

Institutional Role in Adopting Sustainable Construction in Iraq

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ABSTRACT

Adopting the sustainable construction approach has become an urgent necessity due to the environmental, economic, and social benefits it achieves, in addition to its contribution to achieving sustainable development goals. However, many developing countries, including Iraq, have still not officially adopted the sustainable construction approach in the construction industry. Therefore, this study focused on identifying sustainable strategies that can be adopted by the institutions and organizations related to the construction sector to achieve a sustainable construction approach, through which environmental, economic, and social requirements are taken into account together, a focused study was conducted in the literature to identify sustainable strategies that support the trend toward a sustainable construction industry. This was followed by designing a questionnaire and conducting a Delphi approach for three rounds, through which 17 reliable strategies were identified that can be adopted by governmental and semi-governmental institutions in achieving the transition from conventional construction to a sustainable construction approach. The results of this study can help decision-makers in governmental institutions related to the building and construction industry in adopting it as a roadmap to move towards achieving a sustainable construction industry.

Keywords: sustainable strategies, sustainable construction, conventional construction, sustainable development goals.

INTRODUCTION

The move towards creating sustainable buildings has become a necessary matter due to the many challenges facing Iraq due to the impact of environmental degradation and pollution, climate change in terms of drought, high temperatures in summer to above fifty degrees Celsius and drops to below ten degrees in winter, scarcity of drinking water, in addition to a shortage in the supply of electrical energy, accompanied by an increase in the population and significant urban expansion. This requires adopting sustainable solutions that achieve sustainable development goals, and one of the most important solutions is adopting a sustainable construction approach, as government institutions can play a major role in moving towards adopting a sustainable approach through which transforming conventional construction system that has lasted for a long time into a sustainable construction system by adopting and activating sustainable strategies, creating the appropriate climate for the change process, spreading awareness of the necessity and importance of sustainable construction, while taking the necessary measures that support the transformation process, in addition to encouraging and supporting all stakeholders in the construction sector during the process of implementing sustainable practices in the construction industry. Osuizugbo et al, (2020) stated that to ensure a smooth transition toward a sustainable construction industry, stakeholders need to explore and adopt sustainable concepts, especially in the project design stages. Greater effort must be made to train and educate built environment professionals and building owners about sustainable construction. Local guidelines and implementation principles must be developed that are consistent with the goals and principles of the sustainable construction industry. The government must play a greater role in disseminating and implementing the sustainable strategy.

LITERATURE

This study aimed to demonstrate the institutional role that institutions and organizations related to the construction industry can play in adopting and applying the sustainable construction approach in the

construction sector in Iraq, where an extensive study of the literature related to sustainable construction was conducted to identify sustainable strategies that can be adopted by institutions related to the construction industry to transform the long-standing conventional construction approach into a sustainable construction approach that achieves sustainable development goals. In this study, 17 sustainable strategies were identified that included institutional and technological empowerment strategies, evaluation tools, financial support, and investment encouragement in sustainable construction projects and infrastructure projects that support the application of the sustainable construction approach, in addition to providing incentives to stakeholders to encourage them to participate effectively in applying sustainable practices in the construction industry, is shown in the explanation below:

Raising awareness and understanding of the importance of sustainability by government agencies

In recent years, knowledge management in the context of sustainability has gained much attention. This is not surprising because knowledge is a strategically important resource for organizations. Organizations must generate knowledge, share it, and apply it in practice. Effective knowledge-sharing leads to organizational learning, which in turn accelerates and enhances performance (Cormican et al, (2021). Zulu et al, (2022) discussed that environmental education, awareness, and civic advocacy can help address compliance challenges and lack of knowledge and appreciation of environmental protection and can also help reduce political interference. While Sodangi, (2021) argued that organizing sustainability awareness campaigns for key project stakeholders enhances the sustainable construction approach.

The government enacts sustainable building laws and regulations

Al-Otaibi et al, (2022) pointed out that governments should review and evaluate existing legislation and propose necessary amendments in coordination with responsible regulatory bodies. Stakeholders should be supported and develop legislation, regulations, laws, and standards related to sustainable building practices. Abidin et al, (2013) discussed that the institutional enabling factors have a role in creating a sustainable industry, as they stimulate change and development through legislation, policies, and much more that they can do by government, professional bodies, finance institutions, and education Institutions. Darabpour et al, (2018) discussed the importance of setting direct mandatory rules and regulations related to construction by the legislative and administrative authority and imposing appropriate penalties for actions that conflict with the goals of sustainable development. Jagannathan et al, (2018) discussed that the support provided by the government in implementing sustainable practices would go a long way in promoting sustainable practices in organizations. Mandatory reporting of corporate activities, and corporate governance among others, are some steps in this direction. Sodangi, (2021) discussed the enforcement of regulatory support implementing sustainable practices.

Adopting sustainable building evaluation systems and standards

Sodangi, (2021) discussed that one of the strategies that support the adoption of sustainable construction is developing sustainable performance evaluation methods, and establishing a sustainability-based classification and certification for consultants and designers in the industry. Darabpour et al, (2018) discussed the importance of identifying indicators and social and environmental factors for implementing national and local construction strategies. Marichova, (2020) argued that the government at the national or local level should develop an indicator system to evaluate environmental, economic, and social indicators throughout the life cycle of a construction product and promote their use.

Sustainable procurement policies and requirements when awarding sustainable contracts

According to the United Nations Development Program (2008), sustainable procurement means ensuring that the procurement of products and services is as sustainable as possible, with the lowest environmental impact, the greatest economic effectiveness, and in a manner that has a positive social impact. In a construction context, sustainable procurement is a process whereby the client and participating organizations meet design and development requirements in a way that achieves value for money on a whole-life basis, to achieve benefits not only for project stakeholders but also for society and the economy while minimizing any

environmental harm. sustainable construction (Alkilani and Jupp, (2012). Khan et al, (2018) pointed out that green procurement integrates environmental considerations with cost and quality in the purchasing process. For example, green procurement involves purchasing sustainable water, energy, waste, and materials efficient technologies, products, and services, such as recycling, for council buildings, facilities, offices, works, and fleets.

The goal of promoting green procurement is to reduce the negative environmental, social, and economic impacts of purchased products and services throughout their lives. Sustainable procurement looks beyond the initial cost to make purchasing decisions based on the full life cycle of care for products and services which includes environmental and social costs, risks and benefits, and wider social and environmental consequences. Sabbagh et al, (2019) discussed that the support for building materials or energy for green buildings can be impactful catalysts that can offset the additional initial cost of green buildings and let developers and building owners know that having green buildings will pay off quickly. Sodangi, (2021) identified several enabling strategies that support the adoption of sustainable construction, including providing affordable sustainable materials, appliances, and equipment to conserve water and energy, ensuring strict commitment to sustainability by suppliers and project partners supporting the adoption of sustainable construction and the availability of strong market forces that promote sustainable engineering practices. Abidin et al, (2013) argued that more local suppliers should be encouraged to produce green products.

Developing Sustainable Municipal Systems

Municipal administration municipal managers, their management teams, and political leaders can be considered key actors supporting innovations. Their support for the innovation process can be significant when the innovation framework is established and leading development activities and experiments. Furthermore, their role in promoting the organizational culture of innovation is important as they can create a positive culture of innovation. Experimentation and development. In addition, wise and supportive management plays a key role in creating an innovative organization, as managers in municipalities play an essential role in the success of the process, as their role can include being key actors in supporting the innovation process and creating a framework for innovation, experimentation, and development, for example in strategies and leadership of development and experimental activities. While creating and maintaining a positive culture within the organization (Kurkela et al, 2019). Zulu et al, (2022) mentioned that by increasing audits, and improving the presence of regulators by appointing local government environmental planners as dealers and thus improving the ability of the regulator to monitor compliance, increasing cooperation among stakeholders in environmental protection can improve the level of implementation of existing legislation and enhance environmental sustainability in project management, the absence of legislation regarding greenhouse gas emissions and carbon footprint of building infrastructure projects limits the extent to which the construction industry contributes to environmental protection.

Adoption of sustainable designs by governmental and municipal institutions

Marichova, (2020) argued that given the long-life cycle of buildings, it is necessary to encourage design improvements that will reduce the negative impact on the environment and increase the durability and recyclability of their components. Darabpour et al, (2018) discussed that green designs that follow environmental principles and attempt to reduce energy and resource consumption must also depend on the potential of the surrounding environment, the needs of stakeholders, the selection of the appropriate location, recyclable materials, and long-term economic feasibility. While Jagannathan et al, (2018) mentioned that sustainable design leads to a sustainable construction process as the project design must comply with the requirements of the end user. Conflict-free design can only be achieved by considering designability and constructability aspects in the early stages of construction.

Financial incentives (tax credits and grants)

Zulu et al, (2022) argued that providing incentives can mitigate the problem of non-compliance, improve inter-agency cooperation, and help address the challenges of poor coordination between different agencies. While Jagannathan et al, (2018) discussed that government policy support in the form of incentives helps reduce

organizations' resistance to making their practices sustainable. Sodangi, (2021) argued that providing incentives to implement sustainability in engineering practices supports the adoption of sustainable construction. Were Sodangi, (2021) provides incentives to employees who adopt sustainable engineering practices supporting the adoption of a sustainable construction approach. Saradara, (2023) argued that implementing incentives and rewards programs has the potential to enhance sustainability among construction stakeholders. Abidin et al, (2013) argued that to accelerate the process of accepting the concept of sustainability in the construction industry, the government must introduce more incentive-like schemes to attract developers, and information regarding incentives and rebates must be easily accessible to the public.

Sustainable Water Policies

Sodangi, (2021) identified the provision of affordable, sustainable materials, appliances, and equipment for water conservation as one of the enabling strategies beyond adopting a sustainable construction approach. Marichova, A. (2020) discussed that the government must set clear standards for a sustainable approach that promotes the reduction of water consumption and implements systems to detect timely leaks and reuse water for other needs.

Sustainable Energy Policies

Sodangi, (2021) identified the provision of sustainable materials, appliances, and equipment at affordable prices for energy conservation as one of the enabling strategies beyond adopting a sustainable construction approach. Marichova, (2020) discussed that the government must set clear and precise criteria for a sustainable approach that improves the overall energy efficiency of the building, reduces carbon dioxide emissions resulting from energy production, and encourages public investment in energy-efficient buildings, through public-private partnerships or energy-saving contracts with guaranteed results, reduce investment risks, and provide accessible and transparent tools for consultation and assistance.

Pollution Control and Waste Recycling Policies

Al-Otaibi et al, (2022) discussed that governments should provide additional financial costs to manage sustainability while reducing costs through improving quality, reusing or recycling materials, and determining the best ways to transport waste and recycle materials to achieve economic and environmental gains through reducing. Saleh, (2020) discussed that waste management needs a strategy so that waste can be managed as little as possible so as not to disturb and threaten public health. Mohammed et al, (2022) discussed that to sustainably reduce construction waste, one of the most important tools that drive long-term sustainability is a waste management strategy. Waste management is linked to public health and environmental destruction. Therefore, it is crucial to analyze how to manage the resources and waste generated to build a sustainable waste management system.

Sustainable Training Programs

Sodangi, (2021) discussed that provides training to staff and creates an organizational culture that supports sustainable engineering practices and incorporates sustainability courses into civil engineering programs enhancing the adoption of sustainable construction. Abidin et al, (2013) discussed those local practitioners should be trained with practical knowledge and experience, supported by more research on new green technology. Driving forces for developers, capabilities and readiness for sustainable projects should also be explored.

Integrating Sustainable Construction into Education Curricula

Darabpour et al, (2018) pointed out that planning for a sustainable society and a sustainable industry begins with education. Sabbagh et al, (2019) argued that higher education was the one of sources of learning for construction professionals about sustainability in the built environment. Abidin et al, (2013) discussed that government, professional bodies, and academia should work together to reconsider existing standards and rules

and incorporate sustainable needs. Besides, the valuable knowledge obtained through academic research should be effectively disseminated in industry to reduce the gap between theory and practice.

Financing Sustainable Construction Projects

Sodangi, (2021) mentioned that providing innovative financing plans enhances the adoption of sustainable construction. Marichova, (2020) discussed that the government as an economic entity can ensure sustainable development by supporting policies and accompanying construction standards through financial incentives such as tax breaks and loans on favorable terms for sustainable construction. It is necessary to intensify the activities of banks and insurance companies.

Funding Sustainable Research

Funding research institutions related to sustainability is necessary to encourage them to conduct more research to develop sustainable construction approaches. Saradara, (2023) discussed that the research institutions should conduct more research to explore the areas of lifetime cost analysis, value engineering in the use of recycled aggregate, and waste-to-energy technologies further more research should be conducted on the implementation of green building codes in all construction projects. Marichova, (2020) argued that the government at the national or local level must ensure funding and incentives for research and development and the effective participation of companies.

Increase government investment in infrastructure projects that support a sustainable construction approach

The world's population is constantly increasing, and to accommodate this increase there is a need to build modern and sustainable cities. Cities face challenges due to the effects of climate change in terms of rising sea levels, drought, drinking water scarcity, and floods. The development and maintenance of infrastructure also require access to resources, for example. In terms of financing, it is important to develop policies that develop incentives for investment and development (Thuesen and Opoku, 2018). Investment in sustainable infrastructure projects is important to support the sustainable approach in the construction industry. Darabpour et al, (2018) discussed that creating sustainable buildings and infrastructure and, in general, a sustainable society is a public duty. while Sabbagh et al, (2019) argued that all Arab countries have governmental bodies responsible for the environment. However, the main role of these bodies is limited only to focusing on protecting the environment and finding solutions to current environmental problems. Adding to their tasks the responsibility of creating appropriate and environmentally friendly infrastructure and facilitating the way to a green future is important to advance the green wheel in the Arab world. This environmental orientation in planning and building Arab cities would help in transforming the Arab construction industry from traditional to sustainable.

Encouraging investment in sustainable construction projects

Sodangi, (2021) mentioned that providing large-scale investments enhances the adoption of sustainable construction. While Saleh, (2020) discusses that foreign investment can undertake various activities with technology transfer and improvement of practice and environmental management practices and will assist developing countries in achieving sustainable development.

Promoting sustainable partnerships with sustainable international organizations

Darabpour et al, (2018) recommended increasing cooperation with international organizations (including the United Nations, the World Green Building Council, and countries) to protect mutual interests on a global scale. Exchanging experiences with other developed countries can enhance the sustainability process. Sodangi, (2021) established communication channels to allow a clear presentation of shared sustainability goals enhancing the adoption of a sustainable construction approach.

RESEARCH METHODOLOGY

To achieve the aim of this research, an in-depth review of the literature related to sustainable construction was conducted and a questionnaire was subsequently developed that includes two lists, the first related to demographic information, while the second list includes seventeen sustainable strategies, which requires experts to evaluate it using a five-point Likert scale, then the Delphi approach for three rounds applied. Delphi technology allows researchers to obtain highly reliable data from certified experts through the use of strategically designed surveys it is a systematic and interactive research technique for obtaining the judgment of a panel of independent experts on a given topic. Individuals are selected according to predefined guidelines and are asked to participate in two or more rounds of structured surveys, the main goal of Delphi's multiple rounds is to reach a consensus by reducing the variance in responses and to improve accuracy. Both goals are achieved through the use of feedback and repetition. The feedback process is a mechanism for informing panel members of the opinions of their anonymous counterparts (Hallowell and Gambatese, 2010). Delphi's approach was applied by sending the questionnaire independently to a panel of expert engineers who have at least 15 years of experience in green buildings and sustainable construction to collect their different opinions. In the first round, the panel of engineers answered the questions independently to ensure that no one influenced them. After receiving the answers, they were analyzed and the agreement between experts was measured. It was found that there was a preliminary agreement in the engineers' opinions regarding the items of the questionnaire questions. In the second round, the questionnaire was sent with the results of the analysis again to the panel of experienced engineers, after receiving the answers of the respondents and analyzing them, it was found that the level of agreement between them increased in the third round. The questionnaire was repeatedly sent with the results of the analysis to the experts, and the experts' responses were received. It was also noted that the level of agreement among the experts increased. The results were analyzed and a discussion was held. For the three rounds, the findings were analyzed using SPSS, and the degree of agreement between experts was measured using Kendall's coefficient of concordance.

RESPONDENT'S DEMOGRAPHIC BACKGROUND

This study aims to identify effective sustainable strategies that can be adopted by government institutions to initiate the application of a sustainable building approach. To achieve the objectives of the study, a panel of a total of 16 expert engineers with extensive experience in sustainable construction and green buildings were targeted to be respondents to collect their opinions, observations, and recommendations. Belton et al, (2019) stated that the panel size at least include 5 experts, a sufficient range between 5 and 20, but using more is acceptable if so practically to do it and for the optimal number of Delphi rounds repetitions, three rounds are generally necessary to be enough to allow a pattern of stability to emerge from panel members. In this study, the expert panel included project managers, consulting engineers, and design engineers. and execution engineers working on sustainable construction projects. The process of collecting experts' opinions was done using the Delphi method. Table 1 shows a summary of the demographic information of the respondents.

Table. 1 Respondent's Demographic Background

Respondent's Demographic Background				
Academic Background	Bachelor Degree	10		
	Master Degree	6		
Sector Type	Developer	1		
	Consultants	9		
	Contracting	6		
Job Designation	Sustainability Engineer	1	Civil Engineer	3
	project Manager	3	Mechanical Engineer	1
	Resident Engineer	2	Electrical Engineer	3
	Designer/Architect	2	Technical Manager	1
Total Experience in the Construction Sector	15 - 20 Years	10		
	20 - 29 Years	5		
	30 + Years	1		

RESULTS ANALYSIS

Results of Delphi Round One

Examining the results of the Delphi round, one shows that all the strategies were considered significant, where the mean score of each strategy was higher than 3.0, therefore all the strategies have been selected for the next Delphi round. Thirteen strategies resulting from Delphi round one obtained Likert point mean values above 4.0. These parameters were raising awareness and understanding of the importance of sustainability by government agencies, the government enacting sustainable building laws and regulations, adopting sustainable building evaluation systems and standards, sustainable procurement policies and requirements when awarding sustainable contracts, developing sustainable municipal systems, adoption of sustainable designs by governmental and municipal institutions, financial incentives (tax credits and grants), sustainable water policies, sustainable energy policies, pollution control and waste recycling policies, increase government investment in infrastructure projects that support a sustainable construction approach, encouraging investment in sustainable construction projects and promoting sustainable partnerships with sustainable international organizations. The remaining four strategies include sustainable training programs, integrating sustainable construction into education curricula, financing sustainable construction projects, and funding sustainable research achieved Likert point mean values above 3.00. Table 2 shows the results of the Delphi round one.

Table. 2 Results of the Delphi Round One

Code	Strategies	Rank	Likert Point Mean	Mean Rank	Std. Deviation
E1	Raising awareness and understanding of the importance of sustainability by government agencies	6	4.19	8.88	0.403
E2	The government enacts sustainable building laws and regulations	1	4.69	12.50	0.479
E3	Adopting sustainable building evaluation systems and standards	2	4.56	11.81	0.512
E4	Sustainable procurement policies and requirements when awarding sustainable contracts	2	4.56	11.97	0.512
E5	Developing sustainable municipal systems	3	4.38	10.44	0.500
E6	Adoption of sustainable designs by governmental and municipal institutions	3	4.38	10.22	0.500
E7	Financial incentives (tax credits and grants)	8	4.06	8.03	0.574
E8	Sustainable water policies	4	4.37	10.41	0.500
E9	Sustainable energy policies	4	4.37	10.41	0.500
E10	Pollution control and waste recycling policies	5	4.31	9.91	0.602
E11	Sustainable training programs	9	3.81	6.88	0.834
E12	Integrating Sustainable Construction into Education Curricula	10	3.75	5.81	0.447
E13	Financing sustainable construction projects	9	3.81	6.22	0.403
E14	Funding sustainable research	11	3.31	3.50	0.479
E15	Increase government investment in infrastructure projects that support a sustainable construction approach	6	4.19	9.16	0.544

E16	Encouraging investment in sustainable construction projects	7	4.13	8.66	0.500
E17	Promoting sustainable partnerships with sustainable international organizations	8	4.06	8.22	0.574
	Number of parameters	17			
	No. of respondents	16			
	Kendall's Coefficient of Concordance	0.341			

Results of Delphi Round Two

Examining the results from Delphi round two showed that all strategies obtained Likert point mean values above 4 except the strategy funding sustainable research achieved Likert point mean values above 3.00 with 3.88. It was noticed that the level of consistency among the participating experts increased from 0.341 in the first round to 0.428 in the second round. The results of the second round of Delphi indicate that the strategy, the government enacts sustainable building laws and regulations was ranked first, and it achieved a Likert point mean value (Lvi) of 4.88, while the strategy adopting sustainable building evaluation systems and standards ranked second with a Likert point mean value (Lvi) of 4.81, while the strategy sustainable procurement policies and requirements when awarding sustainable contracts ranked third with a Likert point mean value (Lvi) of 4.75, the strategies developing sustainable municipal systems, sustainable water policies and sustainable energy policies ranked fourth with a Likert point mean value (Lvi) of 4.69, while the strategy funding sustainable research gained a Likert point mean value (Lvi) of 3.88 and was ranked last. Table 3 shows the results of the Delphi round two.

Table. 3 Results of the Delphi Round Two

Code	Strategies	Rank	Likert Point Mean	Mean Rank	Std. Deviation
E1	Raising awareness and understanding of the importance of sustainability by government agencies	9	4.13	6.97	0.342
E2	The government enacts sustainable building laws and regulations	1	4.88	13.28	0.342
E3	Adopting sustainable building evaluation systems and standards	2	4.81	12.78	0.403
E4	Sustainable procurement policies and requirements when awarding sustainable contracts	3	4.75	12.28	0.447
E5	Developing sustainable municipal systems	4	4.69	11.72	0.479
E6	Adoption of sustainable designs by governmental and municipal institutions	5	4.38	9.09	0.500
E7	Financial incentives (tax credits and grants)	9	4.13	6.94	0.342
E8	Sustainable water policies	4	4.69	11.72	0.479
E9	Sustainable energy policies	4	4.69	11.72	0.479
E10	Pollution control and waste recycling policies	7	4.25	8.03	0.447
E11	Sustainable training programs	8	4.19	7.50	0.403
E12	Integrating Sustainable Construction into Education Curricula	10	4.00	5.91	0.000
E13	Financing sustainable construction projects	10	4.00	5.91	0.000

E14	Funding sustainable research	11	3.88	5.09	0.342
E15	Increase government investment in infrastructure projects that support a sustainable construction approach	7	4.25	8.03	0.447
E16	Encouraging investment in sustainable construction projects	8	4.19	7.50	0.403
E17	Promoting sustainable partnerships with sustainable international organizations	6	4.31	8.53	0.479
	Number of parameters	17			
	No. of respondents	16			
	Kendall's Coefficient of Concordance	0.428			

Results of Delphi Round Three

Results from Delphi round three showed that all strategies obtained Likert point mean values above 4 except the strategy funding sustainable research achieved Likert point mean values above 3.00 which is equal to 3.94. It was noticed that the level of consistency among the participating experts increased from 0.428 in the first round to 0.544 in the third round. The results of the third round of Delphi indicate that the strategy, the government enacts sustainable building laws and regulations was ranked first, and it achieved a Likert point mean value (Lvi) of 4.94, while the strategy adopting sustainable building evaluation systems and standards ranked second with a Likert point mean value (Lvi) of 4.88, while the strategies sustainable procurement policies and requirements when awarding sustainable contracts and the strategy sustainable water policies ranked third with a Likert point mean value (Lvi) of 4.81, the strategies developing sustainable municipal systems, and sustainable energy policies ranked fourth with a Likert point mean value (Lvi) of 4.75, while the strategy funding sustainable research gained a Likert point mean value (Lvi) of 3.94 and was ranked last. Table. 3 shows the results of the Delphi round two. Table 4 shows the results of the Delphi round three.

Table. 4 Results of the Delphi Round Three

Code	Strategies	Rank	Likert Point Mean	Mean Rank	Std. Deviation
E1	Raising awareness and understanding of the importance of sustainability by government agencies	9	4.06	6.44	0.250
E2	The government enacts sustainable building laws and regulations	1	4.94	13.84	0.250
E3	Adopting sustainable building evaluation systems and standards	2	4.88	13.34	0.342
E4	Sustainable procurement policies and requirements when awarding sustainable contracts	3	4.81	12.81	0.403
E5	Developing sustainable municipal systems	4	4.75	12.28	0.447
E6	Adoption of sustainable designs by governmental and municipal institutions	5	4.31	8.56	0.479
E7	Financial incentives (tax credits and grants)	9	4.06	6.44	0.250
E8	Sustainable water policies	3	4.81	12.78	0.403
E9	Sustainable energy policies	4	4.75	12.25	0.447
E10	Pollution control and waste recycling policies	7	4.19	7.50	0.403
E11	Sustainable training programs	10	4.00	5.91	0.000

E12	Integrating Sustainable Construction into Education Curricula	8	4.13	6.97	0.342
E13	Financing sustainable construction projects	7	4.19	7.50	0.403
E14	Funding sustainable research	11	3.94	5.50	0.250
E15	Increase government investment in infrastructure projects that support a sustainable construction approach	8	4.13	6.97	0.342
E16	Encouraging investment in sustainable construction projects	10	4.00	5.91	0.000
E17	Promoting sustainable partnerships with sustainable international organizations	6	4.25	8.00	0.447
Number of parameters		17			
No. of respondents		16			
Kendall's Coefficient of Concordance		0.544			

RESULTS DISCUSSION

The results of three Delphi rounds indicate that the experts have re-evaluated the effectiveness of the 17 strategies, and a convergence in their opinions has been noted. The analysis of the results of the third round of Delphi indicates that there has been a convergence of opinions among the responding experts, as Kendall's examination of consistency showed an increase in the level of consistency among them from 0.428 in the second round to 0.544 in the third round according to Kendall's scale. The degree of agreement between experts was measured using Kendall's coefficient of concordance, where the range is (0-1). [8] stated that the range of Kendall's coefficient of concordance W (0-1), where W=0 indicates the absence of agreement, while when W=1 indicates complete agreement or unanimity Table 5 shows a Comparison between the results of Kendall's Coefficient of Concordance (W) in Delphi round two and round three.

Table. 5 Comparison between the results of Kendall's Coefficient of Concordance (W)

Kendall coefficient of concordance (W)	Round 2	Round 3
Level of agreement among participants	0.428	0.544

Comparing the results between the second and third rounds of the Delphi survey shows the stability of the ranking of 11 strategies including raising awareness and understanding of the importance of sustainability by government agencies, the government enacting sustainable building laws and regulations, adopting sustainable building evaluation systems and standards, sustainable procurement policies and requirements when awarding sustainable contracts, developing sustainable municipal systems, adoption of sustainable designs by governmental and municipal institutions, financial incentives (tax credits and grants), sustainable energy policies, pollution control and waste recycling policies, funding sustainable research and promoting sustainable partnerships with sustainable international organizations with a slight change in the classification of the rest of the parameters. Table 6 shows a comparison between ranks from Delphi rounds two and three.

Table. 6 Comparison between Ranks from Delphi Rounds Two and Three

Code	Parameters	Rank Delphi Round Two	Rank Delphi Round Three
E1	Raising awareness and understanding of the importance of sustainability by government agencies	9	9
E2	The government enacts sustainable building laws and regulations	1	1
E3	Adopting sustainable building evaluation systems	2	2

	and standards		
E4	Sustainable procurement policies and requirements when awarding sustainable contracts	3	3
E5	Developing sustainable municipal systems	4	4
E6	Adoption of sustainable designs by governmental and municipal institutions	5	5
E7	Financial incentives (tax credits and grants)	9	9
E8	Sustainable water policies	4	3
E9	Sustainable energy policies	4	4
E10	Pollution control and waste recycling policies	7	7
E11	Sustainable training programs	8	10
E12	Integrating Sustainable Construction into Education Curricula	10	8
E13	Financing sustainable construction projects	10	7
E14	Funding sustainable research	11	11
E15	Increase government investment in infrastructure projects that support a sustainable construction approach	7	8
E16	Encouraging investment in sustainable construction projects	8	10
E17	Promoting sustainable partnerships with sustainable international organizations	6	6

The results of the study revealed that experts agreed about the validity of all the 17 sustainable strategies that were identified and measured through the use of the specified criteria for the Delphi approach in enabling government institutions and organizations related to the construction sector to implement sustainable construction practices in the construction industry. Figure 1 shows the scoring of 17 sustainable strategies which is obtained from Delphi round three.



Figure. 1 Sustainable Strategies Delphi Round Three

CONCLUSION

Adopting a sustainable construction approach in the construction sector in Iraq achieves the goals of sustainable development, as it requires the adoption of effective sustainable strategies that are implemented by developing plans and template scenarios for implementation, with the involvement of all stakeholders related to the construction sector in the implementation process. The objectives of this study were achieved in identifying appropriate sustainable strategies that support the achievement of a sustainable construction

approach, as seventeen reliable strategies were identified. These strategies included raising awareness and understanding of the importance of sustainability by government agencies, the government enacts sustainable building laws and regulations, adopting sustainable building evaluation systems and standards, sustainable procurement policies and requirements when awarding sustainable contracts, developing sustainable municipal systems, adoption of sustainable designs by governmental and municipal institutions, financial incentives (tax credits and grants), sustainable water policies, sustainable energy policies, pollution control and waste recycling policies, sustainable training programs, integrating sustainable construction into education curricula, financing sustainable construction projects, funding sustainable research, increase government investment in infrastructure projects that support a sustainable construction approach, encouraging investment in sustainable construction projects and promoting sustainable partnerships with sustainable international organizations.

The results of this study can be considered as a roadmap for decision-makers in government institutions and organizations related to the construction sector in moving towards adopting and implementing a sustainable construction approach in the construction industry.

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