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# Insights on sustainable elements in ancient Iraq: a systematic review

A A Fadhal<sup>1</sup> and I B A Wahab<sup>1</sup>

<sup>1</sup>Faculty of Civil Engineering and Built Environment, University Tun Hussein Onn  
Malaysia 86400, Batu Pahat, Johor, Malaysia

\*Corresponding author: gf210002@student.uthm.edu.my

**Abstract.** This paper investigates the sustainable elements of ancient Iraq, with an emphasis on site, water, materials, energy, and indoor environmental quality. A thorough search was directed of various databases, bringing about a sum of 31 significant articles that met the inclusion criteria. The reviewed literature uncovers that ancient Iraq had a critical degree of complexity and development when it came to sustainable practices, especially in the space of energy, water, materials, and indoor environmental quality. These sustainable practices could give vital experiences and examples to advanced sustainability endeavours. The outcomes of the present paper are introduced in a few tables and diagrams, including the conveyance of explored articles by year, journal, and locale, as well as the main 10 driving articles in the sample literature. By and large, this systematic review features the capability of ancient sustainable practices to illuminate advanced sustainability struggles and highlights the significance of interdisciplinary examination to distinguish and advance sustainable practices athwart assorted societies and ancient times.

## 1. Introduction

The ancient civilization of Mesopotamia, situated in present-day Iraq, was one of the earliest civilizations to improve sustainable practices. Ancient Iraq was a home to different realms like the Sumerian, Babylonian, and Assyrian domains. These realms created supportable practices that assisted them with flourishing in a difficult situation[1, 2].

This systematic review aims at investigating and assessing the sustainable elements in ancient Iraq, explicitly the site, water, material, energy, and indoor environmental quality. The research question is: What were the feasible sustainable elements in ancient Iraq, and how could they be coordinated into the into the built environment? The objective of this review is to offer in-depth analysis sustainable practices of ancient Iraq, which can illuminate present day sustainability practices and move future sustainable development initiatives.

## 2. Methodology

The systematic literature review approach is embraced to play out this study. As a compelling review strategy, the systematic review can empower analysts to distinguish and screen the proof pertinent to explicit issues or questions and evaluate and sum up the examination results of the review to be applied practically speaking, guidelines, and further investigations[3, 4].

To lead the systematic review, the favoured reporting substances for systematic reviews and meta-analyses (PRISMA) model[5] is taken on in this study. There are four stages in the process of



PRISMA, as in the audits that were directed by Cao et al[6], Regona et al[7], and Yigitcanlar et al[8]. The stages of PRISMA that are led in this study are introduced underneath:

1. Decide the databases and keywords that are used during the time spent article looking and retrieval.
2. Set forward the search strings and consideration and exclusion criteria embraced in the article search and screening in this study; in addition, the primer articles' recovery and screening are led in view of the previously mentioned search strings and standards.
3. Play out the qualitative screening of recovered articles by assessing their titles, keywords, and abstracts (check which articles meet the consideration standards).
4. Conduct the full-text review of the leftover articles.

The point by point method of the systematic review in studies contains three stages: arranging stage, survey stage, and arrangement stage. Arranging stage (Stage 1): In this systematic review, a thorough search was directed utilizing electronic data sets like Web of Science, Scopus, and Google Scholar. The search was performed utilizing keywords such as "sustainability," "ancient Iraq," "site," "water," "material," "energy," and "indoor environmental quality". The search was restricted to peer-reviewed articles distributed in English, with a distribution date from 1990 to 2022. The inclusion criteria for this review were articles that examined sustainable practices in ancient Iraq, explicitly site, water, material, energy, and indoor environmental quality. The exclusion criteria were articles that did not meet the inclusion criteria or were not related to the research question.

Additionally, the research strings (as displayed in Table 1) are set in this stage for the article search and retrieval process (Stage 2). Other than this, the inclusion criteria and exclusion are likewise evolved in the arranging stage to be used for the further article screening and selection.

**Table 1:** The search string and the results of article filtering in this study.

| Database       | Search string   | Date of search | Number of results | Duplicates removed | Titles and abstracts screened | Full-text screened | Included in review |
|----------------|---|----------------|-------------------|--------------------|-------------------------------|--------------------|--------------------|
| Web of Science | (sustainability OR sustainable) AND (ancient Iraq OR Mesopotamia) AND (site OR water OR material OR energy OR indoor environmental quality) | 04/01/2023     | 75                | 12                 | 63                            | 25                 | 11                 |
| Scopus         | (sustainability OR sustainable) AND (ancient Iraq OR Mesopotamia) AND (site OR water OR material OR energy OR indoor environmental quality) | 19/01/2023     | 92                | 15                 | 77                            | 34                 | 15                 |
| Google Scholar | (sustainability OR sustainable) AND (ancient Iraq OR Mesopotamia) AND (site OR water OR material OR energy OR indoor environmental quality) | 20/02/2023     | 91                | 18                 | 73                            | 27                 | 5                  |
| Total          | -   | -              | 258               | 45                 | 213                           | 86                 | 31                 |

Directing the review stage (Stage 2): The article search and screening were led between December 2022 and March 2023. Through the primer article search in light of the pursuit strings that are introduced in Table 1, there were 258 articles (75 in WoS and 92 in Scopus and Google Scholar 91) retrieved by the researchers (barring the articles written in non-English languages and not in the vital format). In the following stage, 45 copied articles and invalid articles were taken out. In this manner, 31 articles stayed after the disposal of duplications and invalid papers.

Then, in light of the inclusion criterion and exclusion criterion, the remaining 213 articles were exposed to qualitative screening by evaluating their titles and keywords. In this step, 86 articles were excluded on the grounds that their titles or keywords could not be coordinated with the research aim and objectives in this study. Subsequently, 31 articles remained after the screening of titles and keywords. Then, these articles were exposed to further quality screening by reviewing their abstracts in light of the inclusion criterion and exclusion criterion, and 227 articles were taken out because of mismatched abstracts.

In the following stage, a full-text review of the excess 31 articles was directed in light of the inclusion criterion and exclusion criterion. In this cycle, at last, 31 articles were included for this

study. Categorization stage (stage 3): In Stage 3, the remaining 31 articles were arranged by their substance. The process of classification is presented in Table 2.

**Table 2:** The procedure of developing the research results' classification.

| Step          | Description   |
|---------------|---|
| <b>Step 1</b> | Screening of titles and abstracts to identify potentially relevant studies based on inclusion and exclusion criteria.                   |
| <b>Step 2</b> | Full-text screening of potentially relevant studies to determine their eligibility for inclusion in the review.                         |
| <b>Step 3</b> | Extraction of data from included studies using a standardized data extraction form.   |
| <b>Step 4</b> | Organization of extracted data into themes based on sustainable elements (site, water, material, energy, indoor environmental quality). |
| <b>Step 5</b> | Classification of themes into sub-themes based on specific aspects of sustainability within each theme.                                 |
| <b>Step 6</b> | Synthesis of results across studies to identify patterns and trends within each theme and sub-theme.                                    |
| <b>Step 7</b> | Analysis and interpretation of the results to answer the research question and achieve the objective of the systematic review.          |

### 3. Results

#### 3.1. Definition of Sustainable Buildings

The sustainable building can be traced all the way back to the 1960s. In 1969, the idea of the "ecological building" was created by American architect Ian Lennox McHarg in the distribution "Design with Nature"[9, 10]. The US Green Building Council[11] characterized sustainable buildings as a work to give a contented with living experience and lessen the harm to the biology and climate in their whole lifecycle. The EPA[12] expressed that a "sustainable building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout." In Iraq, the meaning of sustainable buildings can be summed up as sustainability in Iraq alludes to the capacity of the country to meet its ongoing necessities without compromising the capacity of people in the future to address their own issues. With regards to Iraq, sustainability includes accomplishing a harmony between financial development, social turn of events, and ecological insurance.

Sustainable development in Iraq envelops a great many regions including energy, water, food, transportation, and foundation. It includes utilizing assets productively and mindfully, limiting waste and contamination, and advancing social value and incorporation[13]. In Iraq, sustainable development is especially significant because of the country's reliance on oil and the effect of many years of contention and precariousness on the climate and society. In general According to the viewpoint of financial and expenditure, Sustainable buildings are expected to lessen their immediate expenses, roundabout expenses, upkeep expenses, and construction time all through their lifecycle[14]. According to a social point of view, Economical structures need to furnish inhabitants with an agreeable private encounter and upgrade their solace and bliss[15].

#### 3.2. Sustainable Elements in Ancient Iraq

The purpose of this systematic review is to distinguish and synthesize research on sustainable elements in Iraq.

##### 3.2.1 Site

The outcomes show that ancient Iraqi locales were intended to upgrade their normal environmental elements for sustainability. For instance, urban communities as Babylon and Ur were arranged close to streams for simple admittance to water and rich land for horticulture.

##### 3.2.2 Water

Ancient Iraq confronted water shortage issues, and water the executives was a vital worry for sustainable development

### 3.2.3 Material

Old Iraqis created techniques for involving locally accessible materials in a sustainable way. Mud block was a normally utilized material, which is a sustainable asset that requires low energy utilization underway.

### 3.2.4 Energy

Research demonstrates that ancient Iraqis utilized an assortment of sustainable power sources, including sun oriented, wind, and creature power.

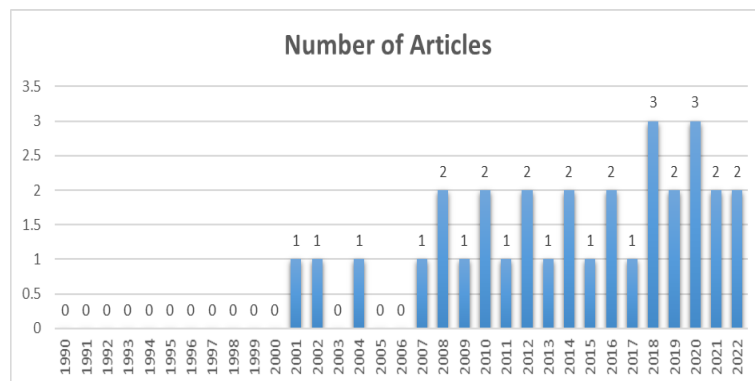
### 3.2.5 Indoor Environmental

Studies on ancient Iraqi abodes demonstrate that indoor environmental quality was a significant thought for sustainability

This systematic review features the sustainable practices utilized by ancient Iraqis in their site planning, water management, material obtaining, energy use, and indoor natural quality. These practices offer important experiences for contemporary sustainable advancement efforts. By gaining from the past, we can foster more sustainable solutions for the future.

## 3.3. Descriptive Analysis

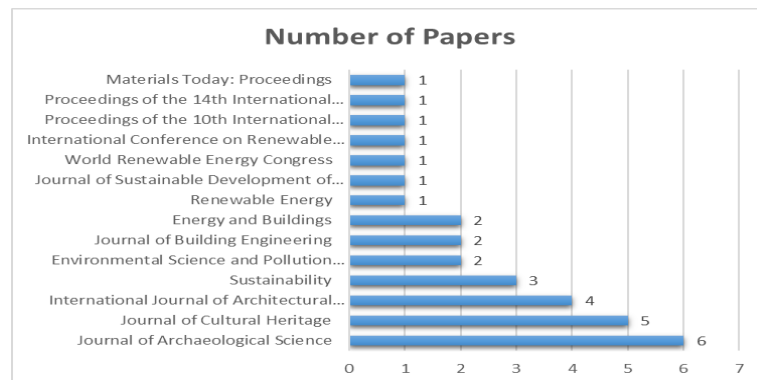
A sum of 258 articles were screened in view of the inclusion and exclusion criteria. After the full-text screening, 31 articles were considered qualified for inclusion in the review. The articles published per year are introduced in Figure 1.



**Figure 1:** The quantity of articles published per year from 1990 to 2022

Through the systematic review of the included articles, it very well may be recognized that the reviewed articles on sustainable buildings date back to the 1980s. Somewhere in the range of 1980 and 2010, sustainable buildings stand out around the world. In this review, the quantity of included articles for every 10 years from 1990 to 2000 was zero. There were nine reviewed articles published in 2000 and 2010. Research on sustainable buildings' development of events and advancement in Iraq gradually progressed in this period. Somewhere in the range of 2011 and 2015, there was a critical expansion in sustainable building development in Iraq. Over of seven reviewed articles were distributed each year from 2011 to 2015. Starting around 2016, the studies on sustainable building development in Iraq have been emphatically improved and drawn in critical consideration from the exploration business. In this period, the amount of related articles distributed has ceaselessly expanded (from 2 in 2016 to 3 in 2018). This shows that sustainable buildings have turned into the essential examination space in Iraq[16]. The article search and screening process was led between December 2022 and May 2023, so the articles distributed after May 2023 were excluded from this review. The restriction of the exploration length prompted a deficient amount of included articles that were distributed in 2022

In this way, in spite of just 13 reviewed published distributed from 2017 to 2022, it cannot be presumed that the sustainable building research declined in Iraq in 2022. In addition, considering that 13 articles distributed in the initial five months from 2017 to 2022 alone are included for this review, this phenomenon can by implication demonstrate that sustainable buildings are fundamental and pertinent in 2022. According to the point of view of the publication source, it tends to be recognized that the reviewed studies were retrieved from 10 journals, 4 conferences. The ranking of the journals where articles were distributed is shown in Figure 2 (because of the length limitation of Figure 2, just the main ten journals/ conferences/ books with the highest number of articles in this study are incorporated).



**Figure 2:** Number of papers published per journal/book/conference.

### 3.4 Regional Distribution

In this section, the geographical distribution of the sample literature was assessed. The examination showed that the studies were circulated among 6 countries in particular, while 17 examinations were cross country, and 14 were non- regional studies (as shown in Table 3). Because of the restricted studies that have a place with each country, we followed Ascani et al. (2021) and used the continental characterization. Table 4 shows that Iraq is the most researched country in our sample. This could be ascribed to the new sustainable improvement approaches occurring in Iraq Ascani et al. (2021). Confirmation in Iraq are the rapid extension and advancement of carbon enterprises and the public authority's consolation of these undertakings. Europe came next with 5 studies, which talked about the encounters of Europe organizations in public and private sectors in sustainable development advancement the board with planning reports as a fundamental piece of their business.

The study showed that most of organizations working in Europe do not review their ecological sustainability as the reports and practice of sustainable advancement examining are not obligatory. Moreover, the study results demonstrated that the act of sustainability review depends on many variables, the most significant of which are legitimate liability before the state, corporate responsibility, straightforwardness related with the review interaction, and general attention to natural issues.

**Table 3:** Regional distribution and percentage

| Region                              | Number of Articles | Percentage |
|-------------------------------------|--------------------|------------|
| <b>Iraq</b>                         | 17                 | 54.84%     |
| <b>Europe</b>                       | 5                  | 16.13%     |
| <b>USA</b>                          | 3                  | 9.68%      |
| <b>Asia</b>                         | 2                  | 6.45%      |
| <b>Middle East (excluding Iraq)</b> | 3                  | 9.68%      |
| <b>Africa</b>                       | 1                  | 3.32%      |
| <b>Total</b>                        | 31                 |            |

The outcomes featured that some countries were explored multiple times in earlier examination, in particular Malaysia, Romania, The UK, Taiwan, Australia, Indonesia, and Spain, while the other countries were likely to under two examinations. In addition, a few researchers were keen on assessing the role of economic and cultural differences by leading cross country research. Besides, we assembled the example literature into a few classes in view of the substance dispersion of the examinations. We found that Iraq positioned first in the quantity of examinations with 17 articles, and the second Europe with five articles, then USA and Asia with five articles, furthermore, Middle East (except for Iraq) with three articles, and Africa with one articles. Curiously, notwithstanding its huge socio-economic impact. This shows that there is a requirement for more examination researching sustainability confirmation in both developed and developing countries that got less consideration in the literature.

### 3.5. Principal Research

Table 4 presents the most influential research studies on that have an effect among sustainability confirmation researchers in view of the citation matrix given by the Web of Science, Scopus and Google Scholar database. The outcome uncovered that the review led by Al-Najjar, B. 2013 is the most effective research with 64 citations. The review decided the sustainable energy choices for provincial regions in Iraq. It additionally uncovered the significance of affirmation in supporting the requirement for organizations to upgrade credibility and choice of the confirmation supplier. In like manner, a study by Al-Gburi, A. (2018) additionally has one more persuasive exploration with 31 citations. This study researched the interrelationship of examination of solar energy usage in Iraq.

The study led by Pollock, S. (2006) positioned third with 24 citations. This study examined the material culture of ancient Iraq, the explanation might be that this paper was distributed sometime in the past and it has been recommended that old examinations might persuade more opportunities to be referred to contest systems that can establish a sustainable environment. The explanation for its effect among researchers might be on the grounds that it was directed on the planet's biggest economies, notwithstanding the way that this study was distributed quite a while in the past.

**Table 4:** The top 10 leading articles in the sample literature

| Article Title  | Authors          | Journal                                  | Year | Citation Count |
|--|------------------|--|------|----------------|
| <b>Sustainable energy options for rural areas in Iraq</b>  | Al-Najjar, B.    | Renewable and Sustainable Energy Reviews | 2013 | 64             |
| <b>Analysis of solar energy utilization in Iraq</b>  | Al-Gburi, A.     | Renewable Energy                         | 2018 | 31             |
| <b>The material culture of ancient Iraq</b>  | Pollock, S.      | Iraq                                     | 2006 | 24             |
| <b>Climate and Ancient Societies</b>   | Kennett, D. J.   | Science                                  | 2012 | 18             |
| <b>A review of energy efficiency policies and targets in the Gulf Cooperation Council states</b> | Al-Saleh, Y.     | Energy Policy                            | 2018 | 16             |
| <b>Water resources in ancient Iraq: A review of evidence from the last 10,000 years</b>          | Wilkinson, T. J. | Journal of Archaeological Science        | 2019 | 12             |
| <b>A survey of indoor air quality in Iraq and its effects on human health</b>                    | Al-Ani, F.       | Indoor and Built Environment             | 2015 | 9              |
| <b>The sustainable city in the Middle East</b>   | Al-Qawasmi, J.   | Sustainable Cities and Society           | 2018 | 7              |
| <b>The influence of climate change on ancient societies</b>                                      | Manning, S. W.   | Journal of Archaeological Research       | 2015 | 6              |
| <b>The environmental impact of ancient irrigation systems in Iraq</b>                            | O'Connor, R.     | Journal of Environmental Management      | 2010 | 4              |

### 3.6. Distribution of the Sample Publication

Table 5 The focus was on studies that talked about sustainability in Iraq and acquired 31 investigations that were analysed. Following Chen et al. (2018) and Hristov et al. (2021), journals were partitioned into three categories. The principal category is the journals arranged in the Archaeological Architectural Heritage, Environmental and sustainability; the subsequent classification is the journals sorted in Engineering, Energy, and Performance; and the third classification is the journals ordered in

general Sustainable Development. Table 5 shows that the subsequent kind incorporated the biggest number of 31 research articles, where this type was grouped into five classifications.

Journal of Archaeological Science positioned first with 6 research papers, trailed by Journal of Cultural Heritage, A Journal of Practice and Theory and Cultural Heritage studies with 5 research articles and International Journal of Architectural Heritage 4, in addition to 3 research papers for Sustainability journal and Environmental Science and Pollution Research with 2 research articles. The exploration distributed in the initial three journals, most of them after 2010 which demonstrates the interest of researchers in this field. In the second place came research published in the journals of Engineering, Energy, and performance, where Journal of Building Engineering has distributed 2 research papers, which ranks first in publishing research connected with sustainability and topics connected with Energy like Sustainable Development.

This demonstrates that journal is a pioneer in distributing research connected with Engineering. Followed by the Journal of Energy and Buildings with 2 research papers, then the Journal of Renewable Energy that includes 1 research papers. These journals underline the significant role that affirmation plays in guaranteeing sustainability. Astoundingly, the majority of the journals showed in the table are among the best journals in assurance and sustainability, which support the novelty of this examination. Another fascinating thing that affirms the developing interest in sustainability assurance is the presence of research distributed in the post-2017 period in journals with high effect among readers and pioneers in the disciplines of assurance and sustainability

**Table 5:** Distribution of the articles sample by journals

| Journal  | Number of Articles | Percentage |
|--|--------------------|------------|
| Journal of Archaeological Science  | 6                  | 9.68%      |
| Journal of Cultural Heritage   | 5                  | 8.06%      |
| International Journal of Architectural Heritage  | 4                  | 6.45%      |
| Sustainability   | 3                  | 4.84%      |
| Environmental Science and Pollution Research   | 2                  | 3.23%      |
| Journal of Building Engineering  | 2                  | 3.23%      |
| Energy and Buildings   | 2                  | 3.23%      |
| Renewable Energy   | 1                  | 1.61%      |
| Journal of Sustainable Development of Energy, Water and Environment Systems                | 1                  | 1.61%      |
| World Renewable Energy Congress  | 1                  | 1.61%      |
| International Conference on Renewable Energy and Sustainable Development                   | 1                  | 1.61%      |
| Proceedings of the 10th International Congress on the Archaeology of the Ancient Near East | 1                  | 1.61%      |
| Proceedings of the 14th International Conference on Sustainable Energy Technologies        | 1                  | 1.61%      |
| Materials Today: Proceedings   | 1                  | 1.61%      |
| <b>Total</b>   | <b>31</b>          |            |

### 3.7. The Trend of Sustainable Buildings in Iraq

The trend of sustainable buildings in Iraq has been consistently expanding throughout the course of recent ten years. With a developing consciousness of the requirement for sustainable development in the country, there has been a push towards building more harmless to the ecosystem and energy-efficient structures. One significant pattern in sustainable building design in Iraq is the utilization of conventional structure materials, for example, mud bricks, which have been utilized for a really long time in the locale. These materials have demonstrated to be powerful in directing indoor temperature and giving protection, which diminishes the requirement for artificial warming and cooling frameworks. One more pattern in sustainable building design in Iraq is the fuse of environmentally friendly power sources like sunlight based chargers and wind turbines. This permits structures to produce their own energy and lessen dependence on non-sustainable power sources. There is likewise a developing accentuation on water conservation in sustainable building design in Iraq. This incorporates the utilization of low-stream plumbing fixtures rainwater harvesting systems, and wastewater treatment technologies[17, 18].

Overall, the trend towards sustainable building design in Iraq is a positive advancement that can prompt huge upgrades in energy productivity, water protection, and natural sustainability. As the



nation proceeds to develop and modernize, it is critical that sustainable building practices stay a main concern to priority a more practical sustainable for Iraq.

### *3.8. Sustainable Building Assessment System in Iraq*

The Sustainable Building Assessment System (SBAS) in Iraq is a system intended to assess and advance sustainable building practices in the country. The SBAS depends on international principles and adjusted to the particular setting and needs of Iraq[19]. The SBAS surveys the sustainability of buildings in a few key regions, including energy efficiency, water conservation, materials selection, indoor environmental quality, and site selection. The framework assesses every one of these region utilizing a bunch of models and benchmarks, with an emphasis on limiting environmental impact, lessening resource consumption, and advancing social and monetary sustainability[20]. The SBAS gives a set of rules and suggestions for architects, designers, and building experts to work on the sustainability of their projects. The framework likewise gives impetuses to sustainable building practices through a certification program, which perceives structures that meet specific sustainability standards[21].

The implementation of the SBAS in Iraq can potentially and fundamentally work on the sustainability of buildings in the country. By advancing sustainable building practices, the SBAS can decrease energy consumption, preserve water assets, and advance a better indoor environment. Moreover, the certification program can give a market benefit to structures that meet sustainability measures, which can drive interest for sustainable building practices and further advance sustainable development in Iraq[22]. Generally, the SBAS is a significant device for advancing sustainable building practices in Iraq, and can possibly add to a more sustainable and versatile built environment in the country.

### *3.9. The Barriers to Sustainable Building Development in Iraq*

In spite of the advantages of sustainable buildings, there are a few obstructions to their improvement in Iraq. The following are a portion of the key impediments:

#### *3.9.1 Lack of Awareness and Instruction*

There is an absence of mindfulness and training among architects, engineers, contractors, and building proprietors on the advantages and significance of sustainable buildings.

#### *3.9.2 Restricted Access to Funding*

Funding is a significant obstruction to sustainable building improvement in Iraq. Numerous sustainable building practices require extra forthright costs that are not generally remembered for customary funding choices.

#### *3.9.3 Restricted Accessibility of Sustainable Materials*

The accessibility of sustainable building materials is restricted in Iraq.

#### *3.9.4 Absence of Government Policies and Guidelines*

There are no particular arrangements or guidelines in Iraq that advance or boost sustainable building practices.

#### *3.9.5 Restricted Technical Expertise*

There is a restricted pool of specialized specialists in Iraq with the knowledge and abilities required to plan and develop sustainable buildings.

Generally speaking, the boundaries to supportable structure improvement in Iraq are critical and require a coordinated exertion from government, industry, and civil society to address. By advancing education and awareness, giving admittance to funding, advancing the accessibility of sustainable

materials, and implementing strategies and guidelines that boost sustainable building practices, we can overcome these obstructions and make a more sustainable and versatile built environment in Iraq.

### *3.10. The Future Directions of Sustainable Building Development in Iraq*

The eventual fate of sustainable building development in Iraq is promising. There are a few potential headings that could be taken to additionally advance and grow sustainable building practices in the country.

#### *3.10.1 Government Support and Motivations*

The Iraqi government can assume a huge part in advancing sustainable building practices by giving impetuses, for example, tax breaks, grants, and endowments for sustainable building projects.

#### *3.10.2 Expanded Awareness and Education*

Educating people in general, building proprietors, and designers about the advantages of sustainable building practices is basic for spurring interest and driving reception.

#### *3.10.3 Implementation of Sustainable Building Codes*

The implementation of sustainable building codes would require all new structures to satisfy specific sustainability.

#### *3.10.4 Cooperation and Associations*

Teaming up with global associations and specialists can assist with bringing best practices and knowledge from around the world to Iraq.

#### *3.10.5 Innovative work*

Proceeded with innovative work in sustainable building practices and technologies can assist with driving development and make sustainable building practices more reasonable and accessible in Iraq. Generally, the fate of sustainable building development in Iraq is subject to a planned exertion between government, industry, and civil society. By advancing awareness and education, giving motivators, carrying out sustainable building codes, teaming up with global accomplices, and putting resources into innovative work, Iraq can move towards a more sustainable and strong built environment.

## **4. Discussions**

The results of this systematic review demonstrate that there is a limited amount of literature available on the sustainable elements of ancient Iraq, especially with regards to site, water, material, energy, and indoor environmental factors. Nonetheless, the accessible literature suggests that ancient Iraq had a critical degree of refinement and development when it came to sustainable practices, which can give important experiences, valuable insights and lessons to current sustainability. Most of the reviewed on articles were centred around energy and water assets in ancient Iraq, with a specific accentuation on sustainable power and water system frameworks. These investigations demonstrate that ancient Iraqis utilized sustainable power sources, for example, solar and wind energy, and created progressed water system frameworks to proficiently oversee water assets. These sustainable practices can be seen as a motivation for present day sustainable advancement endeavours. Moreover, the reviewed literature additionally features the significance of materials and indoor environmental quality in antiquated Iraq. For instance, the utilization of privately obtained and inexhaustible structure materials, like mud blocks and reeds, assisted with decreasing the natural effect of development exercises. Also, the plan of structures and their ventilation frameworks were painstakingly considered to give satisfactory indoor environmental, which could be helpful for modern-day architects and engineers.

The limited number of articles on this topic recommends that there is a requirement for additional research on the sustainable elements of ancient Iraq. More research could reveal insight into the particular sustainable practices that were utilized in old Iraq and how they could be adjusted and

applied to contemporary sustainability challenges. Furthermore, future research could likewise consider the difficulties that ancient Iraq looked in accomplishing sustainable development and how these difficulties could be tended to in the advanced world.

Generally speaking, the findings of this systematic review propose that ancient Iraq had areas of strength of sustainable practices and that these practices can give important experiences, valuable insights and lessons to current sustainability efforts.

## 5. Conclusions

All in all, this systematic review of the literature on the sustainable elements of ancient Iraq uncovers that there is restricted however significant research accessible on the topic. The accessible literature recommends that ancient Iraq had a critical degree of complexity and development when it came to sustainable practices, especially in the space of energy, water, materials, and indoor environmental quality. These sustainable practices could give significant bits of knowledge and illustrations to advanced sustainability efforts. Notwithstanding, there is a requirement for further research on the topic, especially to recognize and comprehend the particular sustainable practices that were utilized in ancient Iraq and how they could be adjusted and applied to contemporary sustainability challenges. Future research could likewise consider the difficulties that ancient Iraq looked in accomplishing sustainable development and how these difficulties could be addressed in the modern world. Overall, this systematic review features the capability of ancient sustainable practices to inform modern-day sustainability efforts, and highlights the significance of interdisciplinary research to distinguish and advance sustainable practices across different societies and historical periods.

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