



Mediation effect of sustainability competencies on the relation between barriers and project sustainability (the case of Egyptian higher education enhancement projects)

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Abstract

Purpose – This study aims to explore the relation between barriers and project sustainability by adding competencies in the mediating role.

Design/methodology/approach – The study uses a mediation model including project sustainability as the dependent variable, sustainability barriers as the independent variable and project managers' sustainability competencies as the mediator variable. Data were gathered from project managers, executive teams, and experts/advisors, working in Egyptian higher education enhancement projects (HEEPs) using self-administered questionnaires; the total number collected was 159, representing a response rate of 93.5 percent. Correlations and multiple regression analysis were employed to analyze the mediation impact of project manager's sustainability competencies.

Findings – The results indicate that sustainability competencies mediate the relation between barriers to sustainability and project sustainability. Sustainability competencies facilitate project achievements, and the sustainability and future expansion of these achievements. The analysis suggests that "continuous competencies" are extremely important, more so than "self-competencies".

Research limitations/implications – This study was undertaken at the level of the projects management unit in the Egyptian Ministry of Higher Education, which manages the HEEP.

Practical implications – The analysis helps to understand the complex and nuanced nature of the projects; these are distinguished when the author considers the different practices.

Originality/value – This study offers two principal contributions: first, a guideline for the development, measurement, and application of an uncommon concept of project sustainability; second, a concept of project managers' sustainability competencies and barriers to sustainability.

Keywords Project manager, Sustainability management, Sustainability competencies, Barriers to sustainability, Egyptian HEEP, Project sustainability

Paper type Research paper



1. Introduction

Sustainability is perhaps the most serious challenge that faces the process of development in both industrialized and developing countries. The term "sustainability" is employed in its narrowest sense in order to tackle the issue of service delivery in developing countries (Abrams *et al.*, 2010). The twenty-first century not only requires greater productivity and effectiveness on the side of management organizations, but it also entails that project

management (PM) pays more attention to the issue of sustainability and the role of human competencies in development (Lapina and Aramina, 2011). In relation to this, managerial competence has become one of the key human features and is closely related to business development and the attainment of sustainability in the new management literature. This remarkable explosion of sustainable business initiatives and competencies has piqued the interest of management researchers. Although PM and sustainability have been widely researched (Atkinson, 1999), research into the alignment between the two issues is still very rare (Labuschagne and Brent, 2007). Little research has been conducted to study the integration of sustainability in PM; most PM methodologies would support organizations in incorporating sustainability in their PM and making it a part of the success of the project (Grevelman and Kluiwstra, 2010; Rearick, 2011).

The conception of the present study arose in two stages. The first was the confirmation of previous studies of the importance of the development of sustainable organizations that adopt projects as a “way of working.” The second was my fieldwork as a director of the Quality Assurance Center at Kafrelsheikh University, where my responsibilities were reviewing and undertaking competitive projects submitted as higher education enhancement projects (HEEPs) in Egypt. After the aforementioned stages, I recognized that organizationally-oriented projects waste manager competencies after the end or expiration of their projects. A HEEP’s project manager is seconded from his university to manage a project. At the end of the project, he returns to his original work. This leads to the waste of several competencies that the project manager has acquired during the lifetime of the project.

To a certain extent, HEEP’s represent best practice as there are certainly common lessons learned, issues confronted, and experiences shared. However, based on the theoretical background (see the literature review and the section on my experience as a reviewer of HEEP’s), we can assert that although a considerable amount of attention is paid to project sustainability, no “model” for successful national development projects in this area has emerged. Each organization is different from another in the sense of barriers, unique resources, competencies, capacity, and historical opportunities.

This study aims to answer the following question: do a project manager’s sustainability competencies have mediating roles in the relation between barriers to sustainability and project sustainability? The study proposes the Egyptian HEEP’s as a sustainable national social system and tests a model for defining the mediating role of project managers’ competencies on the relation between barriers to sustainability and project sustainability. A literature review has been carried out to explore how we can consider the following issues: barriers to project sustainability (Crooks *et al.*, 2008; NCWD, 2007), forms of sustainable leadership that can be seen as a long series of varied future-oriented decisions and actions (Metsämuuronen *et al.*, 2013), a concept of project managers’ sustainability competencies (Hudson, 2008; Janin, 2009; Schmidt and Kunzmann, 2007), and a less common concept and measure of project sustainability (Grevelman and Kluiwstra, 2010; Willard *et al.*, 2010). No study has yet been carried out to explore the combination of the three aspects and their relations as is done in this study. Documents such as the annual reports of HEEP’s are analyzed to gain an insight into the past and current situation of these projects, especially aspects of project sustainability (Abdellah *et al.*, 2008; HEEPF, 2008). HEEP’s are considered a case study in terms of discovering how they apply the concepts of project sustainability and sustainability competencies to overcome barriers to sustainability.

This paper is organized as follows. Section 2 provides a literature review in two parts: first there is a brief presentation of the field of barriers to sustainability, sustainability competencies, and PM and sustainability; next, an overview of sustainability in relation to the HEEPs and rethinking around the project sustainability concept is provided. Section 3 identifies the research gap, delineates the research questions, presents a conceptual model that depends largely on logical links, and develops the research hypotheses. Section 4 sets out the methodology. The results are presented and the implications for management are discussed in Section 5. Finally, conclusions are drawn and suggestions for further research made in Section 6.

2. Literature review

2.1 *Research on barriers to sustainability*

The negative (barrier = obstacle) perspective is commonly found in the fields of institutional development and the management of change, as well as in wider society where all sorts of barriers are striven against through social policy (Scott and Gough, 2005). Generally, there is a lack of research that explores the barriers faced by government agencies when implementing changes in management (Al-Rashidi, 2010). NCWD (2007) identifies the key barriers to the sustainability of PM as follows: skills, vocational rehabilitation staff, and maintaining the momentum offered by their ability to offer flexible funds. Crooks *et al.* (2008) examine eight barriers to the implementation of sustainability for projects, and identify seven themes that are consistently associated with successful and sustainable strategies. Satterfield (2009) classify barriers into four classes: economic and financial, regulatory, educational, and organizational and cultural. The National Development and Reform Commission (NDRC, 2009) identifies a number of recognizable barriers that impede regional endeavors to achieve sustainability in programs and projects, including policy/regulatory, institutional, technical, and financial barriers, and those relating to information and awareness, and the market. Finally, Holmberg and Samuelsson (2005) and Visounnarath (2010) identify barriers that face projects such as a low internal rate of return, poor investment climate, limited financing options, delayed project schedules and high project costs.

Elmualim *et al.* (2010) carried out a survey of barriers and the commitment of senior executives to the sustainability agenda through a questionnaire. The results show that time constraints, lack of knowledge, and lack of commitment from senior management are the main barriers to the implementation of consistent and comprehensive sustainable policy and practice. Furthermore, a number of barriers to sustainable drainage are identified. These include problems with ownership, maintenance, lack of technical expertise, the need to work with other stakeholders, and a lack of design standards (Ofwat, 2011).

2.2 *Definition of barriers to project sustainability*

According to Lind (2003), the concept of a barrier is an integral part of the principles of defense in depth. The concept of “barrier” was proposed by Haddon (1973). Later, it was integrated with the Management Oversight and Risk Tree (MORT) system by Trost and Nertney (1985) in barrier analysis. Hollnagel offered several interpretations of the term in 1999 (Hollnagel, 1999). It is worth mentioning that the concept of barrier has both a normative and a descriptive use. A barrier is seen as an object of design as it refers to any causal factor or process that prevents fault development (Lind, 2003). Critical project barriers are insurmountable issues that can be destructive to a project’s implementation.

Therefore, because the barriers that have an impact on the sustainability of a project depend on the project manager's ability, six types of barrier have been explored as key obstacles to improved sustainability: structural barriers, mindset barriers, information/communication barriers, trust barriers, isolation, and the term "sustainability" itself (Rosell and Furth, 2006).

The above-mentioned review of the literature shows that little attention has been paid to project sustainability barriers. In this paper, the following definition is employed: project sustainability barriers constitute "any causal factor or process that prevents project sustainability" (Lind, 2003, p. 50).

2.3 Research on sustainability competencies

One of the most widely used definitions of the concept of competence is that it is "a set of knowledge, skills and attitudes that qualifies for completion a task of a particular kind or level" (Rauhvargers, 2007). The literature review shows that the concept of competency has been addressed from two different perspectives: the first definition refers to organizational performance, whereas the second definition refers to individuals' underlying attributes (Hoffman, 1999). Recent studies have proposed that anew definition of competency should fit into organizational processes. Competency is defined as "an underlying behavioral characteristic that can result in effective individual performance focusing on personal characteristics not directly tied to work and achievement itself" (Martens *et al.*, 2002). Competence is not only the knowledge learned, or acquired and accumulated skills and attitudes, but also the ability to use and develop them (Lapina and Aramina, 2011). Only one study (Boitmane, 2006) groups competencies and uses these to create different competency models appropriate for each situation to achieve appropriate results.

Schumann and Suhr (2006) conclude that although projects attach great importance to sustainable management, a gap persists between sustainability and actual core business. This is because companies do not bring their intrinsic competencies, their unique expertise and their creative resources to bear. Thus, the scope for value added in sustainable management is still largely unexploited. The importance of sustainability competencies and management practices to the success of projects success has been studied with mixed results (Chye *et al.*, 2010). Sustainable competency approaches are facing fundamental challenges, especially a well-defined and common understanding of each competency, technical level, and competency modeling (Schmidt and Kunzmann, 2007). Sherman *et al.* (2002) identify a set of recognized skills and knowledge areas that affect programs and projects. The competencies reflect seven broadly defined categories: leadership skills, instructional leadership, resource management and allocation, staff supervision, program monitoring and reporting, professional development practices, and community collaboration.

Achieving sustainability requires a new set of skills and abilities. The Cloud Institute for Sustainability Education has proposed systems with competencies that characterize education for a sustainable future. The elements of sustainable competencies are described as follows: twenty-first century themes, learning and innovation skills and information, and media and technology skills (The Cloud Institute, 2004). Schmidt and Kunzmann (2007) present approaches to sustainability combined with suitable modeling methodologies. The International Institute for Sustainable Development (IISD) proposes skills for sustainability professionals to develop the next generation of sustainability leaders (Timmer *et al.*, 2008).

Hudson (2008) has designed sustainability competency approaches from two perspectives: the first perspective is based on applied research that describes sustainability competencies and the second perspective centers on the participants' views in describing sustainability competencies. Janin (2009) conducted interviews with 25 senior sustainability professionals in *Fortune 100* companies, surveying their understanding of competency issues and the challenges that faced them. The International Society of Sustainability Professionals (ISSP) exploited the existing body of knowledge in an attempt to refine, define, and determine the precise competencies required to excel as sustainability professionals, now and in the future. The findings define sustainability competencies and challenges to sustainability such as "hard skill needs" and "soft skill needs" (Willard *et al.*, 2010). Wiek (2010) defines competencies in sustainability as "complexes of knowledge, skills, and attitudes that enable successful task performance and problem solving with respect to real-world sustainability problems, challenges, and opportunities." Bodea *et al.* (2010) present a PM competency model using an ontological approach. They distinguish between the components of PM competencies in sustainable development projects, including knowledge, skills, personal attitude, and experience, and the categories of PM competencies, including technical, contextual, and behavioral competencies.

Some researchers have explored key competencies in higher education for sustainable development. Barth *et al.* (2007) argue that both formal and informal learning settings at universities are relevant in developing competencies. Wiek *et al.* (2011) identified the relevant literature on key competencies in sustainability and on the basis of peer-reviewed contributions, synthesized the literature into a coherent framework of sustainability research. The analysis emphasizes not only the necessity of building the distinguishing competencies in conjunction with "regular" or basic competencies but also the ability to combine these competencies in a meaningful and effective way.

However, there is no agreement on what sustainability competencies actually are. In general, competencies may be characterized as individual dispositions that include cognitive, affective, volitional and motivational elements; they are the interplay of knowledge, capacities and skills, motives and affective dispositions. PM competencies in sustainable development projects can be classified in two categories: self- and continuous competencies. Sustainability requirements have to cover both self- and continuous competencies in an effort to create a complete set of sustainability competencies. Self-competencies facilitate self-organized action in various complex situations (Rieckmann, 2012) and include: strategic planning, systems thinking, PM, financial analysis, risk assessment, sustainability accounting and reporting management, technology and/or engineering expertise, and process management (Six Sigma, etc.). On the other hand, continuous competencies are acquired during action on the basis of experience and reflection (Rieckmann, 2012); they encompass communication with stakeholders, problem solving, inspiration and motivating others, flexibility or adaptability, team building or collaborating, influencing change within project, establishing and managing trinities, consensus building, innovating/re-thinking the business, facilitating and/or training groups, networking with external/internal stakeholders, and influencing change outside the project. These elements have been identified in more than one study because they are crucial to the process of implementing sustainability within projects and building the business case for project sustainability (Bodea *et al.*, 2010).

2.4 Definition of project managers' sustainability competencies

The increasing attention on sustainability competencies has led to the definition of a set of sustainability competencies that can be employed to face the challenges of sustainability, but very little attention has been paid to the sets of sustainability competencies in terms of addressing barriers to sustainability and opportunities. This study adopts a working definition of a project manager's sustainability competencies, namely that they are: "a functionally linked complex of knowledge, skills, and attitudes that enable successful task performance and problem solving" (Baartman *et al.*, 2007). Moreover, the term project sustainability competencies is employed to mean:

[...] functionally linked sets of self and continuous competencies that enable [managers] to prevent fault in the project sustainability and successfully complete achievements, sustain achievements, and create a future expansion in light of the new initiatives caused by the project (Baartman *et al.*, 2007).

2.5 Research on PM and sustainability

PM flourished in the 1950s and 1960s and primarily consisted of techniques for large aerospace and construction projects. The ultimate concern for this type of management was the determination of former relationships, which centered on identifying the logical sequencing of work activities (such as finish B to start A). This model is known as the classic PM model. Later on, the classic model was gradually expanded and applied as a result of the great advances in the 1980s and 1990s. PM has been used in certain governmental organizations as a response to the challenges of globalization and the market driven economy (Johnson, 2007).

Clancy (2008) classifies projects into three resolution types: project success, representing a project that is completed on time, within budget, and fulfills all the functions and features as specified; project challenged, a complementary and operational project, but over budget, over the time estimate, and offering fewer functions and features than originally specified; project impaired, describing a project cancelled at some point during the development cycle. Seaton and Hemi (2006) define a project as "a temporary endeavor to create a unique product, service or result"; and PM is defined as "the application of knowledge, skills, tools and techniques to project activities and project requirements". The British Standard 6079 defines a project as "a unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters." PM is also defined as the:

[...] planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance (Johnson, 2007).

According to Roland Gareis Consulting, projects are perceived as temporary organizations and social systems, and the development of project plans is considered a construction process (Gareis, 2003).

Since the 1990s, sustainability has been the focus of international programs and project professionals. It has also been used in the improvement of health programs in developing countries, although in many respects the issues remain unresolved (Bossert, 1990; Claeson and Waldman, 2000; Shediach-Rizkallah and Bone, 1998). The importance of sustainability in health, as in other sectors of development, stems from the orientation toward the welfare

of future generations in a universe with finite resources at our disposal (Bossel, 1999; IISD, 1997; Meadows, 1998; Olsen, 1998; Shediac-Rizkallah and Bone, 1998).

Recently, sustainability has become a critical issue that concerns all countries. Research on sustainability has been established in two directions:

- (1) identifying factors related to sustainability; and
- (2) creating definitions and models that make the concept relevant.

Statistical models of analysis have been employed in a few studies (Bossert, 1990; Olsen, 1998; Shediac-Rizkallah and Bone, 1998) that have attempted to propose models for the exploration of sustainability.

Sustainability is gradually gaining importance, especially for projects that are concerned with the development of higher education to meet the requirements of social development. However, an effective approach to propelling sustainability in higher education is still in the pilot stage (Chun, 2005). Bossert (1990) used systematic case studies to identify external aid factors of sustainability for national programs. In contrast, Amendola and Lundgren (1994) identified factors related to sustainability in community-based interventions by using individual case studies and reviews of groups of projects. The Universitat Politècnica de Catalunya (UPC) developed strategic plans to initiate a new strategy-oriented towards sustainability through the clear leadership and vision that are necessary in the field of sustainability (Balas *et al.*, 2005). Martin *et al.* (2005a, b) outlined research designed to assess current approaches to sustainable development across the higher education sector in England. Martin *et al.* (2005) hold the contemporary view that focuses on definitions as a potentially serious barrier to an objective and active discourse on the sustainability agenda. Recently, Nielsen and Galamba (2010) have presented a methodology for managers of facilities to reflect sustainability on their role as system builders.

A sound understanding of sustainability challenges and opportunities from the outset is essential to the process of project development (Avenue, 2010). Few attempts have been made to develop a framework for project sustainability management. However, there have been a few attempts represented by six frameworks that can provide us with a useful starting point for the development of project-specific sustainability management frameworks:

- (1) The FIDIC project framework describes how project owners and engineers can incorporate the principles of sustainable development into individual projects (FIDIC, 2006).
- (2) China's hydropower project framework makes a number of suggestions such as people-centered development, management for sustainable development, and management from the viewpoint of sustainability management (Liu *et al.*, 2006).
- (3) The Enexis project framework describes PM in terms of two aspects: mobility and sustainability (Enexis, 2008).
- (4) The Alpurt B2 project framework illustrates how a project meets the objectives of sustainability and social responsibility (Griffiths, 2010).
- (5) The CEEQUAL project framework complements statutory requirements by operating during and after design. It supports clients, designers and contractors in dealing positively with environmental quality issues relevant to the project (Griffiths, 2010).

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- (6) The HEEPs framework incorporates many sustainability mechanisms, most of which have been approved (Abdellah *et al.*, 2008; HEEPF, 2007a, b).

2.6 Definition of project sustainability

Despite the aforementioned important attempts, there are few definitions of project sustainability. Grevelman and Kluiwstra (2010) define project sustainability management as “the discipline of planning, controlling and organizing resources, time and quality to complete successfully a project.” The World Bank defines project sustainability as “the ability of a project to maintain an acceptable level of benefit flows through its economic life” (Khan, 2000). Concerning governmental issues, Khan (2000) states that project sustainability is “the percentage of project initiated goods and services that are still being delivered and maintained after five years of termination of implementation of the project” and “the continuation of local action stimulated by the project and generation of successor services and initiatives as a result of project built initiatives”.

It is clear that the first definition concentrates on project achievements and implies that sustainability is concerned with a project’s manager. The second focuses on the sustainability of project achievements and implies that sustainability is to do with sustainability competencies. The last definition is concerned with new initiatives caused by the project and implies that sustainability relates to the level of continuation of delivery of project goods and services, changes stimulated/caused by the project, and new initiatives caused by the project. However, project sustainability should also be viewed in terms of time, change, and wasted resources dimensions. Although practitioners have called for project sustainability management, how this is practiced by professionals is unclear (Willard *et al.*, 2010). Therefore, to explain what project sustainability is, we have to “rethink” the project sustainability concept as it is to be carried out.

2.7 HEEPs: an overview and rethinking of the project sustainability concept

The Ministry of Higher Education (MOHE) in Egypt established HEEPs in order to develop the Egyptian higher education system. Sustainability has become an integral aspect of the strategies of HEEPs. On 13 March 2003, ministerial decree no. 300 was issued to establish the project management unit (PMU) to manage HEEPs. The PMU board of directors consists of the chair of the board, the executive manager, the chair of the strategic planning unit (SPU), the managers of HEEPs, as well as two members selected by the Minister of Higher Education. According to the HEEP fund (HEEPF, 2008) and Abdellah *et al.* (2008), the issue of project sustainability is a major concern for HEEPs, and HEEPs teams undertake regular follow-up visits to evaluate the degree of sustainability in the continuity of the projects that serve students, universities, other institutions, and communities. Therefore, there is a continued need to rethink the concept of sustainability in relation to HEEPs. These projects are established by the government to meet national strategic goals and work toward sustainable development plans through achieving equity and accessibility to all members of society.

Barriers to sustainability in HEEPs. HEEPs face many types of barriers to sustainability such as mindset, isolation, weak sense of planning, trust, structural, and information/communication. These barriers are outlined in Table I.

The sustainability of HEEPs. The HEEPs have provided several pathways for the sustainability of project outcomes in Egypt including the following:

Sustainability barriers	Examples
Weak sense of planning	HEEPs have been funded by the World Bank since the success achieved in the ETEP under the World Bank's loan agreement No. 3137-EGT. Project preparation includes key performance indicators (KPIs) for successful implementation. However, these focus mainly on outputs rather than overall results, i.e. short- or long-term outcomes or impacts. Moreover, another major barrier is that the bank has changed its strategy during the implementation of the projects to a results-based evaluation including project impact, which was not taken into consideration in the original project design
Information/communication	HEEPs have faced an unforeseen change in directive. This has brought about the initiation of impact assessment studies without having baseline data to compare with the output/outcome from project activities A lack of reliable information and feedback has been a major obstacle to acting in a sustainable manner. In particular, the universities' evaluation does not reflect real performance. In addition, reports often do not provide reliable information about actual performance. The measures used to assess performance tend to reinforce the focus on relatively short-term economic factors. Furthermore, the media tend to cover sustainability issues in terms of isolated issues, spreading a spirit of reluctance and pessimism among people concerning the possibility of change
Trust	The discrepancy between the disbursement procedures from the World Bank loan and local funds has led to many serious problems jeopardizing credibility with suppliers and civil work contractors
Structural	The change in project managers for some projects, the government decision to transfer all bank accounts to the Central Bank of Egypt (CBE), and the limitations of the project budget have constrained the achievement of some planned activities. The limitations of the project budget have resulted in the emergence of certain structural barriers that have created a lot of confusion in the projects
Mindset	The term "sustainability" has been misunderstood and is too far removed from the practical aspects of the work and the staff of the projects. It seems that the project staff members lack sufficient knowledge of the practical steps that will lead to sustainability in their projects
Isolation	The MOHE cannot commit itself to selecting and appointing the management team and issuing the necessary ministerial decrees before the endorsement of World Bank takes place. Moreover, the nature of these projects requires at least six months startup period to develop action plans, operation manuals and guidelines before any notable project disbursement can be achieved. Provision for the planned disbursement has to be more realistic and cater for such startup provisions that lead to delay in sizable disbursements

Table I.
Barriers to the sustainability of HEEPs

Source: HEEPF (2008)

- (1) *Achievements.* The results of performance evaluations from 2004 to 2008 announced by the World Bank biannual supervision missions examining implementation were consistently satisfactory. However, comparing the results of HEEPs from 2002 to 2008 with the planned achievements, it is clear there were many slippages in overall achievements (PMU, 2009).
- (2) *Sustaining achievements.* HEEP learning environments prepare managers to function in professional and societal settings so that they will be able to solve complex problems and work in various domains and with a range of

societal stakeholders. The impact of an assessment study conducted in collaboration with World Bank experts reveals that HEEPs lead to significant improvements in the learning environment (PMU, 2009).

- (3) *Future expansion*. This is twofold:
- (i) *Strategic vision*. Although there was no clear vision on how the HEEPs would be implemented at the start of the projects, the establishment of the SPU, which is responsible for planning, contributed to the development of a road map based on scientific methodology and project appraisal documents (PADs) according to international norms.
 - (ii) *Legislative reform*. Although the development of the new legislative framework has been lawfully unified, the initiative has been temporarily postponed for political reasons (PMU, 2009).
- (4) *Post-completion operation/next phase*. Some projects have developed the application of sustainable quality assurance mechanisms through the next phase (Figure 1).

I consider that the sustainability of HEEPs can be illustrated in a honeycomb graph (Figure 2). The idea of the “queen bee” can be applied generally to the development of a framework to ensure the sustainability of HEEPs. For example, the term “queen bee” is typically used to refer to the PMU, living in a beehive – the MOHE. The PMU is usually the mother of all the HEEPs in the hive and develops all projects based its last experiences as “experience-centered.” The HEEPs are represented by the beeswax. The honeybees are the valuable outcomes of the HEEPs. The outcomes contribute to the development of higher education and the success of national plans for sustainable development. New beeswax is another product of the PMU, which refers to future HEEPs projects that can serve the requirements of continuous enhancement.

The PMU, as shown in Figure 2, was able to develop the application of a sustainable Quality Assurance and Accreditation Project (QAAP) through the second phase (a QAAP2 project), the Continuous Improvement and Qualifying for Accreditation Project (CIQAP), the Development of Academic Programs Project (DAPAP), the Higher Education Institutions’ Labs Certification Project (HLCP), Infrastructural Quality Related Projects (IQRP), and the Monitoring and Evaluation of New Programs Project (MENPP). In addition, the ICTP developed and supported the application of sustainable mechanisms through establishing an MIS/DSS and the National e-Learning Center (NeLC). Moreover, the FLDP developed the application of sustainable training in trainers’ mechanisms through the establishment of the National Centre for Faculty and Leadership Development (NCFLD). Finally, the ETCP project continues in the second phase of the HEEPs. The objectives of the next phase are to continue the reform of the ETC’s governance framework.

Therefore, this paper offers a model of sustainability in PM in the form of a honeycomb. This not only focuses on project achievement and sustaining achievements, but also on the future expansion of project achievements.

Definition of project sustainability in relation to HEEPs. The concept of project sustainability is a process rather than an outcome (since a project which seems worth

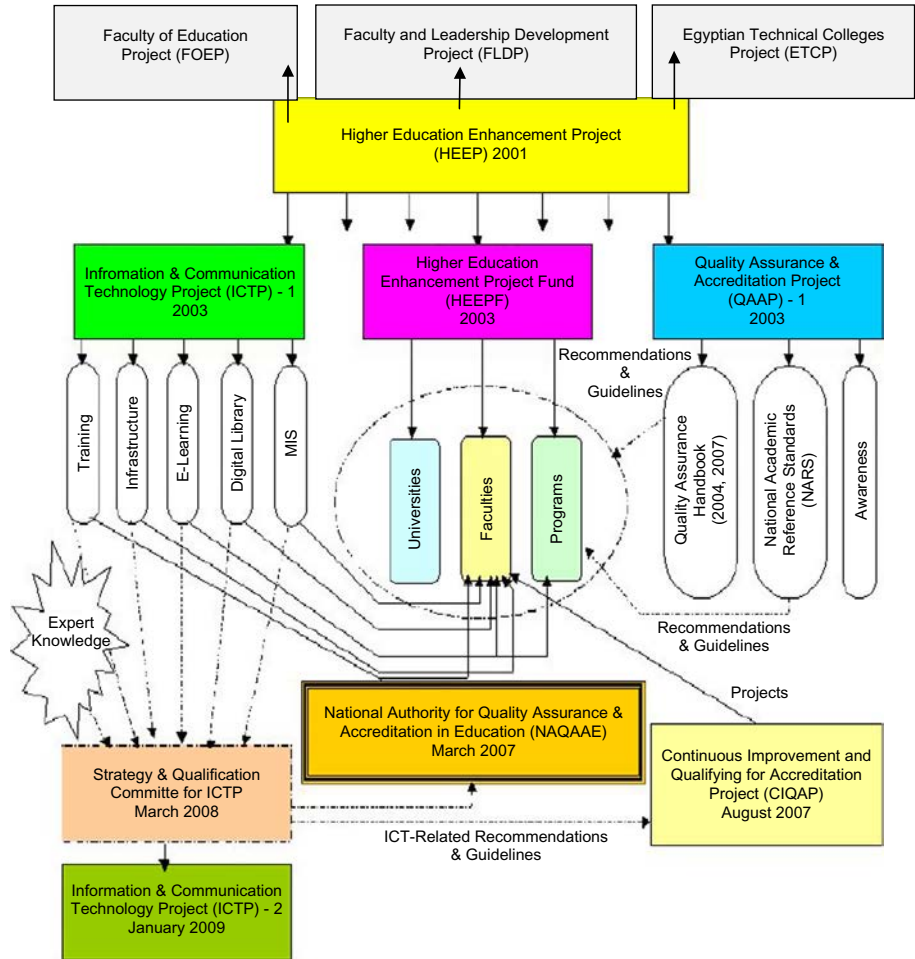


Figure 1.
HEEPs in Egypt

Source: El-Hadidi (2008)

achieving today may not be so in the future). The dimensions of project sustainability are determined by three factors (as shown in Figure 3): project achievements and sustaining project achievements, which indicate the project’s ability to complete and maintain achievements successfully, as well as the future expansion of project achievements.

Whilst the increasing attention on sustainability has resulted in a growing awareness of project achievements and sustaining these achievements, there is still little focus on the future expansion of project achievements. Thus, we cite this definition as a procedural definition of this study: project sustainability is the project’s ability successfully to complete achievements, sustain achievements, and create a future expansion in light of the new initiatives derived from the project.

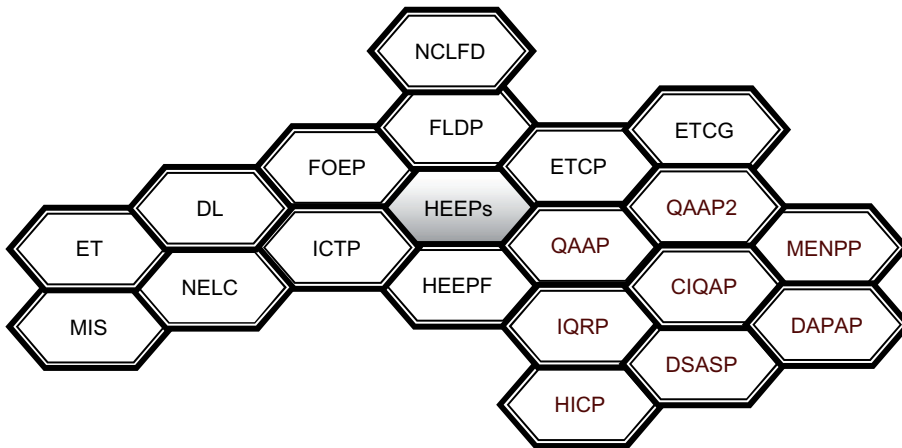


Figure 2.
The sustainability
of the HEPPs

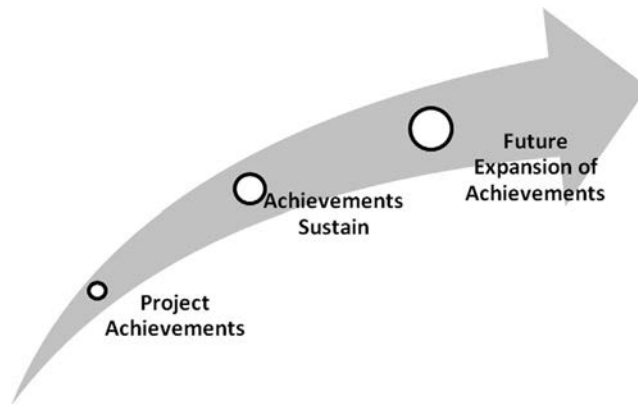


Figure 3.
The dimensions of project
sustainability

3. Research gap, conceptual framework, and hypotheses

3.1 Research gap

Despite the importance of recent studies that have attempted to identify a number of skills (Boitmane, 2006; Lapina and Aramina, 2011; Rauhvargers, 2007), and/or test the impact of these skills on the success of projects (Bodea *et al.*, 2010; Janin, 2009; Sherman *et al.*, 2002), there remains a gap that is addressed in this study. Although there are many types of barrier to sustainability, the HEPPs could achieve the sustainability of project outcomes. Until now, no study has investigated the relation between barriers to sustainability, project managers' sustainability competencies, and project sustainability as an integrated model. In particular, there is a lack of empirical research related to project sustainability management in governmental HEPPs. There are limitations in terms of knowledge and empirical studies concerning the problems faced by these projects. Therefore, this study is driven by the following considerations: the lack of systematic and empirical research that has investigated the relations between barriers to sustainability, sustainability competencies and project sustainability. Based on the theoretical and practical background, the study seeks to

test the mediating effect of project managers' sustainability competencies on the relation between barriers to sustainability and project sustainability by addressing the following questions in the context of Egyptian HEEPs:

- RQ1. Are barriers to sustainability significant predictors of project sustainability?
- RQ2. Are barriers to sustainability significant predictors of project managers' sustainability competencies?
- RQ3. Are project managers' sustainability competencies significant predictors of project sustainability?
- RQ4. Do project managers sustainability competencies have a mediating effect on the relation between sustainability barriers and project sustainability?

Thus, this research aims to consider project sustainability management by highlighting the mediating variables of project managers' sustainability competencies.

3.2 Conceptual model and hypotheses

Bearing in mind the aforementioned theoretical concepts, the conceptual model and hypotheses used in this study are shown in Figure 4. Based on the argument developed earlier, the study examines the hypothesis that HEEPs could achieve the sustainability of project outcomes. The sustainability competencies and administrative roles that can affect the barriers to sustainability and the achievement of project sustainability have previously been ignored. We claim that a project cannot apply sustainability management without the project manager's sustainability competencies.

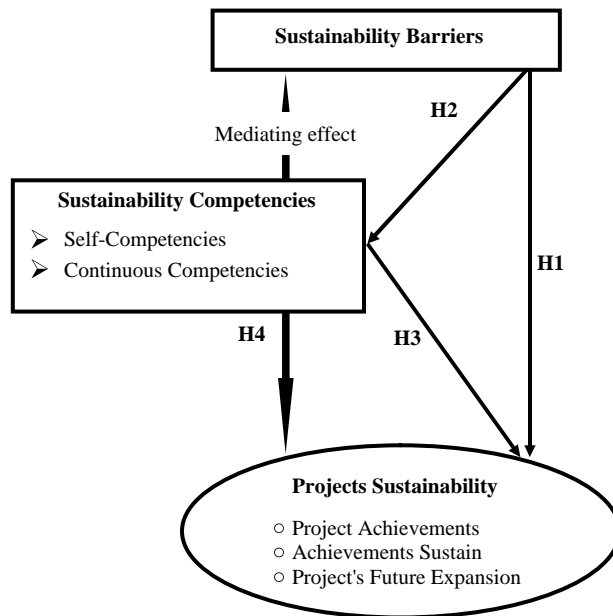


Figure 4. Theoretical research concept and hypothesized model

Consequently, the positive mediating effect of a project manager's competencies on barriers to sustainability and project sustainability is expected to be high.

Consequently, in line with the four research questions, four hypotheses are addressed:

- H1.* There is a significant correlation between barriers to sustainability and the sustainability of the HEEPs.
- H2.* There is a significant correlation between barriers to sustainability and project managers' sustainability competencies.
- H3.* There is a significant correlation between project managers' sustainability competencies and the sustainability of the HEEPs.
- H4.* Project managers' sustainability competencies mediate the relation between barriers to sustainability and the sustainability of the HEEPs.

4. Methodology

To answer the research questions, a cross-sectional study was carried out focusing on those who are aware of sustainability competencies, regardless of whether they are fully aware of project sustainability and barriers to sustainability or not. In this study, the population consists of managers, executive teams, and experts/advisors working in the Egyptian HEEPs. The sampling technique adopted was a purposive judgmental sampling. This study seeks to illuminate sustainability competencies, project sustainability, and barriers to sustainability through the views of those who are in a good position to provide their perceptions of the self- and continuous competencies. In total, 170 questionnaires were distributed and 159 were retrieved, representing a response rate of 93.5 percent. The study used a self-administered questionnaire in Arabic.

This study passes through two different stages. In the first stage, a revision of the completion and results reports for the HEEPs in Egypt was undertaken. The first stage in turn comprised two different phases. In the first phase, each project director prepared reports containing the specific objectives, the outputs achieved, the achieved/expected outcomes, and the expected impact of each project. In the second phase, a field survey was conducted to validate the results of the HEEPs. In the latter phase, I developed a consistent set of barriers to sustainability, sustainability competencies, and project sustainability criteria, which define the success of the performance in terms of sustainability in the overall field of project sustainability management; in doing so, a review of the related literature and a backward chaining approach led to a series of interviews with the PMU board of directors.

Rosell and Furth's (2006) and Rahimnia's (2009) scales were used to measure barriers to sustainability. Willard *et al.*'s scale (2010) was employed, with certain modifications, to measure project managers' sustainability competencies, including both self-competencies that will be needed in the future and continuous competencies that will be necessary for bringing about transformational change in the future. Finally, to measure project sustainability, I used a specific scale related to the HEEP including three components: project achievements; sustaining project achievements, incorporating the HEEPs learning environment; future expansion of the project, including strategic vision, legislative reforms, and post-completion operation/next phase.

Prior to the main study, a pilot study was undertaken. Approximately 12 experts from the PMU board of directors and academics examined the questionnaire in order to ensure that the questionnaire was not too complex and was easy to understand. In the light of the results of the pilot study, the questionnaire was modified. The questionnaire was subsequently distributed to a small sample of 20 executive teams working in the HEEPs. Further changes were made to the questionnaire according to the results obtained that involved shortening and simplifying the instrument. After verifying the validity of the questionnaire, the final versions were delivered by hand or sent by e-mail.

Finally, descriptive statistics, correlation analysis, multiple regression analysis, and hierarchical regression analysis were employed to ascertain whether there are any mediating effects of self- and continuous competencies on the relation between barriers to sustainability and project sustainability.

5. Results

As shown in Table II, the respondents' positions are 10.69 percent project managers, 61.63 percent executive teams, 10.06 percent experts/advisors, and 17.61 percent others from planners and researchers.

The participants have an average of approximately five years of working experience ($M = 4.92$, $SD = 6.33$). Of the respondents, 60.38 percent were male and 39.62 percent were female. Finally, the average age for the respondents was 36 years ($M = 36.45$, $SD = 0.2156$); specifically, 42.77 percent of the respondents were 25-34 years old, and 30.82 percent were 35-44 years old.

As shown in Table III, the correlation analysis reveals that there are significant and positive correlations between barriers to sustainability and project managers' sustainability competencies ($r = 0.41$, $p < 0.01$), and project sustainability

Characteristic	Frequency	Percentage	Mean	SD
<i>Position</i>				
Project manager	17	10.69		
Executive team	98	61.63		
Expert/advisor	16	10.06		
Other	28	17.61		
<i>Work experience</i>				
≤ 1 year	10	6	4.92	6.33
1-2	22	13.84		
3-4	51	32		
5-9	50	31.44		
≥ 10 years or more	26	16.35		
<i>Gender</i>				
Male	96	60.38		
Female	63	39.62		
<i>Age</i>				
25-34	68	42.77	36.45	0.24
35-44	49	30.82		
45-54	24	15.09		
55-64	15	9.43		
65-74	3	1.89		
≥ 75 or older	–	0.00		

Table II.
Respondents'
characteristics

($r = 0.54, p < 0.01$). Project managers' sustainability competencies are significantly related to project sustainability ($r = 0.53, p < 0.01$) as suggested in the hypotheses.

From the theoretical reviews of management and sustainability, a manager's competencies have been identified as an important moderating role in relation to barriers and sustainability. This means that despite the barriers that confront project sustainability, manager's competencies can result in success in achieving project sustainability. Therefore, the project managers' sustainability competencies in Egyptian HEEPs are expected to play a key role in order to reduce the barriers to sustainability and achieve sustainability. In addition, the competencies displayed by a project manager could reduce the effect of the barriers to sustainability on project sustainability. In testing the hypotheses, multiple regression analysis was conducted to examine in greater depth the relations between independent variables, mediator variables, and dependent variables.

5.1 The mediating role of the project managers' sustainability competencies

A mediator variable is defined as a qualitative or quantitative variable that "affects the direction and/or strength of the relationship between an independent or predictor variable and a dependent or criterion variable" (Baron and Kenny, 1986). To demonstrate the mediating effects, the following cases should exist as suggested by Baron and Kenny (1986): independent variables (sustainability barriers) should be related significantly to the mediating variables (self- and continuous competencies); independent variables (sustainability barriers) must be related significantly to the dependent variables (project achievements, sustaining achievements, and future expansion). When the effect of the mediating variables is added to the relation between independent and dependent variables, the β coefficients must significantly be decreased. Moreover, the relations between the mediating variables and the dependent variables are significant. Therefore, before predicting the models for project sustainability, the study predicts models with self- and continuous competencies. As shown in Table III, a series of multiple regression analyses were used to test the mediation effect of project managers' sustainability competencies on the relation between barriers to sustainability and the sustainability of Egyptian HEEPs.

5.2 The relation between barriers to sustainability and project sustainability

Table IV highlights the relation between barriers to sustainability and project achievements, sustaining achievements, and future expansion. As can be seen, the R^2 -values of 0.61, 0.46, and 0.51, respectively, are significant at a confidence level of 0.01. The independent variables could only explain about 61 percent of the variance in project achievements, 46 percent of the variance in sustaining achievements, and 51 percent of the variance in the future expansion of project achievements. However, this model has

Variable	1	2	3	Mean	SD
1. Sustainability competencies	–			2.85	0.88
2. Barriers to sustainability	0.41*	–		3.63	0.45
3. Project sustainability	0.53*	0.54*	–	3.89	0.69

Note: Significant at: * $p < 0.01$

Table III.
Means, standard
deviations and
inter-correlations of the
variables

Hypothesis	Dependent variable	Independent variable	Coefficient	SE	Adj R^2
<i>H1</i>	Project achievements	Barriers to sustainability	1.231	1.605	0.61*
	Sustaining achievements	Barriers to sustainability	0.451	2.314	0.46*
	Future expansion	Barriers to sustainability	1.126	2.033	0.51*
<i>H2</i>	Self-competencies	Barriers to sustainability	0.054	1.023	0.35*
	Continuous competencies	Barriers to sustainability	1.043	0.032	0.49*
<i>H3</i>	Project achievements	Self-competencies	7.084	1.124	0.52*
	Sustaining achievements	Self-competencies	1.812	2.301	0.50*
	Future expansion	Self-competencies	3.036	3.214	0.45*
	Project achievements	Continuous competencies	2.073	1.235	0.59*
	Sustaining achievements	Continuous competencies	1.041	2.012	0.54*
	Future expansion	Continuous competencies	10.24	1.035	0.53*

Table IV.
Results of multiple
regression analysis

Note: Significant at: * $p < 0.01$

an acceptable fit. Thus, the findings support *H1* – that is, that fewer structural barriers, mindset barriers, information/communication barriers, trust barriers, isolation barriers, and the barriers of “sustainability” itself would result in more favorable project achievements, sustainability of achievements, and future expansion.

5.3 The relation between barriers to sustainability and sustainability competencies

Table IV shows the relation between barriers to sustainability and self- and continuous competencies. The results show R^2 -values of 0.35 and 0.49, respectively, significant at a confidence level of 0.01. The independent variables could only explain about 35 percent of the variance in self-competencies and 49 percent of the variance in continuous competencies. The results also show that continuous competencies are deemed to be of extremely high importance, more so than self-competencies. However, the model has an acceptable fit. Thus, the findings support *H2*, which states that more sustainability competencies could weaken the effect of the barriers to sustainability.

5.4 The relation between sustainability competencies and project sustainability

Table IV shows the relation between self-competencies and project achievements, sustaining achievements, and future expansion. It also reveals the relation between self-competencies and project achievements, sustaining achievements, and future expansion. The results show R^2 -values of 0.52, 0.50 and 0.45, respectively, significant at a confidence level of 0.01. Self-competencies could only explain about 52 percent of the variance in project achievements, 50 percent of the variance in sustaining achievements, and 45 percent of the variance in the future expansion of project achievements. When HEEPs’ managers were asked to describe the main competencies related to self-competencies, PM, strategic planning, and systems thinking were at the top of the list as the “most important.” In addition, there is a clear difference between three groups of variables. The second group of responses includes sustainability accounting and reporting management, auditing, policy expertise, financial analysis, life cycle costing, and risk assessment. And the lower group of responses includes accounting and reporting, technology and/or engineering expertise, and process management.

In terms of core competencies, the results reveal R^2 -values of 0.59, 0.54 and 0.53, respectively, significant at a confidence level of 0.01. They also indicate that core

competencies could only explain about 59 percent of the variance in project achievements, 54 percent of the variance in sustaining achievements, and 53 percent of the variance in the future expansion of project achievements. When asked to describe the main competencies related to continuous competencies, HEEPs' managers identified communication with internal and external stakeholders, inspiring and motivating others, innovating/re-thinking the business and problem solving as the most important. The results show that there is a clear distinction between the three groups of variables. The second group of responses included flexibility, influencing change within the project, and consensus building. The third group included team building, establishing and managing trinities, facilitating and/or training groups, networking with external/internal stakeholders, and influencing change outside the project.

The results also signify that continuous competencies are considered extremely important, more so than self-competencies. Nevertheless, the model still has an acceptable fit. Thus, the findings support *H3* as greater sustainability competencies would result in more favorable project achievements, sustaining achievements, and future expansion.

5.5 The mediating effect of self-competencies

Table V shows the results of hierarchical regression analysis carried out to ascertain whether there are any mediating effects of self-competencies on the relation between barriers to sustainability and project sustainability. Model A shows the regression without the mediation of self-competencies between barriers to sustainability and project sustainability and finds an effect. In order to identify the extent of the mediating effect of self-competencies on each significant independent variable in the model, Baron and Kenny's (1986) steps in assessing mediator effects were followed.

As indicated in Table V, the β coefficient is lower in Model A than in Model B for mediating effects. The results also show that the values of R^2 for both Models, A and B, with project sustainability as the dependent variable are 0.401 and 0.543, respectively, with F -values that are statistically significant. This means that the independent variables could only explain about 40.1 percent of the variation in project sustainability, whereas the mediator explains an additional 14.2 percent of the variation.

5.6 The mediating effect of continuous competencies

Table VI shows the results of hierarchical regression analysis carried out to ascertain whether there are any mediating effects of continuous competencies on the relation

Model	Adjusted R^2	SE	F	β coefficients
Model A	0.401	0.263	4.431	1.186
Model B	0.543	0.235	6.301	1.001

Table V.
Hierarchical regression
analysis of barriers
to sustainability,
self-competencies, and
project sustainability

Model	Adjusted R^2	SE	F	β coefficients
Model A	0.491	0.402	5.231	1.175
Model B	0.692	0.334	7.903	1.042

Table VI.
Hierarchical regression
analysis of barriers
to sustainability,
continuous competencies,
and project sustainability

between barriers to sustainability and project sustainability. Model A shows the result of regression without the mediation of continuous competencies on the relation between sustainability barriers and project sustainability.

Baron and Kenny's (1986) mediator assessing steps were also carried out for more mediating effects. As shown in Table VI, the β coefficient is lower in Model A than in Model B. The results also indicate the values of R^2 for both Models, A and B, with project sustainability as the dependent variable are 0.491 and 0.692, respectively, with F -values that are statistically significant. This means that the independent variables could only explain 49.1 percent of the variation in project sustainability, whereas the mediator explains an additional 20.1 percent of the variation. These results support $H4$.

6. Discussion and implications

This study, conducted over a period of nine months, seeks to answer the overall question: "Do the project manager's sustainability competencies have a mediating effect on the relation between sustainability barriers and the sustainability of Egyptian HEEPs?" The main purpose of this study is to develop an understanding of the mediating effect of project managers' sustainability competencies on barriers to sustainability and project sustainability in HEEPs.

The purpose of $RQ1$ was to examine empirically the relation between barriers to sustainability and project sustainability. In order to achieve this purpose, a review of related works in the fields of PM, project sustainability, and barriers to project sustainability was conducted. Based on the preliminary findings in the related academic studies, six types of barriers to sustainability (structural, mindset, information/communication, trust, isolation, and the term "sustainability" itself) may be constructed, and three possibilities for project sustainability (project achievements, sustaining achievements, and future expansion) may be developed. In this model, barriers to sustainability have a direct negative effect on project sustainability.

It is difficult to justify the superiority of this model in governmental HEEPs using theoretical approaches only; therefore, empirical tests are carried out. The objective of $RQ2$ was to examine the relation between barriers to sustainability and sustainability competencies. In order to achieve this purpose, a review of related works in the field of project manager competencies, project sustainability management, and barriers to project sustainability was conducted. Based on the preliminary findings in the related academic studies, two sets of sustainability competencies, self- and continuous competencies were found. In this model, sustainability competencies could weaken the effect of the barriers to sustainability.

The objective of $RQ3$ was to examine empirically the relation between sustainability competencies and project sustainability. In order to achieve this purpose, a review of related works in the field of project manager competencies and project sustainability management was conducted. The main competencies related to self-competencies are as follows: PM, strategic planning, systems thinking, sustainability accounting and reporting management, auditing, policy expertise, financial analysis, life cycle costing, risk assessment, accounting and reporting, technology and/or engineering expertise, and process management. The main competencies related to continuous competencies are, e.g. communication with internal and external stakeholders, inspiring and motivating others, innovating/re-thinking the business, problem solving, flexibility,

influencing change within project, consensus building, team building, establishing and managing trinities, facilitating and/or training groups, networking with external/internal stakeholders, and influencing change outside the project. In this model, sustainability competencies would result in more effective project achievements, sustaining achievements, and future expansion.

The goal of *RQ4* was to test the mediating effect of self- and continuous competencies on the relation between sustainability barriers and project sustainability. Hence, a review of the general approaches to testing mediator effects was conducted. Based on the preliminary findings of these studies, certain conditions must be met, as suggested by Baron and Kenny (1986), i.e.: independent variables must be related significantly to the mediating variables and independent variables must be related significantly to the dependent variables. When the effect of the mediating variables is added to the relation between independent and dependent variables, the β coefficients must be decreased significantly. Finally, the relations between the mediating variables and the dependent variables must be significant.

The findings show that projects that have fewer barriers – structural, mindset, information/communication, trust, isolation, and those related to the term “sustainability” itself – seem to have managers who exhibit more self- and continuous competencies. In addition, they would demonstrate more favorable project achievements, sustainability of achievements, and future expansion. The findings also indicate that continuous competencies are considerably more important than self-competencies. Continuous competencies enable managers to identify opportunities and decide how to exploit them. In other words, continuous competencies mean constantly updating their knowledge, and this requires self-management and responsiveness to the opportunities for development offered by experience. Continuous competencies are not self-competencies although they may include self-competencies.

Overall, this study finds that project managers’ sustainability competencies (self- and continuous competencies) mediate the relation between barriers to sustainability and the sustainability of the HEEPs (project achievements, sustaining achievements, and future expansion) since the independent variable affects the dependent variable upon regressing the dependent variable on both the independent variable and the mediator.

Furthermore, the findings of this study have important implications for governmental HEEPs, which face many barriers during implementation. These barriers are delays in implementing certain activities, e.g. due to changes in project managers at the beginning of the project, lack of trust, resistance to change, lack of sustainability in terms of benefiting from project outputs, lack of sustainability in terms of leaders, staff members and administrators in projects, mindset barriers, and the lack of effective use of technology by some individuals. Governmental projects could overcome these barriers through exploiting project managers’ sustainability competencies to achieve the desired sustainability objectives. They should overcome these barriers by focusing on the sustainability competencies of project managers and employees responsible for the implementation and supervision of project activities, by training technical and administrative staff, and by developing organizational structures to establish subprojects so that they may be sustainable. This new direction would benefit the second phase of implementation of the project and other future projects by providing a basis to develop any missing baseline policies according to the target objectives prior to implementation.

7. Conclusions

The aim of this study was to consider project sustainability management by adding the mediator variable of project managers' sustainability competencies. By proposing the conceptual model and hypotheses, the following theoretical, practical and academic contributions are suggested. Concerning theoretical contributions, the study considers the variable of sustainability competencies; in addition to the interaction between self- and continuous competencies as having mediating effects, it explains the phenomenon of project sustainability based on sustainability competencies. These issues are critical since previous studies have focused primarily on the direct influence of project managers' competencies on organizational performance. They have paid relatively little attention to sustainability competencies as a mediator variable between barriers to sustainability and project sustainability.

In terms of the industrial/practical contribution, the study could be of use in presenting important guidelines and references for thinking about sustainability issues, barriers to sustainability, sustainability competencies, and project sustainability. The research shows that sustainability competencies in PM could be improved in practice. The use of the honeycomb model in relation to PM sustainability can be used to identify aspects that have to be integrated in the strategy, policies and PM processes.

The study also demonstrates that it is necessary to develop a sustainable impact assessment system for governmental HEEPs involving tools that can be simplified and used easily so that they can suit different educational/academic environments. In addition to building a database at the initiation of the project, we can assess the impact of subprojects and provide information on the actual fulfillment of the project objectives. The study considers the way(s) in which sustainability competencies are integrated in the governmental project and how this is aligned in the specific process of PM.

The first recommendation is that ministries should stress sustainability as a part of their strategies and policies. The second recommendation is to implement sustainability within the impact assessment process. We should also distinguish between business methodologies in terms of the principles of sustainable development. The next recommendation is to translate aspects of sustainability competencies in the selection of project managers, in addition to implementing programs of training and development that enable individuals to participate in sustainable development processes through equipping them with the knowledge, skills and attitudes required to understand beyond the initial idea, also incorporating the processes of planning and evaluation of project sustainability. The final recommendation is to incorporate sustainability in PM processes. These guidelines can give us remarkable economic, environmental, and social benefits, and hence aid in moving society toward sustainability.

7.1 Limitations

This study has its limitations, the major limitations being related to data collection. First, there are the data collected from HEEPs reporting that sustainability is practiced in HEEPs projected based on data from the HEEPF (2008). In addition, the responses were only obtained from project managers, executive teams, experts/advisors, and planners and researchers. This may have influenced the independent, dependent, and mediator study variables that were related to strategic decision-making. A final limitation of this study is that all of the data were collected in Egypt. As management practices and business processes differ between countries, the limitation is the lack of

knowledge as to the extent to which the current findings can be applied in other countries. In sum, while all limitations are evident, none is unusual or specific to this study. Given the strong interrelationships evident in the findings, the results appear to be valid and meaningful.

7.2 Suggestions for future research

This study focuses only on self- and continuous competencies as having a mediating role, and explains the phenomenon of project sustainability based on these two factors. Many other variables exist, such as attitudes towards services provided by the project, etc. that could affect the project's sustainability. Future research should attempt to examine the influence of such variables on barriers to sustainability and project sustainability. In addition, this study does not define the levels of sustainability competencies. Future research should attempt to define these levels to provide a suitable framework for developing career paths and personnel development programs for individuals and other organizations. Sustainability is not considered as an integrated part of project strategies and managerial policies. Hence, research should be conducted to overcome this problem. The honeycomb model of sustainability in PM can also be used to create awareness of the possibilities of integrating sustainability in project strategy and PM policies.

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94

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