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Integration of Environmental Management System on Construction Project toward Sustainable Development

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Abstract:- In recent times, the transition towards sustainable development has received considerable attention from researchers and organizations in various construction and industrial projects with its three main dimensions, namely the economic and social environment, the sustainable development provide the socially and economically appropriate environment for the current generation with positive impact on the requirements of future generations. This study reviewed previous studies on the definition of environmental management and the concept of integrated management in construction projects and their linkage to sustainable development and barriers to implementation. The paper also presented a link to some papers during the past eight years with a focus on what was published in the last three years. It noted that the integration of the various programs and project management systems and the transition to work on a wider scale from the organization to the state, to projects on a global scale and with integrated programs will be the most advanced towards Achieving sustainable development. During the study, the importance of environmental awareness at various levels, from citizens to decision-makers as well as the development of legislation in force in the country or at the UN level, was noted. The global application of sustainable development programs is limited. Therefore, the most effective system for sustainable development is the most comprehensive system of integration in wider area.

Keywords:- *Environment, Management, Sustainable, Development, Integration, Construction, Project, System.*

I. INTRODUCTION

Recently, attention has been paid to the development of administrative systems for construction projects and the transition to sustainable development in order to meet our needs in line with the lack of harm to future generations at least, but the goals are to ensure economic and environmental conditions ideal for them and from here we will outline definitions to understand the foundations of sustainable development in the management of construction projects.

A. Integrated Environmental Management

Integrated environmental management means the integration of environmental needs over the life of construction, and this requires consideration of environmental requirements in design, implementation, and service in construction projects, the environment refers to all the surrounding conditions that are affected and affect a project. This includes physical, social, biological and economic conditions. Management is the primary planning and execution processes under control with responsibility and accountability, [1]. The tools used in the application of integrated environmental management system include :The beginning will be the stage of investigation of the expected environmental impacts resulting from the implementation or operation of the project, the second stage is to assess the environmental impacts of the project, whether positive or negative, and includes treatment methods if the effects are negative. The third step is to involve stakeholders in planning, study, implementation and management of proposed activities. Stage 4 is Life Cycle Assessment (LCA), by identifying inputs such as materials, machinery, implementers and outputs such as major products and waste. Stage 5 is the financial management of the environment, which includes auditing, accounting and economic reporting that determines the costs of environmental impacts. The sixth stage is to determine the size of the environmental footprint to measure the environmental impact, for example in surface water or in the atmosphere. Finally, sustainability analysis is a study and evaluation of the compatibility of activities and business with the principles of sustainable development, [2].

B. Concept of Sustainable development

At the institutional level, sustainable development means different things for different people. Some people's concept of sustainable development is the success of the institution financially to ensure continuity in existence. However, the concept of sustainable development includes ensuring the needs of these individuals without compromising the needs of future generations, [3]. Sustainable economy is the ability to produce, then the distribution and consumption through the design of systems that achieve this at the industrial level and service. A sustainable society is a healthy society in optimal economic, environmental and social conditions. Sustainable building is a building of a cooperative relationship between all stakeholders in the construction lifecycle, from planning to building use.

Sustainable construction is the final product of a sustainable planning process that includes management of natural resources, reasonable energy consumption and adequate ventilation while ensuring construction strength, quality of use and inexpensive maintenance, [4]. A sustainable development strategy is a planning approach that relies on further consideration of the broader system in which specific actions are integrated; the strategic model for sustainable development identifies the relationship between different levels of the system, [5].

C. Integrated Environmental Management towards Sustainable Development

Several studies have been conducted on the integration of environmental management systems into sustainable development. Each study identified several factors that influence the transition to sustainable development. Table 1 contains some of these factors:

Table1. The suggested factors for (IEM) system towards sustainable development

Authors and Year of Publication	**The Suggested Factors for Integrated Environmental Management towards Sustainable Development**
Richard (1994)	Setting an environmental policy for activities. Create an organizational structure that identifies decision-makers, responsibilities and communication systems for managing the environment. Create an environmental management program (EMP) which includes instructions and laws that ensure access to the desired environmental objectives. Periodic review of the ecosystem and the introduction of the required modifications to ensure the progress towards the desired goal, [6].
Yeo & Quazi (2006)	Evaluation of environmental awareness of employees. Increase environmental awareness of employees. Commitment of senior management to the environmental program. Empowering staff. Encouraging rewards for the environmental program. Environmental outcomes. Periodic environmental reviews.
Sushi & Sohal (2004)	Senior management and environmental commitment. Training and development. Internal Evaluation. Compliance with sustainability standards.
Hamid. (2011)	Integrate life cycle costs into construction projects. Integrate environmental aspects into policies, plans and programs over the life of the project. Increasing the capital of the institution is an important element that affects all aspects, including the environmental aspect. Supporting technological development and innovation, [3].

D. The Road map for sustainable construction

There are many ways in which different studies have adopted a roadmap for sustainable development, Huovila. (1998), proposed a set of measures in the road map to achieve sustainable development in the constructions as in Figure 1, [7].

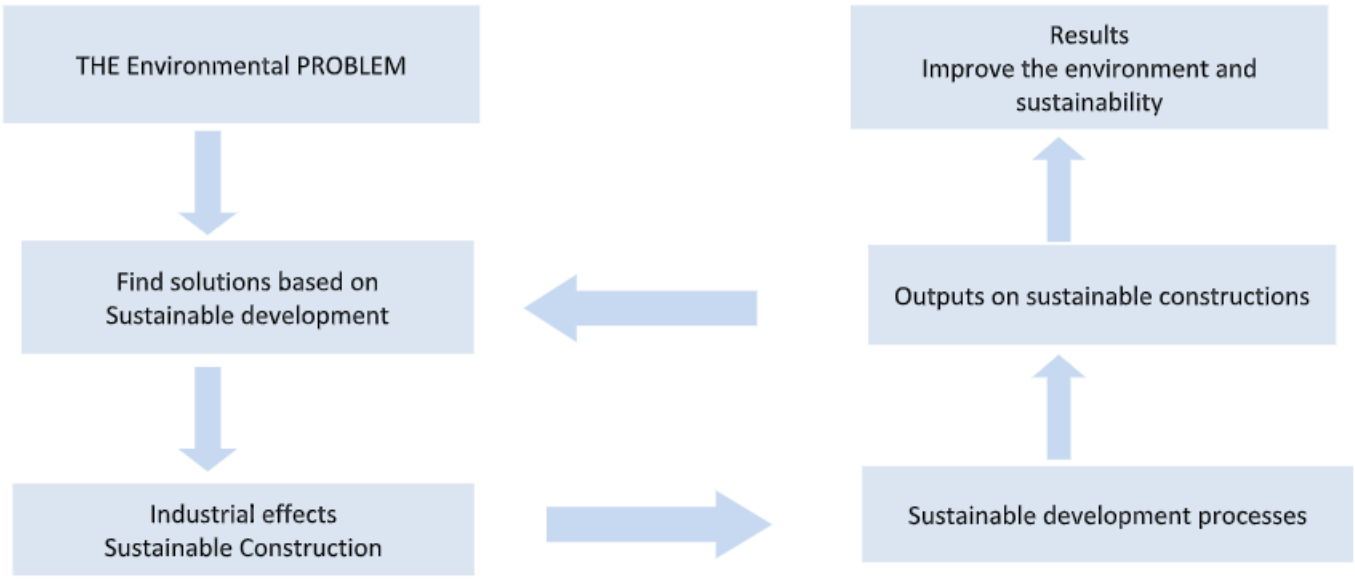

Fig 1. The Road map for sustainable construction, [7].

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E. The Aims of Sustainable Construction

Based on its three pillars social economic and environmental, sustainable development aims to: Competitiveness and profitability. Customer satisfaction and stockholders. Increase stockholder appreciation and respect. Provide better protection for the natural environment. Energy saving and reducing the depletion of natural resources.

F. The challenges in sustainable construction

Sustainable development in construction projects faces different and varied challenges depending on the type of construction, the size of the project, the surrounding environmental conditions and the level of technological development. The most important of these challenges are: Environmental acts, aspects and impact, natural resources, cost, occupational health, safety and training program.

II. LITERATURE REVIEW

Following this presentation of some of the key aspects of integrated management of environment and sustainable development, we will mention here the most important findings in a number of previous studies as follows:

Ying He (2010), conducted a review on the benefits and challenges for implementation of environmental management in projects. The most important obstacles were found: the increase in total costs of materials and labor, and the most important way to overcome these obstacles was to focus on increasing the awareness of stockholders, [8]. Oyedolapo and others (2014), mentioned that the participation of lean construction in sustainable development is limited, and they conducted a survey study on the implementation of sustainable development on lean construction and has concluded a set of links: attention to health and environmental awareness, rationalization of energy consumption, improvement of performance and development of environmental management systems, [9].

Atiq Uz Zaman (2014), concluded a review study on zero waste policies, that some countries have achieved great success at this level. In order for the program to be successful, it must be at the level of the State at least. There should be a desire to implement this program at the level of decision-makers and to educate people and persuade them, to change their lifestyles so that they are involved in the program and to reach the result of zero waste, which means the proper recycle of all waste so as not to harm others or future generations and not to get rid of them by burning or burying in the ground, [10]. Xiaolong Gan and others (2015), Conducted a t study consisting of 25 barriers to sustainable construction based on the owners' perspective, the seven most important barriers to sustainable development were the prevailing laws, natural resources, administrative structure, economic study of the project, sources of supply, problems of use of facilities and environmental awareness, [11].

Amaya Perez (2015). A review study focused on the introduction of sustainability in project management has concluded that research is still discussing the definition of a sustainable project, it has to achieve the objectives of integrated sustainability goal is not currently accessible. The study found that the integration of sustainability criteria into the design and production stages is very important for sustainable projects in addition the laws, procedures, the awareness of the implementers and project managers are all important in making progress on sustainable projects, [12]. Jose Arturo, (2015), has reviewed the previous studies of the green policy and lean and classified on the basis of six foundations, namely the compatibility of programs implemented, the integration and association with others, the extent of impact, impact on the policy of organizations, their impact on the administrative system and the implementation of these programs in various sectors. He concluded that the concept of lean and green is relatively unclear and urges the study to continue research on the subject, [13]. The study integrated the building information modelling (BIM) and modern method of construction programs (MMC) to achieve sustainable development in building projects, but it was noted that the implementation barrier is government decisions, [14]. David Le Blanc (2015), this study was conducted on the United Nations proposal for sustainable development goals for 2014, the network analysis technique was used to determine the objectives of sustainable development, it was noted that the correlation between the goals is weak in some cases, the lack of correlation in other cases and the dependence on the social, economic and environmental sustainable dimension of sustainable development, [15]. Ahmad Huzaimi and others (2015), proposed a model for the integration of poor construction standards and sustainable construction. Also they presented a theoretical initiative that contains a theoretical basis for integrating the two programs and to serve as a platform for future empirical studies to facilitate and overcome the difficulties of integrating programs faced by organizations, [16]. Mauro L (2016), a study of the main dimensions of sustainable construction based on the perspective of project managers. The study concluded four main factors that affect sustainable construction: innovative work, managing stockholders, competition and environmental resources, [17]. Zhe Liu (2016) made a comparative study of a park in a rapidly growing country, China with a park in a developed country, Canada, on the requirements of sustainable development. Due to of the great industrial renaissance in China, the focus was on top-down sustainable development. The Canadian park seems to be slowing down in the direction of sustainable development, [18]. The study investigated the sustainability of water resources in four water basins in Brazil, the United States, Mexico and Thailand. It was noted that the decision to participate in decision making for stockholders has increased in the past 20 years, a good indicator that increases the integrated learning culture but has led to more complex management .The study found that participation in short-term decisions was better and less risky, such as allocation of water quotas. As for the process of long-term decisions, the cost of developing the capacity to participate in the decision is officially neglected and

therefore there will be no effective participation of stockholders, for example in the construction of infrastructure [19]. Ruggero Golini (2017) the study on the adoption by international non-governmental development organizations of the use of the logical framework as a key instrument in the sector. A logical framework (LF) is a matrix of factors, including goals, activities, hypotheses, and resources used to achieve the goals. The study targeted 500 organizations that collected information through the managers of international development projects in the world and found that the use of the logical framework has a significant impact on the success of these projects, [20]. Tatiana Heid Furley (2017) an exploratory study at the initiative of Los Angeles on the effects on the sustainable environment in the Latin American continent consisted of 100 questions sent to various sectors within these countries. The results of 20 questions were collected in a workshop in Argentina. Six important factors affecting the sustainable environment were summarized: Measurement of risks and bio toxicity, environmental chemical components, pollution, public health, used logical framework and policies, [21]. Dayuan Li (2017) the study targeted 100 Chinese companies to study the impact of quality management on the development and innovation of green technologies. It has been noted that these companies are generally negative towards green innovation. To reduce this negative impact by improving environmental management and developing legislation, [22]. Margarita Angelidou (2017) An analytical study on the development of a program that integrates 32 smart cities programs with the foundations of sustainable development and concluded the useful linkage between sustainable development and smart urban systems,[23]. Sian E. Rees (2017), a study on the development of the provisions of the United Nations conventions on marine waters. The study focused in detail on goal 11 of the Convention on Biological Diversity, which identified at least 10% of the area of marine and coastal waters considered as protected areas under the area management system. And merged goal 11 with Goal 14 for sustainable development related to Protection Sea and ocean waters, [24]. Chen Wanga (2017) reviewed previous studies on low carbon development in China and produced a more comprehensive summary based on three axes: low-carbon cities, low-carbon technologies and energy transmission, [25]. Dong, L (2017) the study reviewed 21 previous research on the use of the urban infrastructure system for sustainable development and concluded an innovative model proposal in this direction. It also stressed the importance of innovation in urban infrastructure for progress towards sustainable development, [26]. Bao Jiehe (2018) has integrated three urban development programs in China to formulate a more quality system in the direction of sustainable development. He noted the importance of integrating different technologies and initiatives in reducing barriers and concerns towards sustainable development, [27]. C. Shrubsole and others (2018) conducted a study on building systems in the UK and China and proposed a system to integrate these systems into a high-performance environmental building system. They noted the importance of linking systems to create a sustainable ecosystem where many barriers to the use of a single system, [28].

III. DISCUSSION

Based on the above mentioned in previous studies, it was noted that:

- The previous studies reviewed almost eight years, starting from the year 2000 until this year, with some focus on recent studies over the last three years to observe recent developments on sustainable development research in construction projects
- In general, two main factors appear to be the reduction of barriers and challenges to the transition to sustainable development in various aspects of construction projects and buildings. The emphasis has been placed on several current studies within proposed solutions or recommendations.
- The first factor is the integrated management of several modern systems and technologies, since the systems and methods of sustainable development are numerous and varied to a large extent within institutions within a single state
- The second factor is to increase the participation base of these integrated programs until the application reaches the global system
- In order to clarify more, the previous studies in this paper have been compiled in Table 2, which includes the level of study carried out and the sustainable development targeted by its three environmental, economic and social dimensions.

Table 2. Summary of previous research based on level of study area and elements of sustainable development

The study	Study & area	Study subject	Level of study					Sustainable Development			Ref
			G	R	N	S	O	En	Eco	So	
Ying He (2010)	A review	Environment management of projects (benefits and the barriers)						●	●	●	[8]
Oyedolapo (2014)	United kingdom	the effects of lean construction on sustainable construction			●			●		●	[9]
Atiq Uz Zaman, (2014)	A review	Zero waste management system						●	●	●	[10]
Xiaolong Gan (2015)	Chongqing ,China	The owner's point of view				●				●	[11]
Amaya Pérez (2015)	A review	Integrate sustainability into project management						●	●	●	[12]
Jose Arturo, (2015)	A review	Lean and Green policy						●	●	●	[13]
Zaid Alwan, (2015)	United kingdom	Integrating the BIM and MMC systems for the sustainable development of the project			●			●	●	●	[14]
David Le Blanc (2015)	United Nations	The objectives of sustainable development	●					●	●	●	[15]
Ahmad Huzaimi (2015)	Malaysia	Integrating lean construction standards and sustainable construction.			●			●	●	●	[16]
Mauro L (2016)	A Survey based on researches	Factors of sustainable construction based on the perspective of managers						●	●	●	[17]
Zhe Liu (2016)	A Comparative China and Canada	Sustainable development of two parks in China and Canada		●				●	●	●	[18]
Katharine (2016)	Brazil, Mexico, Thailand, and the United States	Sustainable management on four basins water resource		●					●	●	[19]
Ruggero Golini (2017)	A Survey non-government organizations	logical framework impact on development projects	●					●	●	●	[20]
Tatiana Heid Furley (2017)	A Survey Latin America	Quality of sustainable environment		●	●	●	●	●	●	●	[21]
Dayuan Li (2017)	A Survey in China	impact of quality management on development of green technologies			●		●	●	●	●	[22]
Margarita Angelidou (2017)	An analytical study	Integration sustainable development in 32 smart city programs						●	●	●	[23]
Sian E. Rees (2017)	Study of policies United Nations	Integration of two United Nations items of marine management for sustainable development						●	●	●	[24]
Chen Wanga (2017)	A review China	low-carbon development						●	●	●	[25]
Dong, L (2017)	A review of (21) articles	Development of the urban infrastructure system towards sustainable management						●	●	●	[26]
Bao Jiehe (2018)	An instigation China	Integration of 3 urban system towards sustainable development			●			●	●	●	[27]
C. Shrubsole (2018)	An instigation United kingdom and China	Integration of building systems towards high performance environmental buildings		●	●	●		●	●	●	[28]

- Abbreviations in table 2: G= Global, R= Regional, N= National, S= Sectorial, O= Organizational. IEMs= Integrated Environmental Management systems, En= Environmental, Eco= Economic, So=Social, BIM=

Building Information Modelling, MMC= Modern Method of Construction.

From table 2, noted that:

- The review studies [8, 10, 12, 13, 25, and 26] were related to the sustainable development of building types, elements of sustainability and integration of management systems and techniques. Studies have shown the importance of integrating the programs used to achieve sustainable development. However, trials and implementation of the results of these studies are needed to support the promotion of sustainable development.
- Studies [9, 14, 16, 22, and 27] at the state level: related to the integration of two or more of the technologies or programs towards sustainable development and were more effective than unilateral programs or to implement at a lower level such as sectors or institutions within these countries, and identified some barriers and challenges.
- In the table, each factor was available at a point (●). Studies [21 and 28] were the most important points, as they were comprehensive, covering all factors of sustainable development and targeting levels up to the regional level.
- Studies at the global level only two of the previous twenty-one studies: Regulatory Study [15] were on the objectives of sustainable development in the United Nations and the exploratory study [20] on non-governmental organizations.
- This means that sustainable development is better in the most comprehensive system that is achieved with the most integration on the widest area, from the table 2, we can express the comprehensiveness of the number of points (●) achieved in each study, which helps to know the evolution of the most comprehensive in the programs of sustainable development. Chart 1 shows that previous studies in recent years are the most comprehensive.

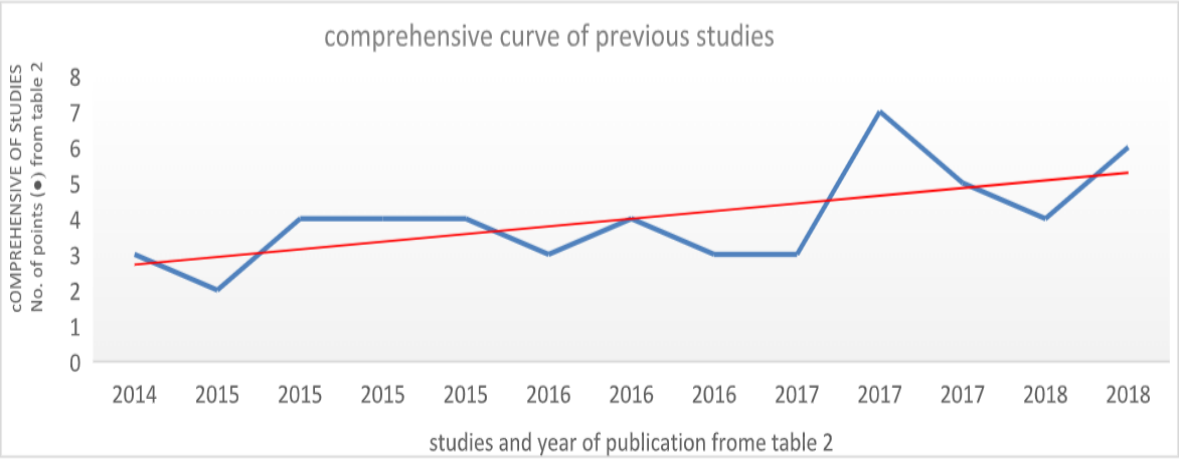

Chart 1. The most comprehensive curve in previous studies over recent years

IV. CONCLUSIONS

- Sustainable development are integrated systems and technologies to meet the needs of the current generation while ensuring the needs of future generations. So it looks like a human right too.
- The integration of multiple systems and programs of the management projects and buildings is very important towards the sustainable development of projects.
- Implementing the integrated programs of sustainable constructions at the regional and global levels will be the best performance on the environment and reduce barriers and challenges in the direction of sustainable development.
- Higher management and legislation at the national or global level are an important barrier to the implementation of sustainable development. They need to be more flexible and more binding at the global level to make significant progress.
- Environmental awareness, training and education at all levels of decision makers, project managers, stockholders and investors are important factors in changing practices and lifestyles to move forward towards a sustainable development community.
- sustainable development is better in the most comprehensive system that is achieved with the most integration on the widest area

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