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The role of project management in the success of green building projects: Egypt as a case study

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Abstract

Sustainability and project management are two trends that have taken global interest in the last decades due to their significant role in various fields of life. However, these two topics have rarely been addressed in one study or framework. As sustainability and environmental issues are not specifically or systematically considered in most major project management frameworks such as the Project Management Body of Knowledge (PMBOK), Individual Competence Baseline (ICB), International Organization for Standardization (ISO 21500:2012), and so on. Furthermore, sustainability applications in the construction field under the term “green buildings” are facing various types of obstacles that obstruct the pervasion of this type of construction in an adequate and required way. Some of these obstacles have been addressed in recent studies with suggested solutions, but the role of project management in overcoming or even mitigating the risk of these obstacles was almost absent in most of these studies. Therefore, this paper attempts to observe the most important obstacles facing the application of sustainability in the construction field and taking the green construction situation in Egypt as a case study. In addition, this paper aims to investigate the role of project management in green building projects’ success, through project management best practices’ applications to overcome the main reasons that obstruct the green building projects movement. The results showed that there is a lack of management methods that address sustainable construction projects. In addition, there is no clear methodology governing the green building management process. Also, the unspecified responsibilities between stakeholders in green building projects lead to difficulties in managing and implementing green buildings. However, some defined obstructions could be overcome by project management’s best practices and methods.

Keywords: Sustainability, Project management, Green building, Rating systems, LEED, Green pyramids

Introduction

The trend towards sustainability and a better life for future generations is one of the global trends that has received great attention in recent times, especially for those interested in the field of construction. Urban and industrial progress, accompanied by greater consumption of natural resources, reflects negatively on the ability of the planet to renew

its resources, and therefore exposes future life to danger. The latest events around the world-like forest fires, floods, and torrents due to global warming, encourage the global interest in sustainability as one of the means to address this phenomenon. And the high cost of oil energy and its negative impact on the environment have prompted the search for alternative sources of energy and developed concepts that aim to reduce dependence on oil energy and rationalize the use of coal and gas for power generation.

A few years ago, concepts such as “eco-friendly building” and “green architecture” emerged within the framework of sustainable development that goes beyond the narrow economic outlook for rapid profit and the aspiration to conserve natural resources and allow them to be exploited for longer periods to serve future generations. The main feature that distinguishes green buildings or ecological buildings from the remaining buildings is that they do not disturb the ecological balance and they aim to produce structures that will benefit both nature and human beings [1].

Green building applications are facing a lot of challenges on more than one level. In this paper, green building applications at the project level were considered. The lack of green buildings in developing countries and the gap between the percentage of the registered projects and the certified projects from green building rating systems in countries like Egypt indicates that there are some obstacles facing this kind of project in all project phases. Some previous studies addressed these obstacles, and some of them provided suggested solutions at governmental and professional levels. But a few of them attempt to find a practical solution from project management and the project manager’s point of view.

This paper aims to investigate the obstacles that face green building applications in developing countries due to the size of the challenges that face these projects there and takes Egypt as a case study. Furthermore, the study observed challenges facing project managers or green building administrators in this project through a questionnaire and online interviews with them. Finally, the study attempted to find solutions through project management best practices to overcome the main reasons that impede the green building movement in developing countries like Egypt.

Literature review

Sustainability and green architecture

Sustainability and a better life for current and future generations have captured global attention in recent decades. In 1972, the term “sustainability” was developed for the first time at the world environmental conference in Stockholm with the Club of Rome through the discussions within the framework of “eco-development” [2]. In 1987, the World Commission on Environment and Development (WCED), published a report entitled “Our common future. In this report, “sustainable development” was defined as development that meets the needs of the present without compromising the needs of future generations [3]. A broader concept of SD is based on the integration of three dimensions: economic, environmental, and social [2], constituting the sustainability known as the Triple-Bottom Line. In 1997, John Elkington, in his book “Cannibals with Forks,” coined the term “triple bottom line” (3BL), which refers to economic prosperity, environmental quality, and social justice. Also, knowing the three pillars of sustainability, or triple P, as follows:

- Profit—The first bottom line is the traditional measure of financial performance—How responsible has the company been in terms of assuring its competitive prosperity?
- People—The second bottom line is the measure of a company's social account—How socially responsible has the organization been in terms of its impact on the quality of life of the individuals it affects?
- Planet—The third bottom line is the measure of the company's environmental account—How environmentally responsible has it been in terms of its impact on natural ecosystems? [4].

Sustainable development insights have been applied in several fields in our life, but the application of SD in the construction field creates a type of building under the term "Green Building". According to the World Green Building Council, a "green" building is a building that, in its design, construction, or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life" [5].

The pervasion of the concept of sustainability and green architecture in the world has been accompanied by the so-called "Rating Systems" programs, which act as arbitrators on whether a building is a "green building" or not, and how green it is. Furthermore, there is an active role played by these programs in the marketing of the green architecture concept around the world by working on the spirit of competition in the design, construction, and operation of buildings. In addition, building owners sought to obtain certificates from these global evaluation programs to prove that their buildings are subject to the principles of green architecture and compete at the highest level in the evaluation.

The most famous and widely used rating system is the American system (Leadership in Energy and Environmental Design (LEED)), which was introduced in 1998 by the US Green Building Council (USGBC). In addition (Building Research Establishment's Environmental Assessment Method (BREEAM)) system in the UK is the world's first green building assessment system.

Project management

With the increasing complexity of projects in general and construction projects in particular, the need for a holistic system to manage all the project's resources, stakeholders, documents, finance, requirements, and solve all issues that come up with the project's progress. According to the American Project Management Institute (PMI), project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Furthermore, project management enables organizations to execute projects effectively and efficiently through the appropriate application and integration of the project management processes identified for the project [6].

In the 1960s, Dr. Martin Barnes introduced the iron triangle (also called the triple constraint), which refers to the idea of being on time, within budget, and according to specifications. The triple constraints were the indicators of the project's success for decades until sustainable projects started to pop up, and other constraints have been raised as environmental and community dimensions [4]. The triple P took attention to a different project's success dimensions that were not realized before, along with the iron triangle, or triple constraint cost, time, and quality.

Integration between sustainability and project management

Project management and sustainability are two topics rarely integrated into one study or a framework, although project management could be a means of positive influence on the integration of sustainability dimensions into projects [7]. Recently, a few studies realized the role of project management in sustainability and green building's success; however, the existing studies are still insufficient [8]. In addition, most major project management frameworks, such as PMBok, ICB, ISO21500:2012, and Prince2, did not take sustainability and environmental issues into consideration [9]. Furthermore, it is noticed that most previous studies care about studying sustainable management and environmental management, but few of them address project management and its great role in sustainable and green architecture.

According to Wu and Low [10], the credits related to project management in some of the rating systems (LEED2.2, Green Globes, BCA Green Mark 3.0), take around 20% of the credits in these rating systems. Furthermore, green buildings must be viewed as a comprehensive solution that integrates sustainable principles throughout the project life cycle, from project planning to design, construction, and operation, rather than simply as a collection of green materials, technologies, and other environmentally friendly innovations [10].

Green buildings are often developed according to rating system guidelines, which provide guidance on measurements and can provide recognition and verification of the level of compliance [11]. Rating systems are designed to evaluate the performance of an entire building or a specific section of a building from planning, to design, construction, and operations phases. This requires a specific management system to manage all procedures and processes of the rating system, the registration and documentation of credits, the interactions between the various stakeholders in the project, the responsibilities of everyone on the project team, resources, cost, and time management.

It is worth mentioning that the management systems of these projects must have a specific nature that is adaptable to the project requirements and sustainable goals. Recently, there are few attempts to develop frameworks or methodologies for sustainable projects. However, until now, most of those attempts have not yet materialized from being studies and have not been applied to green building projects in a significant way. For example, Marcelino-Sádaba et al. [8] developed a framework in their study published in 2015 to help project managers deal with sustainability projects based on four dimensions: products, processes, organizations, and managers [8].

Globally, there is the methodology of (Project Integrating Sustainable Methods (PRISM)) which was introduced in 2013 by the international organization of green project management (GPM). PRISM is a structured methodology for sustainable—"Green Project Management", which is based on a series of standards and incorporates their use in the standard ISO 21500:2012 "Guidance on Project Management" [12]. But this methodology is not yet experienced in a significant way with a lot of applications as well as the studies that address this methodology are very rare. In addition, the methodology is totally not remedied at the local level according to the applied questionnaire in this study.

Another perspective or level that addresses the integration between sustainability and project management is the organizational level. Sustainable project management

is an integral part of the sustainable management of organizations. Where organizations interested in sustainable development, determine clear sustainable goals and issue sustainability reports in which they define their vision and future plans towards sustainability. In order to achieve organizations' sustainable goals, organizations define internal practices and projects either in the form of individual projects, programs, or portfolio aims to achieve the defined sustainability goals. Naturally, not all sustainable projects are implemented due to the sustainable organizations' strategies, as there are a lot of sustainable projects that have been implemented due to marketing considerations or to go with the new trend, especially in the construction field. However, the projects that are achieved based on clear organizations' goals and visions from a sustainability perspective are most likely to have a good chance for continuity and improvement.

Although there are numerous studies on energy management and environmental conservation via ISO 50001 and ISO 14001, a holistic method for the management of sustainability in the context of an organization is still lacking [13]. Moreover, there is a gap between organizations' perception of the importance of sustainable management and its actual use in practice [14]. However, there have been some attempts recently in some studies to integrate the management methods with sustainable principles with the aim of introducing organizational sustainable management. Mustapha et al. [13] proposed the development of an integrated green management framework called the Sustainable Green Management System (SGMS). A systematic, integrated, and efficient approach for collecting, monitoring, analyzing, and managing information and resources. SGMS leads to sustainable organizations, saves resources, removes significant redundancies, promotes cleaner production, and enhances the profitability and efficiency of an organization [13].

Another important aspect in addressing the integration between project management and sustainability or green buildings is the contribution of the project managers to the success of sustainable projects. According to Hwang and Ng [15], many studies have been concerned with the efficiency of project managers to ensure the success of the project. A few of them have been concerned with the project managers' execution of green architecture projects and the challenges they face in such quality of projects. Therefore, in their study, they identified the most important challenges facing project managers in green architecture buildings. Among them, the long period required for planning and designing green buildings; the unavailability of subcontractors, professionals, green materials, and equipment; high-cost and risk; and the lack of experience and knowledge. Hwang and Ng [15] also identified critical knowledge areas and skills that are essential to respond to the challenges. The most important knowledge areas were schedule management and planning, stakeholder management, communication management, cost management, and human resources management. In addition, the most important skills that are required to mitigate the challenges were analytical, decision-making, team working, delegation, and problem-solving skills [15].

Also, Martens and Carvalho [14] pointed out that project managers can improve their results in projects when looking at four factors, which are sustainable innovation business model, stakeholders' management, economics, competitive advantage, environmental policies, and resource saving [14].

Methods

This qualitative exploratory research aims to define the role of project management in the success of green building applications and how it helps in overcoming the obstacles facing these kinds of buildings. For this purpose, a systematic literature review was conducted for a better understanding of the green buildings' obstacles and challenges facing these buildings in developing countries like Egypt as a case study for some reasons as follows:

- Egypt is one of the countries that suffers from a lack of energy sources, environmental pollution, the pervasion of some diseases due to this pollution, and economic problems. As the movement of sustainability and green building principles contribute significantly to solving these problems, it becomes necessary to study the reasons that prevent the pervasion of sustainability and green buildings in Egypt, find solutions, and overcome these obstacles.
- Although the significant recognition of green building projects' importance in Egypt, a very limited number of certified green building projects have been observed, principally in the national rating system GPRS.
- All previous studies addressing the green building project crisis in Egypt totally neglected the role of the most important factor in project management, which led to wondering how these projects are managed in Egypt and how the cases and numbers of green building projects could be improved by a successful project management system.

Following the SLR, an online questionnaire and interviews with project managers and sustainability consultants were conducted to determine how green project buildings are managed in Egypt, a more specific ranking for the most affective challenges that obstruct green buildings in Egypt from the challenges identified previously in previous studies, and finally to determine how the green building situation in Egypt could be improved.

The questionnaire consists of 18 questions with two types of questions, open questions, and multiple-choice questions aiming to benefit from the experience of project managers and to define obstacles they faced in managing green building projects in Egypt, the main aims need to be elicited from the questionnaire as follows:

1. The main project phases that the project managers participated in and their main role in the project.
2. Are the project managers following specific management methods/methodologies to address green buildings' unique natural and requirements?
3. Most management methodologies that have been followed in these projects and what are the most useful software programs have been used.
4. Who decides the management methods in the project and are the project stakeholders participating in choosing the way in which the project has been managed.
5. The main obstacles that project managers face when managing green buildings in Egypt.
6. The main factors which caused discrepancies between the estimated project cost/time and the final project cost/time achieved.

7. The project managers' point of view on how management systems could be developed to be convenient for green building projects.

The target group for the study is project managers and green building consultant who have worked in certified/registered green building projects in Egypt. The method which has been used to collect data is an online survey and personal interviews by using voluntary response sampling. The total number of responses are 10 responses varies among project managers and green building consultants.

For more clarification, the research method was summarized in Fig. 1.

Results and discussion

Green architecture insights have appeared in Egyptian buildings since the early eras in building design considerations such as taking advantage of building location, designing buildings to overcome external environmental conditions without harming the environment, benefiting from daylight, optimizing resource use, and other environmental design concepts now adopted by green architecture. But with the passage of the ages and industrial progress, these concepts faded away and the natural solutions were replaced with artificial solutions in buildings, which led to environmental harm and natural resource exploitation.

Green architecture as a term was introduced in Egypt in the 1990s at the first symposium of "Bioclimatic Architecture", which was held in 1996 [16]. After launching the LEED system (the most popular rating system in the world) in 1998, small steps have appeared toward this trend in this period until the first green building approval in 2010 under the LEED rating system. Following this, a few investors and developers in Egypt were interested in registering their buildings in the LEED program as a kind of marketability to keep up with the new trend.

Green building project challenges in Egypt

Sustainable construction projects known as green building projects face some obstacles and challenges with their implementation in reality. Particularly in developing countries due to certain factors that will be discussed later. In Egypt, as a case study, there are limited numbers of green buildings in the modern era which are certified by third-party or green rating systems, whether by LEED or the Green Pyramid Rating System (GPRS) the national green building rating system in Egypt). The number of buildings registered in LEED until 2021 reached 63, with only 22 certified [17]. As well as there is only one building that has gained the LEED platinum certification in Egypt. On the other hand, the application of the (GPRS) has been neglected at the level of the public and private sectors since its launch in 2011 by the Egyptian green building council. Unfortunately, there are only 5 buildings that were certified under this system [18].

Comparing the number of certified green buildings in Egypt with other countries in light of the rapid movement globally toward sustainability and green buildings, found that Egypt's movement toward green architecture is very slow and needs more encouragement from the government and construction developers, as well as more studies of the factors leading to such delays and exploring solutions to promote strongly the application of green architecture principles.

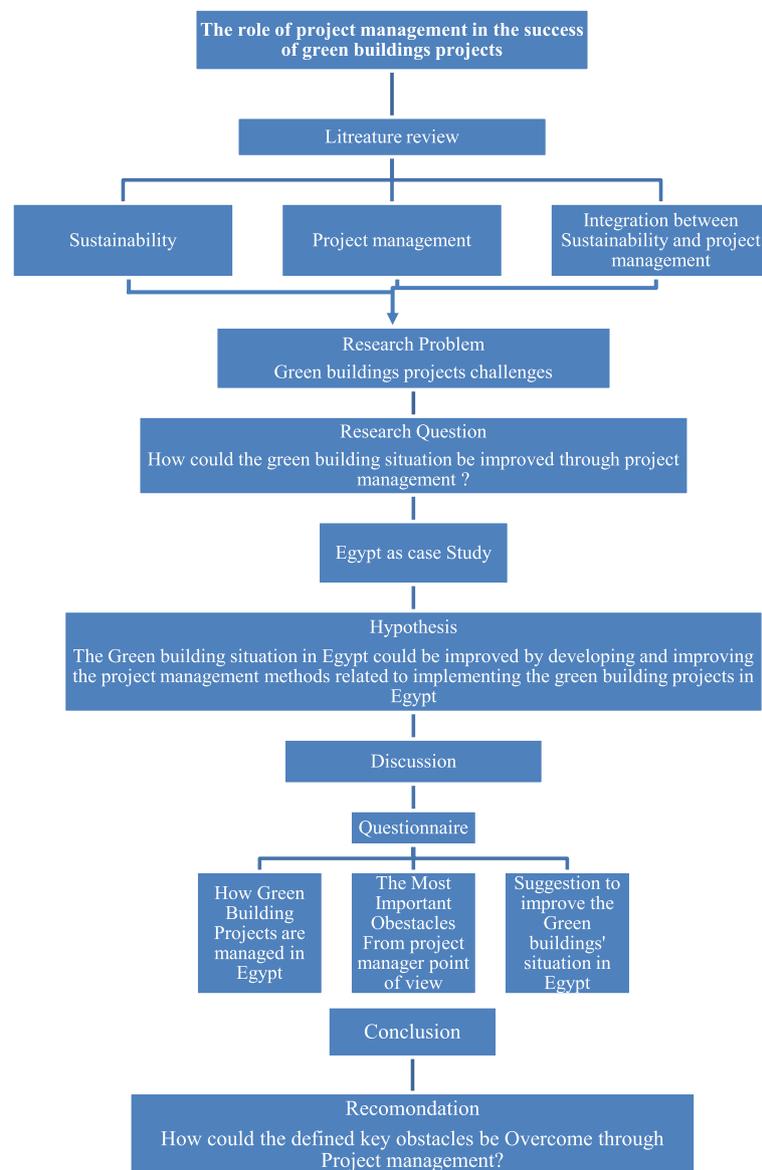


Fig. 1 Research method. Ref: Researchers

During the last decade, local studies in Egypt focused on studying the application of green buildings, but few really addressed the main reasons for preventing the pervasion of green buildings in Egypt and the main problems that face these buildings. In this section, the reasons behind the green building crisis in Egypt will be discussed from the most important previous studies. Some studies focused on general reasons and determining the problems facing green building in Egypt are listed below:

- The absence of governmental incentives toward green building.
- High initial cost for the green building compared with the traditional type.

- Lack of design team specialists who are aware of environmental control strategies and building simulation programs to choose the optimum choices for the building's environmental performance.
- Unavailability of the required technology for some credits.
- Lack of contractors' awareness.
- Unavailability of recycling companies for construction materials.
- Unavailability of data about the life cycle cost of the available materials.
- Unavailability of low-emitting materials in the Egyptian market [19].
- Lack of a database related to green building materials [20].
- The unified Building Law No.119 that was released in 2008 and its executive appendix, which was released by the Ministerial decree No. 144 in 2009, were not formulated having green concepts as a governing parameter [21].

On the other hand, there are studies that point to some reasons behind the inapplicability of the Green Pyramid Rating System (GPRS) in the Egyptian environment. For instance, the lack of knowledge or awareness by architects towards certain elements, principles, or even criteria when it comes to the GPRS. Also, the failure to adapt to the local context to cultural issues, resources, priorities, practices, and economic challenges.

According to Attia and Dabaieh [22], GPRS requires compliance with Egyptian and American codes at the same time, which has led to inconsistencies in some cases and requires a lot of effort. Furthermore, there are missing guidelines and documentation methods in some credits, for example, indoor air quality and material credits. In addition, GPRS ignores the local Egyptian built environment, for example, local building techniques, vernacular architecture, heat island effect, informal housing, natural ventilation and ceiling fans, solar water heating, Cairo air pollution, occupational behavior, health, Egyptian society, and economic aspects [22].

Furthermore, some studies highlighted the lack of a database related to (GPRS) certified materials that can be used as a benchmark for assessment and as a guide for the user. In spite of that, there are currently over 120 international green labeling programs for building materials worldwide [19]. As well as the lack of comprehensiveness in achieving the remains of social, cultural, and economic sustainability goals [23].

All the mentioned studies did not recognize role of project management, along with project manager competency, and how a poor management system could affect the successful implementation of green building projects anywhere, particularly with regard to overcoming the extracted obstacles, and helping in implementing successful green building projects as the previous studies emphasized as mentioned in the literature review.

From the systematic literature review, the research reached an important hypothesis, which is that green building situation in Egypt could be improved and go faster in steady steps by developing and improving the project management methods used in implementing the green building projects. Therefore, to experiment research hypothesis, it is needed to know how green building projects are managed in Egypt and study the management methods used in these projects.

The role of project management in green building project success

This section of the study aims to investigate how green-building projects are managed in Egypt. Moreover, discover if the way of managing these buildings affects project success in achieving the sustainability goals and whether it is among the factors leading to the obstruction of the construction of green buildings in Egypt. Furthermore, the study investigated how to overcome the obstacles identified in the research problem by project management. Accordingly, an online questionnaire and interviews were conducted with Egyptian project managers and green building administrators (with experience of 3 to 20 years in green buildings) who worked in green buildings in Egypt, whether registered or certified buildings, under LEED or GPRS. The results came as follows:

- There is confusion between the roles of project managers and green building consultants in most cases, while the responsibilities of each of them are also unspecified.
- In some cases, the project manager is not involved in the green building certification process and all responsibilities related to the green building process, and rating system certification is the green building consultant's responsibility.
- Involved personnel presented themselves as project manager and green building consultant at the same time, in spite of the fact that their responsibilities did not cover all aspects of project management. This means that there are some neglected management areas in the projects due to multiple responsibilities.
- The project managers/green building consultant most involved in green building projects is at the construction stage, followed by the design development, then the schematic design and bid stage, then the conceptual design, and finally in the pre-concept design stage as shown in Fig. 2.
- The main role of the project manager in the green building project is sustainable management and then selection of rating system credits and verification of rating system achievement of prerequisites and credits. However, there are some management areas that do not get proper attention as other important issues such as time, quality, and risk management. Moreover, there is a neglected area such as stakeholder management, as shown in Fig. 3.
- Seventy percent of the results showed that there is no specific management methodology to be followed in managing green building projects, and the most used management methodology is Agile due to its ability to control project output and then Waterfall, Prince 2, Critical Path, and PM Book framework as shown in Fig. 4.

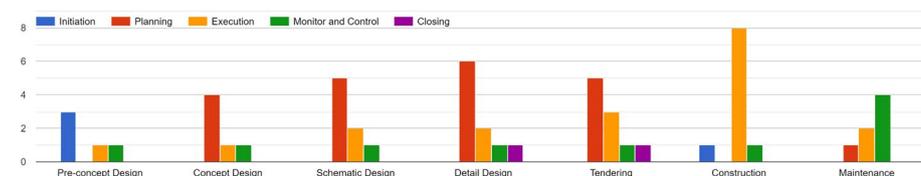


Fig. 2 The project phases in which project managers participate in green building projects. Ref: Researchers

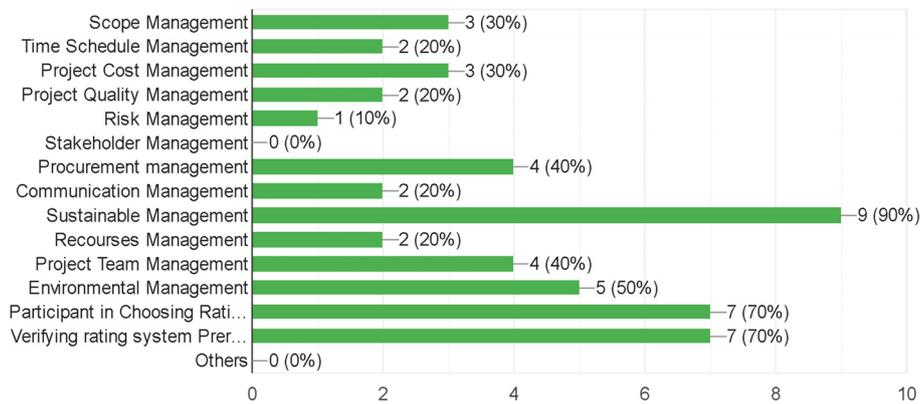


Fig. 3 The area of knowledge in which project managers participate in green building projects. Ref: Researchers

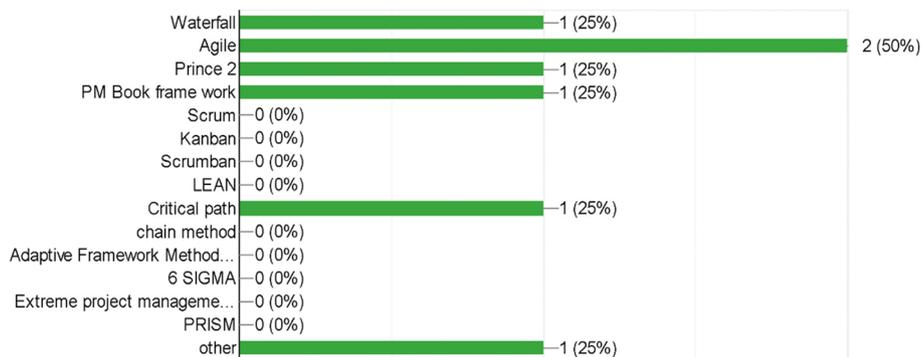


Fig. 4 Project management methodologies most commonly used in green building projects. Ref: Researchers

- The most commonly used software programs in managing green projects in Egypt are Revit, then Excel, Autodesk Green Builds, Primavera, and finally Microsoft Project and Green Wizard as shown in Fig. 5.
- The responsibility of choosing the methodologies and software programs used in green building projects falls on the project manager, then the green building consultant, and finally the project management office, as shown in Fig. 6.
- The main obstacles that project managers face when managing green buildings in Egypt by the order are as follows and shown in Fig. 7:
 - The lack of awareness of contractors.
 - The absence of government incentives.
 - The lack of professional expertise.
 - The lack of recycling companies.
 - The lack of data on the lifecycle cost of available materials.
 - The lack of green resources and their data.

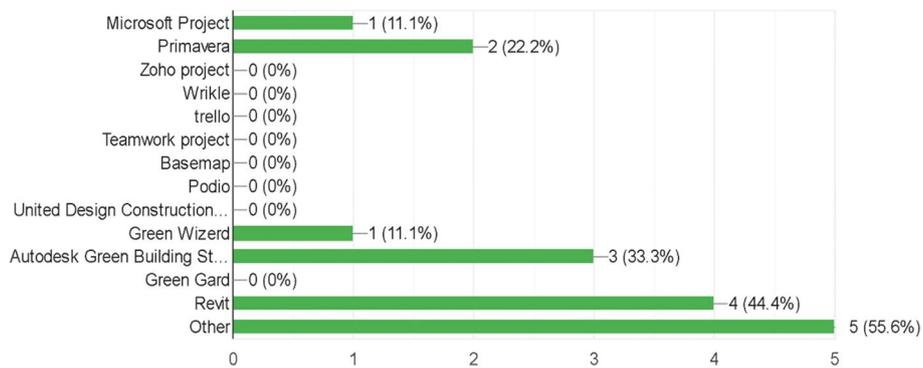


Fig. 5 The most used software programs in managing green building projects in Egypt. Ref: Researchers

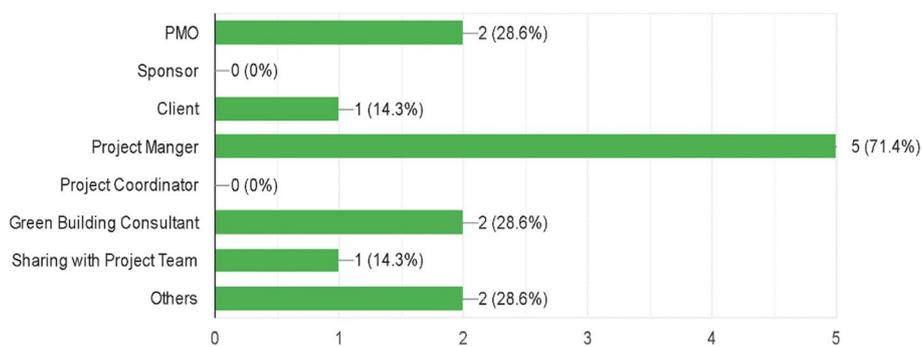


Fig. 6 Responsibility for defining project management methodologies and software. Ref: Researchers

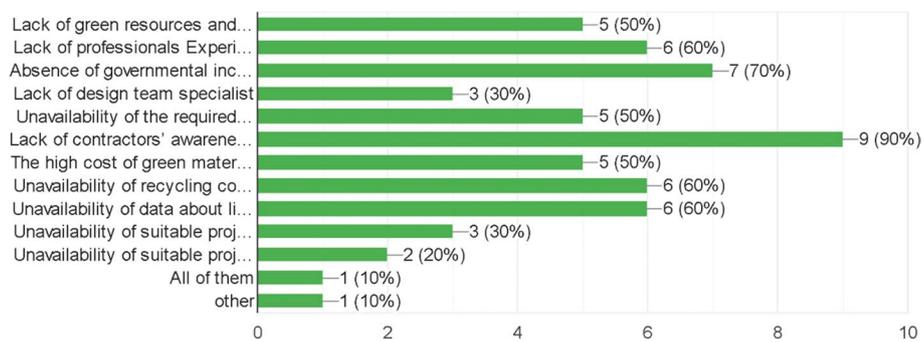


Fig. 7 The Obstacles that are facing project managers in green building projects in Egypt. Ref: Researchers

- The lack of technology required for some credits.
- 57% of the results showed that there were no discrepancies between the estimated project cost and the final project cost achieved, while the other 43% who admitted that the discrepancy existed, 67% of them classified the discrepancy as minor, and 33% as intermediate, as shown in Fig. 8.

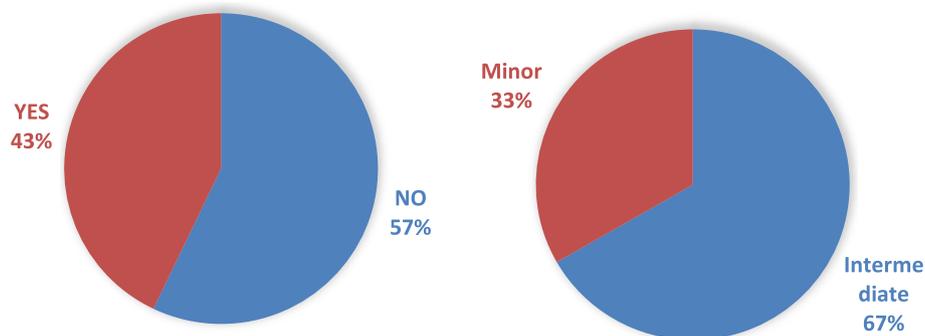


Fig. 8 Discrepancies between the estimated project cost and final project cost achieved. Ref: Researchers

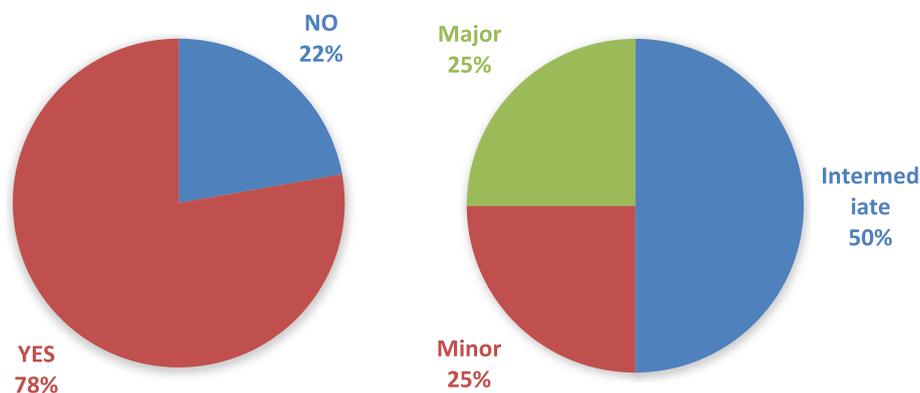


Fig. 9 Discrepancies between the estimated project duration and final project duration achieved. Ref: Researchers

The reasons behind this discrepancy are the unrealistic estimation, the change in material costs, and those green building requirements that were overlooked in the early design phase.

- Seventy-eight percent of the results showed that there are discrepancies between the estimated project duration and the final project duration achieved in green building projects, and these discrepancies are estimated as 50% intermediate and 25% major and 25% minor as shown in Fig. 9. The reasons for this are that the process is not usually smooth, there are many project stops, the client changed the design, and the estimates are unrealistic.

Conclusions

In general, as mentioned in the literature review, there is a lack of project management methods/methodologies that address sustainable construction projects around the world. In addition, it is concluded from the study that there are many defects in the way that green building projects are managed in Egypt, which could be one more obstacle in addition to the set of obstacles extracted from the previous studies, which led to delays in the green building movement. As it is concluded from the questionnaire results, open questions, and the interview with the project managers as follows:

- There is no clear methodology governing the green building management process in Egypt. All efforts in that field rely on the vision and experience of the project manager with the assistance of current general management methodologies such as Agile, PM BOOK, and Waterfall. As well as, these methodologies are not used efficiently to overcome the major obstacles and solve the problems that these projects are exposed to in Egypt.
- The roles of project managers and green building consultants are unclear. Sometimes the project manager and the green consultant are the same person in charge of the managerial work as well as the technical consultant and certification process, which is a huge task, especially in large-scale projects. In other cases, the project manager is completely isolated from the sustainable management or the green certification process, which also leads to poor project bonding, and does not activate the principles of the integrative process.
- Cases in which the project manager and the green building consultant are the same person, showed complete ignorance of some management knowledge areas like stakeholder management and weak risk management. As well as, the concept of a green project manager is missing, the person who has the project management knowledge, including management methodologies, methods, tools, and techniques, and has leadership skills to lead the entire project team and organize all project processes in an integrative manner holistically in the context of sustainability.
- Late commissioning of a green consultant in the project or deciding to follow building green principles after the start-up design phase may result in repeat work, increase budget, schedule delays, and failure to obtain green building certification.
- Stakeholder and risk management knowledge areas are the most neglected, although studies emphasize the importance of these areas in green building projects' success.

Recommendations

- Green architecture needs to develop more simply applied management methods, methodologies, tools, and techniques in order to overcome some of the obstacles facing green buildings around the world, especially in Egypt, to encourage the sustainability movement.
- There should be a distinction between the roles and responsibilities of project managers and green building consultants. The main factor in the success of the project is that everyone knows their role in the project and what their duties are.
- The green building consultant is the person who leads the building certification process and must have knowledge of the technical data involved in green building construction, be supportive of the team on technical matters, and coordinate all project disciplines. Meanwhile, the green project manager is the person who deals with the management aspect of the project in the context of sustainability. In addition, he must be familiar with the principles of sustainability and green buildings, the requirements of the rating system, and the process involved in the system of certified green buildings.
- The participation of a green project manager in the project from the pre-design stage is mandatory for organizing all project operations, maintaining project sequence,

putting the project on track, recording and solving problems, making decisions, and others. Any delay in involving the green project manager or even the green consultant from the pre-design stage of the project affects the success of the project.

- It is very important to incorporate green building requirements into the design from a very early stage. This doubles the ease of fulfilling these requirements and increases cost-efficiency in addition to saving time.
- Overcoming issues of lack of knowledge of the team, contractors, suppliers, and operators through scheduled training during the project life cycle. This training should be continuous, repetitive, and defined in pre-design in a separate plan developed by the project managers.
- Documentation of green building projects is a very important issue, especially for the certification process, so the documentation plan should be defined at the initiation stage and developed throughout the project life cycle.
- Stakeholder management is an effective management area that needs to be noticed and given more attention by project managers in the field of green building.
- Most of the obstacles that contradict sustainable construction in Egypt could be overcome by project management. The most important obstacles identified in the literature review and ranked by the project manager in the questionnaire are as follows, with some suggestions from the project management point of view:

Lack of awareness of contractors and professional expertise, which could be mitigated in the current projects and future projects by organizing scheduled training that is performed throughout the project life cycle. In addition, recording the lessons learned and sharing them within the organization and outside the organization, if possible, is an active action toward increasing awareness and professionalism in this field.

Through stakeholder management, project managers could participate with the authorized government agencies in the early project discussions to be involved in the project and recognize the benefits that the project will introduce to the surrounding environment and the community, which could lead to an increase in the authorized agency interest and recognition toward sustainable construction and green buildings and could lead to increase government incentives for the project.

National database systems for all available green building materials with lifecycle assessment data, recycling companies, sustainability, responsible manufacturers, and all required green building resources are needed to facilitate the green certification process and overcome the lack of information and verified green resources. The database systems should have frequent updates periodically to include all the new resources and companies.

Project managers could avoid or mitigate the problem of the lack of professionals or technology required for some credits by involving professionals or specialized agencies from abroad in the project, which required efficient human resources management and strong communication plans to acquire and manage the project virtual team effectively.

Finally, research on green building project management should be encouraged, especially at the local level, due to its important role in the success of the project, overcoming the obstacles that may face this type of construction, and the ability to organize the process and coordinate between several of its elements.

Abbreviations

BREEAM	Building Research Establishment's Environmental Assessment Method
GPRS	Green Pyramid Rating System
ICB	Individual competence baseline
ISO	International Organization for Standardization
LEED	Leadership in Energy and Environmental Design
PMBOK	Project Management Body of Knowledge
SD	Sustainable development
SLR	Systematic literature review
USGBC	US Green Building Council

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s44147-022-00112-5>.

Additional file 1. Questionnaire.

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Authors' contributions

All the authors have read and approved the manuscript. HF collected the study data and did the analysis. HH reviewed the study data and made the appropriate modifications, as well as both authors cooperated in the questionnaire structure.

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Availability of data and materials

All data generated or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The researchers of the current work used an online questionnaire on google form, which has been published on LinkedIn to induce experts to share their experience. https://docs.google.com/forms/d/e/1FAIpQLSeS0RLIFBmL7bebgFDobiwvNDtLdDtAYTq880MoLhXysLKWQA/viewform?usp=pp_url

The authors do believe that there is not a need for informed consent from experts as all the participants of the questionnaire gave their consent by answering the questionnaire on the google form link.

Consent for publication

The manuscript does not contain any individual person's data in any form.

Competing interests

The authors declare that they have no competing interests.

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