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THE IMPERATIVE NEED FOR SUSTAINABLE DEVELOPMENT STRATEGIES IN IRAQ'S CONSTRUCTION INDUSTRY

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ABSTRACT

Iraq's economy was devastated by years of war, and so was the case for its industries, including the construction sector. However, the developments in the last few years indicate positive growth, and the construction sector will be instrumental in the country's economic growth. However, as the construction sector continues to rely on traditional construction methods, the existence of Iraq's future generation hangs in question, as does the quality of life they would have.

This research explores the imperative need for sustainable development strategies in Iraq's construction industry. Due to its geographical positioning, the country faces a hot and dry climate with a prevalent water shortage. In this context, adopting sustainable construction practices becomes a need of the hour.

This research explores the current challenges Iraq's construction industry faces and various sustainable construction practices from the existing literature. It uses semi-structured interviews as a data collection method from qualitative research to interview 16 participants; nine of them are senior managers, while six are CEOs in Iraq's construction companies. Their responses on issues such as challenges faced in implementing sustainable construction practices, benefits of sustainable construction practices for Iraq, suggested design features for sustainable housing projects, local community and stakeholder engagement, impact measurement for sustainable construction projects, and potential benefits for community from sustainable housing projects have been analysed and discussed in this research.

KEYWORDS: Iraq, construction industry, sustainable development, liveable future, climate change, environment protection.

1. INTRODUCTION

The construction industry in Iraq was severely affected by the rise of the Islamic State in the country. With the extensive destruction caused by this internationally recognised terrorist outfit and various instances of sectarian violence, the country now appears to be focused on rebuilding its infrastructure

and promoting economic development [1]. As a result, the construction industry is currently in a crucial phase to recover and grow after years of instability and conflict in the region. According to a Yahoo Finance report, the annual average growth of the construction industry in Iraq is expected to be around 5% from 2024 to 2027, with an increased focus on the completion of stalled construction projects worth \$18 billion [2].

The Iraqi government has received support from international organisations and foreign investors to prioritise and build critical infrastructure, including hospitals, schools, housing facilities, bridges, and roads [3]. Multiple large-scale projects are underway, such as rebuilding Mosul, rehabilitating the Old City, and restoring essential services across the country [4]. The government has launched the “Reconstruction Fund for Areas Affected by Terrorist Operations” to utilise resources for adversely affected areas [5]. Moreover, while international donors have already contributed billions in aid, countries like Turkey [6] and China [7] have participated in various construction projects, such as commercial buildings and residential complexes.

The construction industry will drive Iraq’s quest for economic development for multiple reasons. First, it creates many job opportunities that will be essential to controlling the country's high employment rate and poverty. Given the construction industry’s labour-intensive nature, it has the potential to absorb a prominent portion of the available workforce. This will specifically benefit young Iraqi residents and provide them with social stability.

Second, infrastructure rebuilding has a positive domino effect on the recovery of other sectors, such as transportation, healthcare services, and education. All of these sectors contribute to the development of human capital in sync. Moreover, modernised infrastructure can attract foreign investments, providing capital for other economic activities. Similarly, the growth of the construction industry contributes to the development of allied industries such as manufacturing and services. This multiplier effect can add further stability to the country; therefore, the construction sector will continue to be a cornerstone of the country’s long-term development.

On the other hand, Iraq faces an uphill battle against environmental challenges such as air pollution, desertification, and water scarcity. According to IQ Air World Air Quality rankings, Iraq was ranked sixth in the countries with the worst air quality after Bangladesh, Pakistan, India, Tajikistan, and Burkina Faso. Iraq’s capital, Baghdad, has the worst air quality of all major cities in the world [8]. The leading contributors to air pollution in Iraq include oil exploration, industrial emissions, vehicle exhaust, and burning of fossil fuels. Traditional construction methods are energy inefficient, resulting in higher greenhouse gas emissions. Construction projects without modern energy-efficient technologies undoubtedly require additional heating, cooling, and lighting energy [9]. Meanwhile, the country’s fertile lands turn into arid deserts, worsening the food security [10]. With decreasing water levels in rivers such as Euphrates and Tigris, water scarcity is another emerging challenge that the country needs to deal with [11].

The continued reliance on traditional construction practices contributes to these environmental issues. The construction sector requires large quantities of building materials like sand, water, and gravel, contributing to continuous resource depletion [12]. Lacking waste disposal mechanisms for construction waste, inefficient waste management accumulates debris in landfills and open areas, resulting in land pollution and decreased usable land. To address these challenges, adopting sustainable construction practices such as implementing energy-efficient solutions, improving waste management practices, and controlled extraction of natural resources is necessary to minimise or mitigate the environmental impact and envision a sustainable future for the country and its people.

Sustainable development is a comprehensive, future-first, and holistic approach that meets today's demands without compromising future generations. It proposes a balanced and equitable approach to development. It integrates social inclusion, environmental protection, and economic growth to achieve this. As the global community becomes increasingly aware of climate change and its potential impacts, sustainable development is gaining traction to address climate change, natural resource depletion, and social inequalities [13].

At present, multiple international agreements and covenants promote sustainable construction practices. For instance, the United Nations' 2030 Agenda for Sustainable Development, through Sustainable Development Goal (SDG 11), promotes sustainable communities and cities with resiliency in overall infrastructure and resource-efficient buildings [14]. The Paris Agreement, an international treaty on climate change, encourages countries to adopt and implement green building practices to decrease carbon emissions and increase energy efficiency [15].

The LEED (Leadership in Energy and Environmental Design) certification, developed by the US Green Building Council, is a globally recognised sustainable construction standard promoting resource efficiency and environmentally responsible construction projects [16]. The World Green Building Council's Advancing Net Zero Initiative is another step in this direction, as this initiative's goal is to achieve 100% net zero carbon buildings by 2050 [17]. These international initiatives underline the importance of sustainable construction for long-term development and mitigation of environmental impact.

In the following chapters, this research highlights this gap in existing industry practices and the need for sustainable development strategies in Iraq's construction sector. It explores the imperative need for Iraq's leading players in the construction sector to adopt sustainable development strategies so that the rest will follow suit. The next chapter provides a comprehensive literature review of the subject matter, discussing the outcomes of existing literature on the lines of existing challenges in Iraq's construction industry and sustainable development's role in the construction industry. The third chapter provides information about implementing a qualitative methodology for conducting a study based on semi-structured interviews with open-ended questions. A total of 16 participants consented to participate in

this study. Of these 16 individuals, nine are currently working as managers in Iraq's construction companies, while the remaining seven are Chief Executive Officers of their construction companies.

2. LITERATURE REVIEW

While the Iraqi economy is slowly picking up the pace and the construction sector is on its way to recovery, rebuilding, and transformation, it faces many challenges. As identified by Al-karawi [18], these challenges can be categorised under 11 heads: political, financial and administrative problems, and problems related to tender documents, quality of work, contracting parties, sector environment, natural environment, dispute resolution, technology usage, and ethical issues. The author also recognised the prominent role of the construction sector in the country's economic development and pushed for an urgent need to address these challenges. In another paper, while discussing challenges in the successful completion of construction projects in Iraq, researchers Khudhaire and Naji divide the challenges into six groups: management-related, finance-related, cost-related, time-related, resource-related, and external challenges [19]. While management and finance-related challenges are addressed with adequate human and financial resources, the other four challenges remain an obstacle for the construction industry. Lack of time-bound completion of projects and instability associated with costs often push the construction sector away from adopting sustainable development practices, and construction companies continue their traditional practices [20].

According to a UN report, the 2003 war resulted in the destruction of over 70% of the country's infrastructure, consisting of bridges, roads, oil refineries, storage tanks, electric power plants, educational institutions, industrial facilities, and communication systems. The country could only generate 20% of its pre-war capacity when the war ended [21]. At the 2003 Madrid Conference, a joint team of the United Nations and the World Bank assessed the country's funding needs. The assessment found that the country needed a minimum of \$36 billion for the next three years, i.e. 2004 to 2007, across 14 sectors. The Coalition Provisional Authority estimated an additional \$20 billion is needed, including \$5 billion for law enforcement and \$8 billion for the oil industry [22].

Neamat and Yitmen conducted a study focused on the Kurdistan region of Iraq, and their research sought to identify factors preventing innovation and competitiveness in the construction industry in the area. After analysing over 85 responses to their questionnaire, they found a lack of skill development at construction companies, along with financial shortages [23]. This prevents innovation or any possible shift towards sustainable development practices, which is also supported by the findings of Hatem et al. [24]. In line with them, Mahdi and Mawlood illustrate how other countries have started adopting modern and sustainable practices, Iraq continues to depend on traditional methods for the design and management of construction projects [25].

However, it must be noted that the construction sector in Iraq has faced multiple changes in the past few decades, which may not be similar to the experience of construction sectors in other countries. For example, a lack of a stable political environment, years of conflicts and war, absence of well-defined

rules and regulations, and unavailability of basic infrastructural requirements [26]. Fadhil and Burhan's research underlines that a single construction project is a complex set of activities performed in an environment with dozens of uncontrolled variables. They critically analysed the financial crisis of 2014, in which Iraqi state bodies were not able to pay contractors. This negatively impacted the project completion timelines as contractors struggled to avail the required materials for their projects [27]. The authors found that financial and administrative corruption was one of the biggest reasons for the further worsening of the situation for project contractors. Their survey found that the country continues to suffer from corruption, even after multiple announcements by the government to initiate a fight against corruption. This outcome is in line with the findings of Faeq and Khaleel as they worked on identifying the most critical construction risks and how they impact a construction project in Iraq. Their analysis of responses given by 44 participants points towards inefficiency in project delivery due to time delays. Time delays occur due to a lack of payments, and hence, they concluded that this prevents the contractors from innovating or adopting a new approach [28].

Similar concerns were raised in 2020 research by Hadi, where the researcher conducted an exhaustive literature review on the current performance of Iraq's construction industry. He found that project delays and cost overruns are common reasons for construction project failures in the country [29]. Moreover, a lack of security measures for project stakeholders, a corrupt tendering process, and low productivity further hamper the growth prospects of the construction industry [30]. Other important issues include lack of skilled labour, non-fulfilment of contractual obligations, and regulatory interventions in business operations. As the existing projects face delays, the construction companies cannot realise the profits on the projects as they should. As a result, they cannot adopt technology-based solutions or move towards sustainable development practices [31].

In their research, Al-Qaicy and Breesam conducted an analytical study to evaluate the readiness of Iraq's construction sector to manage reconstruction initiatives post-disaster. They found that even though the concerned Ministry has developed disaster recovery plans after years of exposure to war, most respondents in their survey were unaware of it. Only 9% of the respondents had well-defined guidance for implementing recovery campaigns for disaster reconstruction and how these campaigns differ from regular construction projects [32]. In similar research conducted by Waheeb and Andersen, the researchers analysed the reasons behind time delays and cost overruns in 30 post-disaster reconstruction projects in Iraq. The authors noted that there is very little data available on construction industry-related issues in Iraq in the last 10-15 years. They found 12 factors that impacted time delays and cost overruns. These 12 factors more or less align with the factors identified earlier by Al-karawi [18] and Khudhaire and Naji [19].

While discussing sustainability in the construction industry, Mohamed has noted that it is not clearly recognised in most developing countries like Iraq. In most developing countries like Iraq, the construction sector focuses only on cost, time, and quality; however, if they focus on environmental considerations, they will be able to minimise the depletion of resources, reduce emissions, and

maintain a healthier environment [33].

It must be noted that the places people live in, work at, or go for leisure are not possible without the construction industry. However, as the discussion has revealed, the construction industry has been criticised extensively for its environmental impact. The construction industry is considered one of the major consumers of resources and is a leader in greenhouse gas emissions. At the same time, it generates large amounts of waste [34]. To address these problems, sustainable development has emerged as a holistic approach to construction.

The Brundtland Commission defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [35]. For the construction industry, this means that construction companies should aim to minimise environmental degradation, ensure economic viability, and promote social equity throughout the building life cycle, starting from design to construction, operation, maintenance, and finally, demolition [36]. Put simply, there are three facets to sustainable development: environmental considerations, social responsibility, and economic liability.

The first facet, environmental considerations, focuses on efficiently using resources, energy, and water while reducing the total generated waste. It is well-acknowledged that building materials require extraction and processing, which further leads to the destruction of natural habitats, resource depletion, and deforestation. Moreover, construction activities in themselves generate a significant amount of noise and air pollution, while the buildings, once constructed, contribute massively to energy consumption and greenhouse gas emissions [37]. Existing research suggests various ways to address these issues and move towards sustainable development. For example, construction companies can utilise renewable and recycled materials and reduce their reliance on virgin resources. Moreover, they can rely on locally sourced materials to minimise transportation emissions. Construction companies can start utilising prefabrication techniques to decrease the amount of waste generated on construction sites [38].

Regarding energy efficiency, buildings must be designed to prioritise ventilation, natural light, and passive cooling. This will decrease the reliance on heating, ventilation, and air conditioning (HVAC) systems, and power consumption will also be reduced. As for equipment and electronic appliances, energy-efficient devices will further contribute to decreased energy consumption [39]. While designing buildings, sufficient provisions should be made for rainwater harvesting and water-efficient landscaping to decrease freshwater usage. Water treatment and reuse systems can be incorporated into large-scale projects to reduce reliance on freshwater sources [40]. Furthermore, when construction companies focus on minimising waste generation and recycling construction waste, they contribute to a more circular economy [37].

The second facet, social responsibility, promotes that sustainable development goes beyond

environmental concerns. It encompasses the safety of construction workers, fair wages and labour practices, and a positive impact on communities. Construction companies should invest time and resources in sufficient training of construction workers depending on the project requirements and provide them with the required safety equipment. This helps improve their overall well-being and minimises risks [41]. This should be backed by well-defined safety protocols to be followed during the construction phase of a project [42]. Sustainable development also seeks to ensure that construction workers are paid fair wages, their working conditions are safe, and the construction company complies with relevant labour laws for all the individuals involved in the project [43]. An essential element here that is often ignored is the involvement of local communities. This can be done by sourcing materials or human resources from nearby areas or planning the movement of vehicles and materials so that residents living in nearby regions face minimum disruption [44].

The third facet, economic viability, is often a decisive factor for construction companies when they calculate their returns on investment for a project. Existing research acknowledges that initial investments in implementing sustainable construction projects are comparatively higher; however, they have multiple long-term benefits [45]. For example, when a constructed building is certified as a green building under any green building rating system, it is often valued higher by potential buyers, increasing the property's market value [46]. Buildings constructed with sustainable construction practices result in lower energy bills for the residents or users, while low-maintenance materials decrease the long-term repair and replacement costs. With adequately ventilated buildings, they have comfortable thermal conditions, sufficient natural light, and good indoor air quality to improve the well-being of individuals residing there [47].

While the benefits of adopting a sustainable approach to construction projects are apparent, the construction industry faces three significant challenges. First, sustainable projects have a higher initial cost and require upfront investments in new technologies, human expertise, and materials [48]. Second, not all stakeholders, such as clients, project developers, and architects, may be fully aware of sustainable construction practices and their long-term benefits [49]. Third, a lack of policies and regulations can hinder the adoption of sustainable practices. Government policies, such as subsidies or tax reliefs, make it attractive for a construction project owner to adopt a sustainable approach to their project [50].

At the same time, continuous innovation is happening in the market in energy systems, construction techniques, and building materials. New innovative solutions will create new opportunities for sustainable projects. With the increasing awareness among consumers, buyers' demand for sustainable projects is rising [51]. At the same time, government regulations can mandatorily require sustainable development practices in specific projects, such as residential buildings, while introducing incentives for implementing sustainable development practices [52]. While it is true that there are challenges to adopting sustainable development practices in the construction industry, innovations and increased consumer demand will drive the construction industry in the right direction to adopt sustainable

construction projects. Sustainable construction projects will ensure that the present generation will leave a world where future generations can survive. The country has identified multiple goals related to sustainable development and the construction industry in an Iraq Vision 2030 document published in 2019 and available on the UNESCO website. For example, Goal (1-5) declares providing decent housing and ending informal settlements as a national priority. Similarly, Goal (5-1) focuses on reducing environmental pollution and greenhouse emissions, Goal (5-2) covers efficient use of water resources, Goal (5-3) is concerned with environmental conservation, while Goal (5-4) underlines the mandate to develop the consumption and production patterns to achieve environmental sustainability [53].

3. METHODOLOGY

The discussion in previous sections has clarified that the construction sector cannot continue relying on traditional practices. It must switch to sustainable development practices so that future generations have adequate resources for survival. While this shift is devoid of any challenges, as illustrated earlier, various opportunities will push construction companies towards this shift. Qualitative research methodology has been used to understand why the construction industry needs to adopt sustainable development practices in Iraq and what obstacles prevent them.

Unlike quantitative research methodology, which relies entirely on numbers and statistical analysis to prove or disprove a hypothesis, qualitative research seeks to identify the underlying reasons behind a problem, issue, behaviour, practice, thought process, or reality. Instead of relying on numerical data, qualitative research uses descriptive or non-numerical data. This research methodology helps a researcher gain a detailed understanding of the subject matter of their research [54]. This research methodology is beneficial when the subject matter in focus has not been thoroughly explored by other researchers or is emerging or new. It does not restrict the researcher within the bounds of a pre-defined hypothesis [55]. Instead, it allows the researcher to collect contextual information to develop fresh and realistic perspectives on the research problem. Standard data collection methods in qualitative research are focus groups, case studies, audio/video recordings, structured/semi-structured/unstructured interviews, and surveys with open-ended questions [56].

This research paper first used qualitative research to explore the existing literature on two major research areas. First, it sought to identify relevant academic papers and research articles discussing various challenges faced by the construction sector in Iraq. Second, it focused on the role of sustainable development in the construction industry, finding relevant research outcomes and discussing different practices through which sustainable development is possible in this industry. These findings have been documented and detailed in the first two chapters of this research paper.

In another component, this research involved conducting semi-structured interviews with the participants. While structured interviews have limitations and unstructured interviews possess a very high risk of the interviewee deviating from the main topic, semi-structured interviews were considered

viable [57]. In semi-structured interviews, the interviewer prepares an initial list of questions from the research participants, i.e., interviewees. However, if needed, the discussion can go beyond these questions if the interviewer believes their discussion may contribute to their research findings. The initial list of questions prepared for the interviews is as follows:

- i. What are the key challenges in implementing sustainability practices in construction projects in Iraq?
- ii. How can sustainable construction practices benefit housing projects in Iraq?
- iii. What specific sustainable design features would you prioritise in a housing project in Iraq?
- iv. How do you plan to engage and educate local communities and stakeholders about the benefits of sustainability in construction projects?
- v. How do you intend to measure the success and impact of sustainability initiatives in housing projects in Iraq?
- vi. In what ways do you think sustainable construction practices can benefit the community and environment in Iraq?

For these interviews, the researcher contacted 38 individuals who are either Chief Executive Officers (CEOs) or senior-level managers in Iraq-based construction companies. Sixteen individuals accepted the researcher's invitation for the interview and agreed to participate in the study. They can be divided into two categories: first, participants who are senior managers in a construction company, and second, the Chief Executive Officers of construction companies. Before the interviews were scheduled, the researcher explained the research's purpose, the literature review's findings, and how their inputs would be utilised to derive conclusions and outcomes. Once the initial briefing was done, the researcher scheduled virtual meetings with the participants. The records were documented for these interviews, and the responses were proofread. The participants' responses were analysed using thematic analysis to interpret if the results were generalisable. The results of this exercise are detailed in the next section.

4. Data Analysis

As identified in the last section, the first set of participants, i.e., senior managers in construction companies, are identified as SM1, SM2, SM3, SM4, SM5, SM6, SM7, SM8, and SM9. The second set of participants, i.e., CEOs in construction companies, are identified as CE1, CE2, CE3, CE4, CE5, CE6, and CE7. To discuss the findings here in a structured manner, this discussion contains the following six sub-sections corresponding to six questions for sub-structured interviews listed in the last section.

Key Challenges in Implementing Sustainability Practices in Construction Projects in Iraq

Upon reviewing the participants' responses across these two sets, thematic analysis reveals that key challenges include economic viability, lack of awareness, knowledge and expertise, availability of

sustainability materials, regulatory gaps, extensive focus on short-term gains, and availability of qualified human resources. For instance, SM5 and SM8 pointed out that sustainable projects require a higher upfront cost than traditional construction practices, which is an obstacle for them when adapting to sustainable practices. CE1 underlined the absence of any initiative that provides them financial incentives for adopting sustainable practices; this makes it difficult for them to justify the requirement of higher funds than usual at the beginning of a project.

Lack of awareness, knowledge, and expertise are common concerns across both sets. SM2, SM4, and SM7 explicitly mentioned that their existing and potential employees have limited understanding of and exposure to green building concepts and resource-efficiency processes. CE3 stated that there is a dire need for comprehensive education and training programmes for the construction industry to bridge this knowledge gap and move towards a sustainable future. SM3 shared that there is a lack of skilled professionals such as architects, engineers, and construction workers with specialised knowledge to implement sustainable practices. CE5 answered this question on similar lines while also suggesting the need for training programmes to address this skill gap, a suggestion that CE3 has also given.

Participants in both sets acknowledged the fact that there is limited availability of materials that are locally sourced and sustainable. SM6 and SM9 strongly made this point and elaborated on how they are heavily dependent on imports and how it directly impacts a project's total cost and timeline. This sentiment was also expressed by CE2 who suggested that the government should launch initiatives to promote local production of sustainable materials. SM1 and CE4 emphasised the need for well-defined laws and regulations and strict enforcement mechanisms. SM1 believes that having a defined framework will ease the process of implementing sustainable practices. Participants also pointed out that construction companies primarily focus on short-term project completion and minimised costs due to market requirements. As mentioned by CE6 and CE7, this approach overshadows the long-term benefits of adopting sustainable construction projects.

Benefits of Sustainable Construction Practices for Housing Projects in Iraq

Upon reviewing the participants' responses across these two sets, they shared various positive benefits impacting the economy, environment, and social sphere. SM1 stated that in the context of housing projects, it is crucial to have energy-efficient appliances and proper insulation to reduce the residents' energy costs. A similar submission was made by SM7 while discussing proper air ventilation and natural light arrangements in the buildings. While discussing the costs, CE2 emphasised that using sustainable materials and construction techniques will require a higher initial investment, but they will have lower maintenance costs in the long term. CE1 suggested that increasing awareness among the public about sustainable housing will increase the value of such housing projects.

Another prominent theme in the participants' responses was potential environmental benefits. SM3 said that rainwater harvesting will help in water conservation, which would be crucial for the country's future. They also mentioned a research study where more than half of Iraq's children cannot access

safely managed water services. Though CE4 discussed water conservation, their response talked about sustainable construction's overall environmental impact, including resource consumption and reduced carbon emissions. CE3 specifically mentioned the benefits of efficient resource consumption, while CE5 said that reduced carbon emissions will help Iraq present a better image on the climate change front. CE7 suggested installing solar panels on housing projects so that buildings can achieve energy independence and do not need to rely on electricity supply from the government.

Another significant advantage of sustainable housing projects is social benefits. SM4 and SM8 talked about how the quality of life differs in sustainable buildings from buildings built with traditional practices. The health and well-being of residents are undoubtedly better, a statement that SM1 also believed in. SM6 underlined the importance of good air quality and average building temperatures. From a business perspective, CE6 answered that such projects can help construction companies project a positive image while showcasing a strong commitment to environmental protection.

Specific Sustainable Design Features to be Prioritised in Housing Projects in Iraq

Upon reviewing the participants' responses across these two sets, they have offered a wide range of important considerations while designing an Iraqi housing project. A commonly expressed concern was regarding the climatic conditions of the country, which are hot and dry. SM1 suggested that housing projects must be designed to utilise passive cooling strategies while ensuring proper building orientation and shades and utilising natural ventilation as much as possible. CE5 offered a similar suggestion but suggested that housing projects with good insulation rely less on air conditioning. This will also help reduce carbon emissions and decrease the overall electricity consumption. Other participants, such as SM3 and CE7, suggested using solar panels and other renewable energy sources to decrease the housing project's electricity dependence.

Another challenge unique to Iraq is water scarcity. SM4 very strongly stressed design features to address these challenges, such as water-efficient appliances and fixtures. At the same time, they suggested using water harvesting, which is a feature also emphasised by CE4. CE4 made another suggestion: to use greywater recycling systems in housing projects to complement the existing freshwater supplies. Participants also talked about the utilisation of locally sourced and sustainable materials. SM5 pointed out that construction companies should prefer using recycled materials or materials with a low-carbon footprint whenever possible. According to them, this is one initiative that deserves immediate attention. CE2 expressed their desire to work on construction projects that use materials naturally adapted to Iraq's climate.

Some of the participants suggested that waste management should not be an afterthought. When the buildings are being designed, it must be done by adopting waste reduction strategies due to construction during the design and construction phases. CE6 said construction companies should explore ways to reuse or recycle construction waste. If they have multiple ongoing projects, they can move the material from one location to another to be utilised. Meanwhile, some participants suggested

durable features that require low maintenance in the long term. While most participants focused on the designing and maintenance aspects of the building, SM8 and CE3 suggested social considerations such as green spaces, community halls, and public gardens to increase social interaction among residents. CE3 further suggested that living spaces in housing projects should be inclusive and accessible to cater to the needs of all residents.

Ways to Engage and Educate Local Communities and Stakeholders About the Benefits of Sustainability in Construction Projects

Upon reviewing the participants' responses across these two sets, they have offered multiple suggestions to involve local communities and stakeholders. SM9 proposed organising workshops and seminars to explain the benefits of sustainable housing projects in plain and simple language so that there is a direct community outreach. CE2's suggestion was similar, and they explained the importance of clear communication, which is understandable by the public and free from technical jargon. Participants SM3 and CE4 suggested that local media outlets can be engaged to increase awareness among the general public about sustainable construction practices through print media, television, and online platforms. SM4 and CE6 discussed collaborations with local organisations and community leaders as a crucial step in stakeholder engagement. SM4 proposed that construction companies partner with local organisations and community leaders to reach the public effectively. CE6 also mentioned involving the residents in the design phase to understand their problems and address them thoroughly in the housing projects. While agreeing to this, SM8 also suggested organising guided tours of existing sustainable housing projects to give a practical demonstration of the benefits. CE1 discussed the role of costs from a buyer's perspective regarding residential properties. To address this, they suggested using data-based analysis to visualise and present the long-term cost savings for potential buyers.

SM7's suggestion also concerns financial constraints while buying a residential property. They highlighted the urgent need for financial incentives to encourage individuals to purchase property in sustainable housing projects. These benefits can be in the form of tax savings or government subsidies. SM2 discussed the importance of showing a long-term commitment to sustainability to win the public's trust. However, they said that this cannot be done by the construction companies alone, and the role of the government would be crucial in achieving this. Also, CE7 mentioned that stakeholders should be updated regularly about the project's actual environmental impact.

Measuring the Success and Impact of Sustainability Initiatives in Housing Projects in Iraq

Upon reviewing the participants' responses across these two sets, they have suggested various qualitative and quantitative ways to measure the success and impact of sustainable housing projects in Iraq. SM2 suggested using quantitative metrics like energy consumption per family, water consumption per family, and CO₂ emissions before, during and after the completion of the construction project. CEOs CE2 and CE7 expressed similar thoughts and stated that there must be clear benchmarks for measuring environmental performance. SM6 went a step further and suggested incorporating complete lifecycle assessments to analyse the environmental impact of materials used in

the project. CE3 made a similar suggestion; however, they believed this is evidence of mature project management practice, and it would take some time for the country to reach there.

Another key theme of suggestions revolved around measuring the efficiency of resources being used and the total amount of waste generated. For example, SM1 suggested monitoring the volume of water and the number of electricity units used during a project. CE6 mentioned that the construction and demolition waste generated during a project can also be measured while documenting the percentage of waste recycled or reused. Participants also recommended using financial metrics to measure the success and impact of sustainable housing projects. For instance, SM4 suggested an analysis of cost savings with the help of reduced water and electricity consumption in sustainable housing projects. CE5 focused on the long-term economic viability of the project by monitoring the overall maintenance costs.

Some participants suggested qualitative metrics that were community-oriented. For instance, SM9 proposed tracking the level of community engagement and resident participation in outreach initiatives and awareness programmes, along with their participation in the planning process. CE4 also argued in favour of measuring the social impact of projects, such as happiness indicators, appreciation of project value, and overall community well-being.

While suggesting metrics, some participants, such as SM8 and CE3, highlighted that collecting or deriving insights from the collected data will not be fruitful if it is done at a project level. There should be a single centralised portal where such data is collected and visualised across various housing projects. This will also ensure clear and transparent metrics reporting, and this data will be easily accessible to potential buyers and stakeholders.

Benefits for the Community and Environment in Iraq Due to Sustainable Construction Practices

Upon reviewing the participants' responses across these two sets, various potential benefits for the community and environment have been identified. Starting with environmental benefits, SM3 mentioned lower greenhouse gas emissions due to using renewable energy sources and energy-efficient design features in housing projects. CE5 believes that with the help of sustainable practices, natural resources such as wood and water will be conserved. Specifically for wood, this would decrease the dependency on imported products and control deforestation domestically. According to SM6 and CE3, switching to sustainable construction practices will improve the residents' air and water quality. CE2 underlined that sustainable practices enable the constructed buildings to be adaptable to extreme weather conditions.

Multiple participants highlighted the benefits of resource efficiency and waste reduction. While the country is already facing a water crisis, SM4 stated that adopting sustainable practices will help minimise the water used during a building's construction lifecycle. Similarly, CE1 talked about the benefits of reusing and recycling building materials to reduce the construction and demolition waste

generated in any construction project.

As for community-centric benefits, SM2 mentioned improvements in public health as a prominent benefit. With proper air ventilation and utilisation of natural light, residents will have access to better indoor air quality. Meanwhile, some participants also discussed economic and development benefits for the community. SM7 mentioned employment generation in the sustainable construction sector as the construction industry adopts sustainable practices. CE6 mentioned long-term cost benefits as a prominent benefit for the community. SM9 stated that sustainable buildings can be aesthetically pleasing and contribute to a liveable future.

5. RESULTS AND SUGGESTIONS

An analysis of the participants' responses to the first question identifies a series of challenges in implementing sustainability practices in construction projects in Iraq. Prominent challenges include the economic viability of projects, lack of awareness and qualified workforce, regulatory gaps, availability of sustainable materials, and short-term focus. While a detailed discussion on these issues has been done in the previous question, it is pertinent to note that these findings align with the existing literature. While they are not precisely bifurcated as per existing taxonomy provided by researchers at [18] and [19], participants submission that construction companies tend to follow traditional construction practices with cost as a significant factor resonates with the conclusion provided by Al-Hadithi at [20] and Mahdi and Mawlood at [25].

Participants' responses to the second question illustrated the range of benefits sustainable construction projects would have for Iraq. These benefits are economic, environmental, and social in nature. Economic benefits include energy savings, lesser reliance on air conditioning, and low maintenance costs for sustainable materials. Environmental benefits include water conservation, reduced carbon emissions, thoughtful consumption of natural resources, climate change adaptation, and increased reliance on renewable energy sources such as solar panels. Social benefits focus on improving the quality of life, good air quality, better health and well-being of residents, and lower average temperatures of buildings. These findings align with existing research, such as [37, 39, 40, 45, and 47]. Participants' responses to the third question highlight that there is an awareness of sustainable design features. This partly contradicts the findings of Neamat and Yitmen [23] in terms of the availability of skill development; however, their research only focused on the Kurdistan region and not the entire Iraq. Participants' responses indicate that they are well aware of various sustainable design features; however, there is a research gap that can be addressed in future to ascertain how much of this knowledge is actually implemented in practice. Participants have suggested design features such as shading, proper building orientation, passive cooling, natural ventilation, solar panels, and energy-efficient appliances. Other suggestions include water harvesting, greywater recycling systems, reusing or using recycled materials during a construction project, and using sustainable long-term materials that require low maintenance.

Participants' responses to the fourth question reveal a variety of measures to engage local communities and stakeholders. This can be done by organising workshops and seminars for local communities, and they can also be involved in the planning and designing phases to address the ground-level problems. Participants suggested using clear, simple, and easy language to convey sustainable project benefits, instead of technical jargon. A suggestion has been made to use local media outlets through print media, television, and online platforms to reach a wider audience. As for stakeholders, suggestions include partnerships with local organisations and community leaders, along with giving guided tours to illustrate the benefits of a sustainable housing project. Some of the participants also hinted at the cost-sensitiveness of the property market and how construction companies can show visualised cost benefits of buying a property in a sustainable housing project.

In the responses to the fifth question, participants elaborated on various metrics they suggest using to measure the success and impact of sustainable housing projects. Quantitative metrics include energy consumption, water consumption, and CO₂ emissions before, during, and after a project. Participants have also expressed the need for having a well-defined benchmark to measure the success of a project. Other suggested metrics include electricity and water used during the construction, waste generated and reused or recycled, and maintenance cost savings. Qualitative metrics suggested by participants included community engagement, resident participation, happiness indicators, project value appreciation, and community well-being. Some participants even proposed setting up a centralised platform to access such metrics about various housing projects in the country.

Participants' responses to the sixth question were similar to those to the second one, as they discussed how the community and environment will benefit from sustainable construction practices. Environmental benefits include lower greenhouse gas emissions, increased reliance on renewable energy, conservation of natural resources, controlled deforestation, and quality of air and water with buildings being adaptable to extreme weather conditions. The participants also discussed the benefits of resource efficiency and waste reduction to help the country's water shortage. Community-centric benefits suggested by participants included improved quality of life and long-term cost benefits while buildings being aesthetically pleasing, contributing to Iraq's liveable future

6. CONCLUSION

War, in any form in any country, has a disastrous impact on the country, its general population, its economy, and various industries. As the existing research and available statistics indicate, the same applies to Iraq's construction industry. However, developments in the last few years show a positive growth towards this industry's contribution to rebuilding the Iraqi economy. In this research, an attempt has been made to highlight the urgent need for adopting sustainable construction practices in the country. The country already features a unique set of challenges, such as a hot and dry climate and water scarcity, among others; interviews with senior managers and CEOs of construction companies reveal that there is a good understanding of the environmental challenges facing Iraq. The interviews also indicate a growing interest in sustainable construction practices; however, when these benefits are

realised, a research gap remains to be addressed. As identified, significant challenges include lack of awareness, economic viability, limited availability of sustainable materials, qualified personnel, and regulatory gaps.

While there is a vision for Iraq and how the country will look in 2030, there is little data on Iraq's construction industry. As various participants have illustrated, sustainable housing projects will benefit the country despite these challenges. Their responses have been discussed and analysed in the context of the literature review conducted earlier. The researcher believes this is an appropriate time for the government and stakeholders to come together to adopt sustainable construction practices for a future in Iraq that is liveable for future generations.

Overall, this research has made a humble attempt to underscore why adopting sustainable construction practices in Iraq is the need of the hour. Participants indicated that adopting sustainable construction practices will contribute to the country's environmentally conscious future. By adopting sustainable practices, the construction industry's contribution will not be limited to Iraq's economic growth but will also extend to environmental and social benefits.

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