Mapping Sustainable Development onto Project Management Processes

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Abstract

In the past two decades, sustainable development has attracted increasing attention from both researchers and practitioners in different industries. For project-based organizations, an effective way to satisfy the three pillars of sustainable development (economic, environmental, and social) is to develop guidelines that integrate sustainability into project management processes and practices, which mapping sustainable development of project management processes can achieve. This paper identifies and maps sustainability practices of the five project management process groups that the Project Management Body of Knowledge Guide recognizes, which include controlling, closing, executing initiating, monitoring, and planning. This study comprised a comprehensive literature review and consultations with experts in the construction industry in the United Arab Emirates. Accordingly, eighty sustainability practices related to the three pillars of sustainability were identified and mapped onto the five processes that the PMBOK Guide recognizes. The results of this study are of value to project managers in the construction industry who are interested in incorporating sustainability into project management practices, thus achieving the sustainable development objectives of their organizations. The results may also contribute to integrating sustainability into project management standards.

Keywords
Project management, sustainability, sustainable construction practices, sustainable management

1. Introduction

The perceptions of sustainable development associated with the triple fundamentals of economic, environmental, and social development have evolved into a concern of prominence for projects (Labuschagne et al. 2005; Valdes-Vasquez and Klotz 2013). Although sustainability has become an essential factor for scholars and professionals in project management (Silvius et al. 2013; Sánchez 2015; Silvius and Schipper 2015; Sarkis et al. 2012; Valdes-Vasquez and Klotz 2013; Labuschagne et al. 2005) and project management can enhance the integration of the dimensions of sustainability (Bocchini et al. 2014), an inconsistency is present between the perceptions of the prominence of the need for sustainability and the substantial usage of sustainability in project management (SPM) practice (Martens and Carvalho 2016a). Additionally, project management, which focuses upon eco-design is an incipient theme (Brones and Carvalho 2015) a deficiency exists in the eco-design literature (Brones et al. 2014) as little research has associated these fields with each other. Thus, although the literature about this research topic has emerged, it persists in being discrete (Martens and Carvalho 2016b). Confirmation of this is present by the exclusion of fundamental controversial issues concerning sustainability in the governing bodies in the project management field. Additionally, further research is required for advancing methodologies, techniques, and tools (Singh et al. 2012) and in addressing the absence of the integration of sustainability in project management routines (Cole 2005; Brones et al. 2014). Sustainability can be connected with project management in several ways. For instance, this linkage could include leading variables that must be handled to achieve sustainability during a project life cycle and an assessment of indicators like the impacts that a project has on money, people, and the planet. (Carvalho and Rabechini 2011). The motivation of this study is the need to bridge sustainability in project management (Brones and Carvalho 2015), given its increasing importance in the current business environment. Silvius et al. (2012) distinguished between what sustainability means for projects

and project management in finding the most suitable approach to fit an objective. Silvius (2015b) referred to Eid's study, which concluded that project management standards often have failed to address sustainability agenda. Hence, this area needs more focus to develop standards for incorporating sustainability in the project management process to prepare project managers for their essential role in realizing project sustainability.

2. Research Objectives

The construction industry makes significant contributions to bettering the quality of life, and the need to manage projects in ways that optimize the utilization of existing resources without compromising the resources of future generations resources has become crucial. Project management standards often do not integrate sustainability practices that can help project managers and organizations to function in more sustainable ways. Thus, guidelines should be created and promulgated to help project managers incorporate sustainability in construction projects. The objective of this research was to identify and map sustainability practices onto the five project management process groups that PMBOK Guide recognizes, which are closing, controlling, executing, initiating, monitoring, and planning. The remaining parts of this paper are organized as follows. Section 3 presents a literature review on the concept of sustainability and sustainable project management. The research methodology and results are shown in Sections 4 and 5, respectively. Finally, section 6 concludes the paper by summarizing the findings, identifying limitations, and making suggestions for prospective research.

3. Literature Review

3.1 The Concept of Sustainability

The term "sustainable development" was first coined among activists and political leaders as a reaction to the increase in resources used as a result of industrialization (Meadows et al., 1972). If the world's populations and economies continue to increase at their present speed along with the continuing growth of pollution, food production, industrialization, and population of the world, then this would eventually lead to the critical reduction of the world's resources. According to Brundtland (1985), sustainable development is a development meeting present needs without compromising the capacity of future generations to meet their own requirements. He interlinks the concept of sustainability with aspects of the economy, environment, and social well-being. Therefore, sustainability is about integrating the triple bottom line of economic, environment, and society, which influence each other in multiple ways despite regional differences in the emphasis on each of the three pillars. In the same manner, Silvius and Schipper (2016) concluded that sustainability is also about integrating short-term and long-term aspects for the full lifespan of a matter at hand. Concerning the sustainability pillars, the economic perspective suggests that economies should consume income rather than capital and tend to prefer short-term effects because of present discount rates. However, the social and environmental aspects both indicate that long-term resource degradation might occur because these impacts might be invisible in the short term. Sustainability implies that the source and sink functions of the environment should not be degraded and the natural capital should remain intact. This can be achieved by ensuring that the rate of the renewal of natural resources should higher than their depletion rate must exceed the maximum ability of the environment to assimilate waste.

3.2 Sustainable Project Management

The notion of sustainability has been implemented recently in project management knowledge, although, to some extent, the concepts of sustainability and project management, are contradictory. Considering the nature of projects is often seen as temporary, project management standards often fail to address the sustainability agenda seriously. Hence, this conclusion may not be surprising. Projects and sustainable development are probably not natural friends (Silvius 2015a).

Bocchini et al. (2014) considered project management as a method to affect the integration of sustainability dimensions in projects positively. Thus, sustainability may be viewed as a model that simultaneously addresses the needs of today but also impacts future generations by combining the three dimensions of ecology, economy, and society. The significance of sustainability has arisen in political strategies, the goals of countries, the concerns of cities and communities, and the business strategies of companies in the last two and a half decades. Long-term sustainable development can be attained only if the concept of sustainability is applied at different levels, ranging from national

guidelines to real-world on-site applications. The various levels must trade information and knowledge to ensure an efficient progression.

Fernández-Sánchez and López (2010) noted that one of the main problems when measuring sustainability is identifying sustainability indicators and selecting an indicator set. For this reason, they advocated the creation of a methodological process to identify and choose sustainability indicators that considered them as opportunities (positive risks) of a project and to strike a balance among the effects of a project life cycle and to garner social, economic, and environmental benefits. They also proposed a methodology that comprises a first approach toward the standardization of identifying and choosing sustainability indicators in construction projects. They gathered information by consulting different stakeholders to attain a consensus on the common goal of sustainability.

Based upon an interpretation of sustainable development from the World Commission on Environment and Economic Development, a comprehensive perception of sustainable development is built on the incorporation of the three scopes of economic, environmental, and social sustainability, which is frequently known as the "triple bottom line" (Elkington 1998). Furthermore, the increasing amount of firms implementing project management techniques confirms that project management has attained prominence among firms pursuing agile, effective, and efficient responses in their business and project development procedures (Kerzner 2001). Corporations have begun to adopt the rules of institutes and associations and their respective project management bodies of knowledge in developing projects. Among these are *A Guide to the Project Management Body of Knowledge* (PMBOK Guide) (5th ed.), the *International Project Management Association Competence Baseline* (ICB) (IPMA 2013); and the *APM Body of Knowledge* (APM 2013) of the Association for Project Management. Nonetheless, these governing bodies have not paid any attention to the sustainability field. Carvalho and Rabechini Jr. (2011) claim that sustainability encompasses the tension between the diverse groups of stakeholders. Multiple researchers also suggest that an enhanced necessity exists for comprehending topics associated with integrating sustainability aspects into organizational processes, especially at the managerial level (Singh et al. 2012; Labuschagne et al. 2005; Carvalho and Rabechini Jr. 2011; Silvius et al. 2013; Silvius and Schipper, 2015; Martens and Carvalho, 2016a). However, some researchers dispute that the notion of triple bottom line sustainability requires implementation and integration into the project management function. Thus, as Thamhain (2014) indicates, sustainability will remain a substantial dispute, particularly in sizable projects. The research on sustainability in project management remains developing, and researchers in different epistemological fields offer heterogeneous terminology (Brones and Carvalho 2015; Martens and Carvalho 2016b; Brones et al. 2014).

4. Methodology

Figure 1 illustrates the steps used in mapping sustainable practices onto project management processes. As shown in Figure 1, the sustainability indicators were determined from the literature; then their relevant practices were identified and mapped by an expert panel onto the five management process groups that PMBOK Guide recognizes, which are closing, controlling, executing, initiating, monitoring, and planning. The expert panel formed for this study comprised five practicing/practitioner project managers employed in different organizations in the United Arab Emirates construction industry. A key selection criterion for the practitioner members of the expert panel was their demonstrated level of professional construction management experience, which was considered approximate to the status of a professional engineer.

5. Results

Based on the literature review, more than 35 indicators corresponding to the three pillars of sustainability were identified, as shown in Table 1. For practical purposes, the identified indicators in 50% or more of the reviewed studies were included. According to the percentages shown in Table 1, the indicators corresponding to the environmental pillar are natural resources, energy, water, and biodiversity. The indicators corresponding to the economic pillar are financial performance and financial benefits of good practice. The indicators corresponding to the social pillar are labor practices, relationship with the local public, engagement of stakeholders, society, and products and services. The identified relevant practices and their mappings to the five management process groups are given in Table 2. As shown in this table, 80 practices were identified, and each of them is mapped onto one or more of the process groups. This table also shows that almost all practices could be mapped to the planning and execution processes.

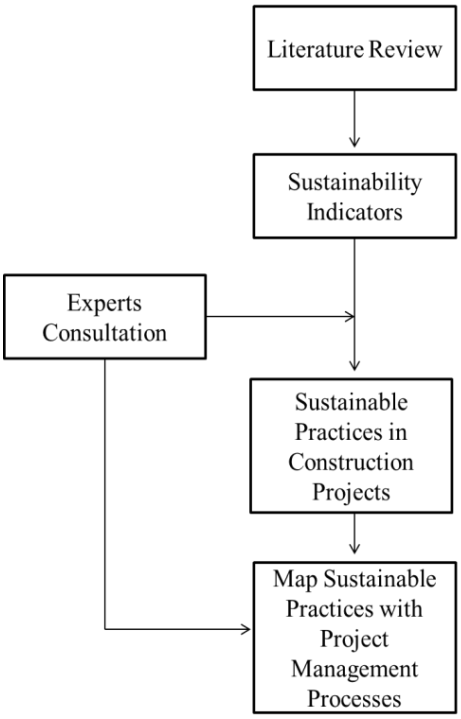

Figure 1. Research method to map sustainable practices with project management processes

6. Conclusions

The motivation behind this study was to make a contribution to sustainable development in the construction industry through identifying and mapping 80 practices related to the three pillars of sustainability onto the five processes that the PMBOK Guide recognized. This was achieved through the literature review and in consultation with experts in the construction industry in the United Arab Emirates. This research is intended to shed light on the importance of incorporating sustainability into project management processes in construction projects. It also gives project managers tentative guidelines on where to incorporate sustainable practices in project management processes, hence contributing to the sustainable development goals of their organizations. The results may also contribute to integrating sustainability into project management standards. However, because they were obtained based on the opinions of experts in the construction industry of the United Arab Emirates, indicating to what extent the results reported in this study apply to the construction industries in other counties is difficult. This could be investigated in future studies. Another possible future study direction would be to examine to what extent the practices identified in this study are implemented in the construction industry in either the United Arab Emirates or other countries

Table 1. Sustainability indicators

Sustainability Pillars	Indicators	Percentage from Studies
Environmental	Natural resources	93%
	Energy	93%
	Water	82%
	Biodiversity	87%
	Management systems of environmental policies	13%
	Management of impacts on the environment and the life cycle of products and services	33%
	Eco-efficiency	23%
	Environmental justice and responsibility	7%
	Environmental education and training	7%
	High-risk projects, climate strategy and governance	40%
	Transportation	40%
	Environmental reports	13%
Economic	Financial performance	80%
	Financial benefits of good practices	53%
	Business ethics	27%
	Cost management	40%
	Management of the company's relationship with customers	33%
	Participation and involvement of stakeholders	33%
	Innovation management	40%
	Economic performance	20%
	Culture of the organization and its management	7%
	Economics and environmental accounting	20%
	Management of intangibles	7%
	Internationalization	13%
	Investments and improvements in services and installations	20%
Social	Labor practices	100%
	Relationships with the local community	87%
	Engagement of stakeholders	53%
	Financing and construction of social action	20%
	Society	53%
	Concepts of social justice	33%
	Relationships with suppliers and contractors	20%
	Products and services	60%
	Human rights	47%
	Social reports	27%

Sources: (Berzosa et al. 2017), (Fernández-Sánchez and Rodríguez-López 2010), (Silvius 2015a), (Yu et al. 2018), (Fiksel 1999), (Sarkis et al. 2012), (Shen et al. 2010), (Xing et al. 2009), (Nation 2007), (Labuschagne et al. 2005), (Mulder and Brent 2006), (International Organization for Standardization 2014), (14001, 2004), (GRI Standards 2016)

Table 2. Integrating sustainability practices into project management processes

Sustainability Pillars	Indicators	Practices	Initiating Process	Planning Process	Executing Process	Monitoring and Controlling Process	Closing Process
Environmental	Natural Resources/Material	Reduce the use of natural resources		✓	✓		
		Use recyclable materials		✓	✓		
		Use environmental friendly materials (not toxics)		✓	✓		
		Choose sustainable suppliers		✓	✓		
		Specify chlorine free (FC free) gases, Such as R-143a & R-507a for AC		✓	✓		
		Use exhaust fan for AC to equip discharge sound anuters in order to minimize the noise		✓	✓		
		Provide advanced waste management onsite		✓	✓		
	Energy	Use Solar panels for hot water generation		✓	✓		
		Use photo cell panels for electrical generation		✓	✓		
		Use Energy Recovery by using recovery wheels for HAVC system		✓	✓		
		Reduce fossil fuel use		✓	✓	✓	
		Feed excess energy that is generated on-site back into the grid "net-metering"		✓	✓	✓	
		Minimize the utilization of generators in site as per required		✓	✓	✓	
		Maintaining the site equipment periodically			✓	✓	
	Water	Select ultra-low-flow plumbing fixtures to reduce fixture's water consumption	✓	✓	✓		
		Use Irrigation and landscaping measures (water-efficient irrigation systems, irrigation control systems, low-flow sprinkler heads, water-efficient scheduling practices and using of native or climate appropriate plants that are adapted to the local climate as thus require less water)	✓	✓	✓		
		Provide on-site Reclaimed/treated wastewater that can be used for end uses such as landscape irrigation, decorative fountains, cooling tower makeup water, toilet flushing, fire sprinkler systems	✓	✓	✓		
		Provide on-site Reclaimed/treated grey water to be used as landscape irrigation and toilet flushing	✓	✓	✓		
		Provide on-site Reclaimed/ filtered condensate water that is derived from air conditioning units such as FCUs, AHUs, and then filtered to remove solids and to be used as landscape irrigation and toilet flushing	✓	✓	✓		
		Provide water catchment systems: rainwater collection systems , the captured water can be stored in storm water tanks and can be used for landscape irrigation, and toilet flushing	✓	✓	✓		
		Use grease interceptor to intercept most greases and solids before they enter a wastewater disposal system	✓	✓	✓		
		Collect any wastewater generated from site activities in settlement tanks, screen, discharge the clean water, and dispose of remaining sludge according to environmental regulations	✓	✓	✓		
	Biodiversity	Improve indoor air quality for CO_2 level and fresh air by good ventilation system	✓	✓	✓		
		Maintain indoor air quality by keeping the building under positive Pressure	✓	✓	✓		
		Cover piles of building materials like cement, sand and other powders, regularly inspect for spillages, and locate them where they will not be washed into waterways or drainage areas	✓	✓	✓		
		Use low Sulphur diesel oil in all vehicle and equipment engines, and incorporate the latest specifications of particulate filters and catalytic converters	✓	✓	✓		
		Place fine mesh screening close to the dust source to stop it from spreading		✓	✓	✓	
		Control dust through fine water sprays used to dampen down the site	✓	✓	✓	✓	
		Maintain Tobacco-free environment for better indoor environmental quality	✓	✓	✓	✓	
		Choose local or regional materials to reduce transportation pollution	✓	✓	✓		
		Segregate, tightly cover and monitor toxic substances to prevent spills and possible site contamination		✓	✓	✓	
		Avoid burning of materials on site		✓	✓	✓	
Economic	Financial performance	Prepare well established business Plan before implementing the project	✓	✓	✓	✓	
		Prepare return of investment or payback assessment	✓	✓			
		Provide a study that discuss the possibility of increasing profitability	✓	✓	✓	✓	✓
	Financial benefits of good practices	Offer more jobs for employment generation and growth	✓	✓			
		Use the marketing Advantage of using sustainable practices and products			✓	✓	

Table 2. Integrating sustainability practices into project management processes (continued)

Sustainability Pillars	Indicators	Practices	Initiating Process	Planning Process	Executing Process	Monitoring and Controlling Process	Closing Process
Social	Labor practices	Maintain good health and safety and provide insurance and health coverage for affected workers		✓	✓	✓	
		Use the marketing Advantage of using sustainable practices and products		✓	✓	✓	✓
		Ensure training all workers on the hazards they may encounter due to new materials or installation processes	✓	✓	✓	✓	✓
		Conduct a comprehensive hazard analysis before the start of a construction project	✓	✓	✓		
		Use low Volatile organic compounds materials	✓	✓	✓	✓	✓
		Decrease reflectivity by choosing tan or light gray roofing membranes rather than white. Alternatively, require your workers to wear tinted eyewear during installation		✓	✓	✓	
		Place photovoltaic panels closer to the ground or in the center of the roof with the consider of higher parapets		✓	✓	✓	
		Enlist a local third-party waste management company to sort and recycle construction materials offsite		✓	✓	✓	
		Provide proper induction related to country traditions and culture for employees		✓	✓	✓	
		Provide proper accommodation with needed facilities for labors		✓	✓	✓	
		Provide proper working areas (ventilation, light)		✓	✓	✓	
		Cover up and protect all drains on site		✓	✓	✓	
		Provide proper personal protective equipment		✓	✓	✓	
		Open a communication channel between the labors and management		✓	✓	✓	
		Provide ethics and code of conduct training		✓	✓	✓	
		Provide on-time salary payment		✓	✓	✓	
		Prepare proper evaluation system for personality and technical knowledge		✓	✓	✓	
		Provide annual leave scheduling and flexibility with Emergency leaves		✓	✓	✓	
		Circulate the open vacancies among the workforce to give equal opportunity to everyone		✓	✓	✓	
	Relationships with the local community	Prepare assessment that address at minimum the following social responsibility elements: No child / forced / bonded labor ,Health and safety procedures and training , Right of freedom of association , Non-discrimination , Discipline / harassment and grievance procedures , Fair working hours and compensation , Anti-corruption and bribery)		✓	✓	✓	✓
		Provide the labors with access (phone number, email, person) to a neutral parties to resolve any conflict or report any offensive behaviors			✓	✓	
		Circulate the emergency contact numbers (local authorities and within the company) and make them visible to all		✓	✓	✓	
		Restrict the working hours according to the country law and holidays off should respected	✓	✓	✓		
		Prevent of forcing employees/labors to work after duty hours		✓	✓	✓	
		Provide labors with proper breaks depending on the work performed and the tasks needs to be finished		✓	✓	✓	
	Engagement of stakeholders	Engage the developer and consultant where needed in the project cycle	✓	✓	✓	✓	✓
		Interact with vendors in engineering and procurement stages to provide sustainable solution			✓	✓	✓
		Engage Testing & Commissioning agency where needed in the project cycle		✓	✓	✓	✓
		Engage the Facilities Management where needed in the project cycle			✓		✓
	Society	Consider aspects of race diversity and gender equality in the composition of the project team	✓	✓	✓		
		Consider contingency reserves to ensure reimbursement of any damages that may be caused by the project in the environment and in the people involved in the baseline cost	✓	✓	✓		
		Follow engineering ethics and moral	✓	✓	✓	✓	
	Products and services	Use safe products	✓	✓	✓	✓	
		Provide a Life Cycle Cost assessment	✓	✓	✓	✓	✓
		Prepare and provide a supplier Assessment	✓	✓	✓		
		Get products sourced from manufacturers with self-declared reports (valued at one half of a product)		✓	✓	✓	✓
		Make sure that products sourced from manufacturers with third-party verified corporate sustainability reports (CSRs) that address the extraction operations and activities associated with the product's supply chain			✓	✓	✓
		Have a verification from a certified third party to eliminate corruption			✓	✓	✓
		Ensure of supplier material conformity with environmental regulations		✓	✓	✓	
		Provide nominating of bidder to be fair chosen		✓	✓	✓	
		Use clear suppliers selection criteria		✓	✓	✓	

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Biographies

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