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Towards conceptual understanding for the adoption of building environmental sustainability assessment methods in the UAE built environment

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Abstract. The UAE is witnessing increased interest for sustainable development which poses challenges on the development processes for the large amount of built environment projects taking place in this emerging economy. While, great attention has been given to the development of tools and methods to measure and assess the performance of buildings to meet specific environmental sustainability targets, however, less is known about the effect of these assessment methods on the built environment development process itself. This paper addresses this gap through the investigation of the adoption of building environmental sustainability assessment methods for development projects in the UAE. Currently, there are two assessment methods in the UAE; Pearl Building Rating (PBR) and Al Sa'fat systems. Background study revealed that both systems: are developed in parallel to the development of building codes, adopt performance-based approach for assessment methods, and their adoption for development projects is basically mandatory. This paper draws from diffusion of innovations theory and growing literature in the adoption of similar assessment methods in projects, with the objective of proposing a conceptual framework that conceptualizes PBR and Al Sa'fat methods as innovations and the development projects as the social system for adoption, while focusing on the adoption process dynamics rather than the decision to adopt or not. The proposed framework captures specific conceptual themes, providing the foundation for further empirical investigation. As such, this paper contributes to the growing literature on the adoption of global energy assessment tools and specifically addresses the UAE's sustainable development policy and regulation.

1. Introduction

Sustainable development is important for emerging economies such as the UAE, which has been witnessing rapid development in buildings and infrastructure for the last 30 years or so, propelled by an oil-rich economy. As the country aspires to couple economic development with social and environmental development [1], and to confirm its commitment to the sustainable development goals (SDGs) set out by the United Nations for 2030 [2], numerous federal and local policies and strategies has started to converge to enable the realization of sustainable development goals. Examples of these



are: UAE Vision 2020, the UAE Centennial 2071, and the UAE Energy Strategy 2050. This sustainability discourse which is increasingly emerging and diffusing from policy into practice has great effect on construction work and firms specially that construction and building sector contributed 8.40% of the UAE GDP in 2017 [3]. Hence, the broad focus of this research is the sustainable development for the UAE built environment.

A lot of attention has been given to the development of tools and methods to measure and assess the performance of buildings to meet specific environmental sustainability targets. While, assessment methods have been considered as *market transformation tool*, which not only provide objective evaluation of environmental performance but also enable green design guidance and encourage communication within sustainable project teams [4], less is known about the effect of these assessment methods on the built environment development process itself. A growing literature has started to address this gap and found that while these methods provide opportunities for innovation, it also has the potential to stifle innovation by prescribing specific solutions and promoting a tick-boxing approach to meet required regulations instead of adopting sustainable design and construction practices [5] [6]. Drawing on Diffusion of Innovations (DOI) theory, this paper contributes to this growing literature by proposing a conceptual framework for understanding of the adoption of Building Environmental Sustainability Assessment Methods by the UAE built environment projects, this framework serves as the foundation for further empirical investigation of the UAE construction industry.

The paper is organised as follows: The following section introduces the UAE context for environmental sustainability of the built environment. That is then followed by conceptual framework for understanding the adoption of assessment methods by development projects based on the analysis of relevant literature in light of DOI theory. Finally, the paper concludes with a discussion of the planned empirical investigation through case studies of UAE sustainable projects as the next step for this research.

2. The UAE context for environmental sustainability of the built environment

The UAE has started to adopt a pro-active approach towards sustainable development of the built environment from the mid-nineties. In 1996, the Environmental Agency-Abu Dhabi (EAD) was established with the aim to protect biodiversity; provide cleaner environment and sustainable development; and decrease energy and water use, waste and carbon footprint. The focus of EAD is on 6 themes, which are: air and climate change, water, marine, energy, biodiversity and waste [7]. In 2006, the Emirates Green Building Council (EmiratesGBC) was established, also, work has started on Masdar city, which is a carbon-neutral, zero-waste city in Abu Dhabi. Masdar city sheds the light on Abu Dhabi as a technology developer instead of being an importer [8]. The UAE places attention on increasing sustainability literacy through launching pioneer projects such as Masdar, as well as setting clear guidance for performance and methods for assessment of buildings, this could be attributed to its nature as a wealthy emerging economy opposite to other developed countries which focus on subsidising energy cost or providing tax reduction for sustainable products and services.

The use of assessment methods to promote sustainable practices for the built environment has started in the UAE through the adoption of two adaptations for the main two international assessment methods of LEED and BREEAM in 2007 and 2008, respectively. To meet the specific requirements of the UAE environmental resources, both methods gave special attention to the issue of water, hence, Emirates LEED has three more total scoring points compared to LEED for giving a higher weight to water conservation according to the region's climate. This increased emphasis on water conservation is exemplified in the fact that UAE buildings could not be certified unless potable water is reduced by 20% regardless of the points achieved in any other category. Similarly, the weight of the water category in Gulf BREEAM was increased to 30% compared to 6% in BREEAM [9]. This reflect the country's awareness and sensitivity to the adoption of assessment methods that address its specific climatic condition and available resources, which is in line with what has already been established in the literature

proving the difficulty in having a set of pre-designed environmental criteria that is prepared for worldwide use without further adjustments [10].

Currently, there are two building environmental assessment methods in the UAE. First, there is Abu Dhabi's Pearl Building Rating (PBR) system which was launched in 2010, PBR system is based on Estidama program which is a framework for sustainable built environment launched in 2009. Similar to other sustainability frameworks, it addresses the three main pillars of sustainability: environment, economy and society, this is in addition to a fourth pillar "culture" which is unique to Estidama to reflect the local climate and culture of the UAE. Unlike BEEAM and LEED which reference existing national codes and planning guides, PBR system is being developed in parallel to the building codes. PBR assessment method is set to assess the performance of buildings, communities, and villas, establishing separate ratings across the design and construction phases of development projects. The system addresses seven categories - integrated development process, natural systems, liveable communities, building and villas, precious water, resourceful energy, stewarding materials and innovating practice - where there are both mandatory and optional credits. To achieve a 1 Pearl rating, which is mandatory for all new projects, all the mandatory credit requirements must be met. Government funded buildings must achieve a minimum of 2 Pearl rating. To achieve a higher Pearl rating (2-5 Pearls), all the mandatory credit requirements must be met along with a minimum number of credit points.

Second, there is Al Sa'fat building rating system launched in the Emirate of Dubai in 2016, which is a reestablishment of the Dubai Green Building Regulations of 2010. The rating system focuses on building performance, and evaluates all buildings types - residential, commercial, industrial and other facilities- at four stages; planning, design, construction and operation, and is split into four classifications: platinum, gold, silver and bronze. All new buildings are required to achieve bronze rating. It's worth noting that Al Sa'fat in its new form is at the early stages of adoption compared to PBR which hasn't changed since 2010.

This review of building environmental sustainability assessment methods in the UAE shows that both PBR and Al Sa'fat systems are developed in parallel to the development of building codes for each emirate, they both also adopt a performance-based approach for diffusing environmental sustainability practices, as such, they have the potential to improve performance leading to systemic technological change, however, this will only be achieved if these new innovations are adopted following a progressive approach which promotes information sharing and integration among the different parts of the development projects [11]. This raises questions around the processes, people and technology associated with this progressive approach, hence, the aim of this research is to investigate the adoption process of available local UAE assessment methods for development projects.

3. Conceptual framework

3.1 Diffusion of innovations lens and process approach for understanding

Diffusion of innovations theory examines how new ideas move through a particular social system. Diffusion is defined to be "*the process in which an innovation is communicated through certain channels over time among the members of a social system*" [12]. While, innovation is classically seen as both a process to generate new ideas and a new product or service resulting from this generation process [13] [14], innovation adoption is more concerned with the behavior of the adopting unit towards the innovation. In other words, how decisions are made to either adopt or reject the innovation. However, in the case of this research, and as presented above, the adoption of PBR and Al Sa'fat assessment systems in the UAE is basically mandatory for all buildings with opportunities for voluntary adoption for higher ratings, therefore, the focus of this research is on the dynamics of the adoption process rather than the decision itself. The goal of this paper is to develop a framework which will provide the conceptual foundation for further empirical investigation to achieve the research aim.

3.2 Assessment methods as innovation

Classic diffusion of innovations theory claims that there are certain attributes of the innovation that influence adopters' behaviour towards the innovation and subsequently influence the decision and rate of adoption [12]. On one hand, there are attributes which are inherent in the innovation, such as the innovation complexity and trialability. While, Ding argues that the inflexibility, complexity and lack of consideration of a weighting system are still major obstacles to the acceptance of environmental building assessment methods [10], differences between PBR and Al Sa'fat and to other well-known systems such as BREEAM and LEED might lead to different adoption patterns and behavior by projects teams calling for further analysis of the structural characteristics and components of both assessment methods.

On the other hand, there are other attributes which are linked to the adopters and their envisaged use of the innovation (competitive advantage, compatibility and observability). Along this line, construction innovation is found to influence and be influenced by the interdisciplinary and interorganisational nature of development projects [15] [16]. Furthermore, the adoption of BREEAM in projects is found to be influenced by the level of experience of the tool specifically and sustainable design in general among the project team participants, as well as the degree of the assessor's involvement in the project [17]. This argument calls for further investigation of the assessment methods in relation to the development projects to capture project characteristics which influence the assessment process, and the alignment of PBR and Al Sa'fat methods with the development process itself.

3.3 Construction projects as the social system for diffusion

Innovations diffuse into social systems which are defined as "*a set of interrelated units that are engaged in joint problem solving to accomplish a common goal*" [12]. This social system is comprised of two main structures: formal and informal, each represents information that reduces uncertainty and gives regularity and stability to human behavior in the system. Rogers defined structure as "*the patterned arrangements of the units in a system*" [12], and highlighted the ability of the system's norms to facilitate or impede the diffusion of innovation. While, built environment development projects are considered as the social system for innovations such as building environmental sustainability assessment methods, the growing literature highlighted some of the components and dynamics associated with assessment methods in projects. For example; Schweber and Haroglu's investigation of the adoption of BREEAM in eight UK projects highlighted the impact of the assessment process on standard project practices [18], revealed factors influenced the fit of the assessment method to design processes [17], and captured significant design changes in order to meet the rating requirements [19]. Similarly, Thomson and El-Haram presented the findings of four case studies of BREEAM adoption over 15 years period and highlighted four elements associated with the assessment process in projects, these are: sustainability leadership, alignment of assessment method with project management, project culture which promote engagement, and efficient knowledge flow [6].

While, delivery methods such as Design-Build-Operate-Maintain, which integrates the designers, contractors and operation and the maintenance managers under one contract to the owner were suggested as useful methods to integrate sustainability practices in projects [20]. Other scholars have also investigated relevant issues such as the importance of the integration of the project supply chain [21] and stakeholder engagement [22] into the assessment process in order to achieve environmental sustainability goals. Linked to this is the importance of adopting and promoting effective knowledge management and learning mechanisms to ensure knowledge brokering [23], and dynamic flow of sustainability knowledge through codification and personalization [6]. Furthermore, besides sustainability leadership and the involvement of sustainability assessors, sustainability literacy and project team dynamics and communication have received considerable attention as enablers for successful adoption of assessment methods. [16] [24] [6]

The above discussion provides useful points of departure which are summarized in Table 1 below, these will provide conceptual foundations for the empirical investigation of the adoption of assessment methods in the UAE development projects which will be presented in the following final section of the paper.

Table 1. Conceptual themes for empirical investigation.

PBR and Al Sa’fat assessment methods as innovation	1.	Structural elements for PBR and Al Sa’fat systems, and their effect on the assessment process.	
	2.	Project characteristics which influence the assessment process and the alignment of PBR and Al Sa’fat methods with the development process	
Development projects as the social system for adoption		Formal structure	Informal structure
	3.	Project delivery method and (supply chain management, stakeholder engagement).	
	4.	People issues: leadership, assessors’ involvement, sustainability literacy, and culture of engagement.	
	5.	Knowledge management and learning mechanisms for sustainable practices.	

4. Conclusion and future research

The aim was to propose a conceptual framework for understanding the adoption of building environmental assessment methods in development projects in the UAE. This aim was founded on the need to address the emerging discourse for sustainable development of the built environment through policy and implementation of local assessment methods in the UAE. Guided by diffusion of innovations theory, literature review of relevant studies considered the conceptualization of the two current assessment methods in the UAE - PBR and Al Sa'fat – as innovation. The adoption process of this innovation is likely to be influenced by its structural elements and how that effect project work. Furthermore, structures and dynamics of development projects also impact the adoption process; these are focused around issues related to project delivery methods, people, and knowledge management. This conceptual framework is useful because it provides the foundation for further understanding and the starting point for the empirical investigation of the research aim which is set to investigate the adoption process for local assessment methods in development projects in the UAE employing case study approach.

This paper contributes to the growing literature concerned with the effect of assessment methods in the development process by providing focus for environmental sustainability of the built environment in emerging economies, with substantial similarities between the UAE's local assessment methods and those developed by other countries, the core concepts and adoption themes could be generalized for various contexts, hence the proposed framework's applicability in terms of conceptualizing development projects as the social system for the diffusion of rating systems. However, the uniqueness of the UAE's context remains evident due to its climatic, social, cultural, and economic conditions. The paper also contributes to the rising discourse in sustainable development in the UAE and beyond through policy and regulations and has the potential to provide directions for projects and regulation development.

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