon emissions and to develop plans for reduction. The study demonstrates how carbon footprint calculations vary across different sectors and lifestyles. Carbon footprint has a significant impact, particularly on transportation, dietary habits, waste management, and energy consumption. One of the primary components of carbon footprint is fossil fuel usage. As dependency on fossil fuels for electricity generation increases, the carbon footprint resulting from energy use will also rise. Utilizing renewable energy sources can significantly reduce carbon footprints. Substantial carbon emissions are produced due to fossil fuels used in transportation. Promoting the use of electric automobiles, bicycles, and public transit is a good way to lower carbon emissions associated with transportation. The manufacture of animal products produces extra greenhouse gasses than the manufacture of plant-based sustenance. The considerable quantities of energy and water wanted in the production of meat and dairy products bring about a high carbon footprint. Individual carbon footprints have been established to be meaningfully reduced by shift to plant-based nourishments. Reusing and trash lessening methods are vital in lessening carbon footprints, since reusing explicit waste substances can decrease raw material utilization and, then, emissions. To lesser carbon footprints, administrations and businesses must make important adjustments as well as different initiatives. Growing the usage of renewable energy sources is one of the highest conducts to do this. Carbon emissions are reduced by renewable energy sources containig solar, wind, and hydroelectric power, which diminish reliance on fossil fuels for energy production. It may be luxurious and time-consuming to make variations to the present energy substructure and procedures so as to make the switch to renewable energy. Dropping the carbon footprint of cities will generally rely on the modification to sustainable modes of transportation, for example encouraging the use of electric vehicles, making public transit, and extending bike lanes. This transformation is not without its complications, however, for example the prerequisite for better substructure, the installation of charging stations for electric cars, and the promotion of public transportation use. Carbon footprints may be significantly reduced by implementing sustainable dietary behaviours, for example eating foods that are obtained locally and converting to plant-based diets. Persons might find it hard to alter their eating habits, and social considerations might make this modification hard. By putting a spherical economy idea into practice, waste production and resource consumption might be reduced. Recycling makes trash administration easier, and it may lesser carbon footprints, specifically when it comes to recycling plastic and electronic junk. But, it takes important substructure expenditures to set up a viable reprocessing system.

Individual efforts in addition to corporate and administrative regulations must be put into place with the aim of effectively lesser carbon footprints. Persons must modification their consumption and mobility patterns to become further energy efficient. To have a better effect on dropping carbon footprints, administrations must create climate-friendly protocols and businesses must shift to sustainable production practices.

Table 2. Comparison of Carbon footprint strategies by different disciplines in literature

Reference	Environmental Effects	Gauging Techniques	Measures
Joachim Schleich et al. [1]	Greenhouse gas emissions from humans	Large-scale representative investigation data from 1,000 people in Germany	Development carbon engagement strategy should be considered in statistically
Marinko Skare et al. [2]	The effects of digitalization on the carbon footprints	Utilization digital Carbon footprint models	Officials and experts should tactically review sustainability strategies to facilitate business and financial shifts, enhance climate change adaptation, and promote green economic development and maintainable development.
David Castañeda et al. [3]	Greenhouse gas emissions from construction materials	Experimental analysis with the optimisation of the construction procedure and contributed to decisive the optimal	Alternative construction materials with low carbon footprints and potential for developing worth-added crops for the building manufacturing

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		hydrogen peroxide content, pozzolan-to-fine aggregate percentages, and the suitable fiber content	
Shaoqing Shi and Jianhua Yin [4]	World-wide climate change	Systematic international literature review investigation	The main fields of carbon footprint research include Environment, Toxicology, Nutrition and finally economy
Fabien Delhomme et al. [5]	Greenhouse gas emissions from construction materials	Experimental analysis	Utilization of a low carbon footprint building material (hempcrete)
Hagar Hammad et al. [6]	High stages of carbon emissions from building industry	Calculation of the carbon emissions with a case study	Recogniton of the numerous foundations of greenhouse gas emissions in the building sector and practical application
Andreas Wagner and Denise Fischer-Kreer [7]	Carbon footprint from companies	Analytical examination of S&P 500 companies from 2007 to 2018	The cognitive and motivational aspects of CEOs are crucial for corporate carbon management
Víctor Cloquell Ballester et al. [8]	Carriage sector's GHG releases from maritime transportation	Measurement of carbon footprints method given by The Spanish Ministry for Ecological Transition and Demographic Challenge	Reduction in emissions when compared with emissions using the baseline emission factors

Atmaca and Atmaca [9]	Global greenhouse gas emissions from residential buildings	Analytical CFP calculations (type of construction materials, energy consumption habits, maintenance and demolition stages)	The effects of transportation, construction material selection and energy consumption habits should be taken into consideration
Aguerata Kabore et al. [10]	Global greenhouse gas emissions from building envelopes	Assessment of the hygrothermal performance of hemp concrete integrated into a building envelope using the hygrothermal tool WUFI Pro 6.2	The excellent thermal performance of hemp concrete and its positive effects on sustainability control in the building envelope.
Tarun Jami et al. [11]	Greenhouse gas emissions from construction materials	Systematic literature review investigation	Promising recommendations include exploring cradle-to-grave GHG emissions, recyclability, and reusability of hempcrete to ensure sustainable and eco-friendly construction practices
Fei Lun et al. [12]	Carbon footprint from the forestry production to the disposal	The life cycle analysis approach (from seedling cultivation to the final disposal of)	Significant opportunities to further reduce carbon emissions from the specific trees through more efficient use of wood fuel and the adoption of cleaner energy sources.
Luqian Weng et al. [13]	Greenhouse gas emissions from construction materials	Experimental analysis	Utilization of alkali-activated slag cement concretes reduce carbon footprints and meet sustainable development requirements.
Xiang Zhao et al. [14]	Carbon footprint and enegy efficiency architectural design	The life cycle analysis with the development of new materials and innovative building types	Achieving sustainability goals in modern architecture by the potential of Ethylene Tetrafluoroethylene -based constructions

4- CONCLUSIONS

Current studies in literature on the concept of the carbon footprint, its environmental effects, gauging and reduction methodologies are scrutinized in this paper. The carbon footprint is a vital metric for evaluating how much each people, group, and country contributes to climate change. It is closely related to normal activities including energy usage, transportation, diet, and waste removal. According to the present study, carbon footprints might be significantly reduced by using materials, especially in construction sector. In addition, renewable energy, encouraging ecologically friendly transportation, embracing plant-based nourishments, putting spherical economy ideologies into reality, and cultivating a additional maintainable economy are other prominent methods used to decrease carbon footprint. But, dropping the carbon footprint requires community cooperation as well as individual and official cooperation. Managements must therefore enact laws that are environmentally sensitive, businesses must use eco-friendly manufacturing methods, and persons must adopt maintainable lifestyles. It is sure that energy, transportation, and consumption shapes will need to be reshaped so as to decrease greenhouse gas emissions. As well as protection the environment, this is as well essential to reduce the negative consequences of climate change. In summary, with the aim of create a more sustainable and liveable world in the future, hard work to lesser the carbon footprint must be intensified. In this context, it is vital to promote the adoption of numerous sustainable approaches, ranging from individual initiatives to societal alterations, with shared responsibility from entirely areas of civilisation.

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