Conceptualising eco-innovation practices in contractor firms – the dynamic capability approaches

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Abstract. The world has witnessed extreme environmental deterioration over the past few decades due to rapid development in urban areas and unsustainable way of past construction. Recently, eco-innovation (EI) has increasingly been accepted as the solution to major environmental problems. EI involves new or modified processes, techniques, products, systems, and services that can satisfy human needs and provide quality of life whilst significantly decreases environmental impacts. In addition, EI revolutionary path to improve contractor firms’ competitiveness and sustaining business endeavour. Thus, the aim of this paper is to develop EI framework practices in contractor firms. Unfortunately, to be eco-innovative, the contractor firms need to strengthen their green knowledge, technology and resources as well as to develop their capabilities and strategies faster than their rivals. They also need to absorb and capitalise any external opportunities for their own advantages. Therefore, this study adopts dynamic capability theory to investigate a firm’s ability to integrate, build and reconfigure its competences and resources to accomplish the environmental goal in its business strategy. The outcome of this paper could provide clear directions of EI practices by means of dynamic capability theory in demonstrating how contractor firms can adapt to changing current industry conditions to remain competitive.

1. Introduction
The construction industry in Malaysia is an essential sector in contributing 3% to 7% in Gross Domestic Product (GDP) over the past decade and had played an important function in the country’s development by supporting other sectors to expand [1]. Since the 1980s, Malaysia has been driven towards industrialisation [2] and targeted to become a high-income developed nation by 2020 [3]. Despite the rapid advancement in the construction industry, most of the construction projects in Malaysia are still applying the traditional methods which are no longer sustainable. The traditional construction is actually going nowhere without innovation [4]. The construction industry is generally recognised as a major contributor towards environmental degradation, global warming, a massive producer of waste, excessive resource consumption and the building’s operation also contribute to greenhouse gases (GHGs) through its lifecycle [3][5]. Thus, the construction industry faces difficulty and an urgent change to a greener mode of overall operations and management with the use of green technology and innovation in the construction project.

Although, the concept of green development along with its advantages has been widely agreed and accepted, however, numerous studies [6-7], revealed that this concept has not been widely applied and the implementation is still below than expectation. Most of the innovation in construction were not aligned with the green obligation whereby the environmental impact is often neglected [6][8]. Hence,
new environmental-friendly construction process, as well as improvement in building design and management practices, are needed to attain greater respect for the environment. These objectives can be accomplished by encouraging contractor firms to implement EI. In light of providing green development, EI has emerged as a new paradigm for contractor firms seeking to shift from traditional construction practices that are inefficient, slow, and labour-intensive towards better green practices [3-5]. In addition, EI is increasingly been accepted as one of the best initiatives, considering that its core objectives are directing towards sustainable development and environmental sustainability [9]. Unfortunately, the contractor firms are still unable to blend EI practices which focus on the environmental requirement in their business strategies. Thus, they need to have sufficient capabilities to absorb and transform green knowledge, technology and innovation to improve the construction process. Refining this practice, dynamic capability theory demonstrates how a contractor firm ability to integrate, build and reconfigure its competences and resources to accomplish the environmental goal in its business strategy.

2. Literature review

2.1. The concept of eco-innovation

The term EI can be interchangeably used with green innovation, environmental innovation or sustainable innovation by a different scholar [9-11]. Organisation for Economic Cooperation, and Development (OECD) described EI as “the creation or implementation of new, or significantly improved, products (goods and services), processes, marketing methods, organisational structures and institutional arrangements which - with or without intent - lead to environmental improvements compared to relevant alternatives” [12]. Meanwhile, the Eco-Innovation Observatory [13] defined EI as “the introduction of any new or significantly improved product, process, organisational change or marketing solution that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle.” Thus, from the definitions, this innovation differs from general innovations since EI result in producing quality products in both economic and environmental benefits. EI can also move towards more environmental-friendly production processes and services, indirectly able to reduce the GHGs and to more efficient use of various resources. The core element of EI definition is focused on the positive environmental impact towards innovation.

Rennings [14] clarified the term EI addressing explicitly three kinds of changes towards sustainable development named, technological, social and institutional innovation. Meanwhile, Reid & Miedzinski [15] asserted that the EI concept is part of the sustainable development strategy, whereby, EI is the development of products, processes, services and technologies innovation that can make better use of the natural resources and reduce the ecological footprint to the environment. Charter & Clark [16] expressed that EI is a process where sustainability considerations in environmental, social and financial are integrated into firm systems from idea generation through research and development (R&D) and commercialisation which applies to products, services and technologies, as well as new business models. Other industries had improved their environmental performance after enhancing their EI orientation [17-19]. In developed countries, EI is one of the leading strategies to promote resource and energy efficiency and create a low carbon society [12-13][15,19]. In Malaysia, most of the EI practices had been discussed in the chemical sector, the automotive sector, and green technology companies [20-24]. However, in the construction sector, it is barely limited. Slaughter [25] and Fang et al. [26] concluded that successful EI implementation in construction able to contribute in reducing project duration and cost by simplifying construction work, improved quality, increased efficiency and productivity, which ultimately competitiveness and environmental-friendly. In addition, EI is significant in order to reduce the materials consumption and labour usage as well as reducing the carbon footprint on the environment [27-28].
2.2. The implementation of eco-innovation within the contractor firms
EI has been viewed as an effective way for contractor firms to avoid or reduce environmental damages but at the same time still remaining sufficiently profitable [29]. EI practices are crucial to being embedded within the contractor firm as they are responsible for delivering successful completion of a construction project. Thus, contractor plays a mediator role in the interface between the organisations that develop many of the new products and processes such as materials and components suppliers, specialist consultants and sub-contractors, and those which adopt these innovations in their project [25][28]. In addition, as indicated by Xue et al. [28], EI is critical for contractor firms’ competitive advantages and at the same time able to modernise the industry. For those reasons, the contractors need to equip themselves not only with innovative knowledge but to combine it with green knowledge and technology. Hence, it is the liability of contractor in connecting the vision of EI between the client, the suppliers, consultants and others project stakeholders in order to eliminate or reduce the impact of construction activities on the natural environment.

2.3. Dynamic capability approach
The innovation literature focusing on EI has shown that increasing investments in EI were influenced by the capabilities of the firms and to firm competitiveness [18]. Firm capabilities have been defined as a firm’s collective physical facilities, skills of employees and firm capacity to deploy its assets, tangible or intangible to perform a task or activity to improve performance [30]. Winter [31] viewed dynamic capability as the process of extending, modifying, or creating new capabilities. The key differences between ordinary capabilities and those that are dynamic are that dynamic capabilities are linked with change and more specifically, changing the resource base of a firm [32-33].

The dynamic capability approach is particularly relevant nowadays when global competitive forces are changing landscapes of the construction industry. Thus, firms in this industry must have timely strategies, versatile infrastructures, and an ability to utilise its competences and resources in an innovative way [34]. The effective use of a firm’s capabilities defines the firm’s overall performance [23]. In practising EI, Xavier et al., [9] claimed that a firm need direction on how to apply their capabilities in a systematic manner in order to achieve environmental goals and maintain continual enhancement in the environmental performance of services, products, and processes. Explicitly, management innovation alone is inadequate for generating success without the dynamic capabilities of a firm to create, extend or modify its resource base [32].

2.4. Eco-innovation components for contractor
A considerable amount of literature comprehends the notion of EI practices is broader than merely reducing environmental impacts through waste minimisation [34]. EI involved utterly new products which a net reduction in environmental impact as well as products that can satisfy human needs and improve the quality of life. Cheng et al. [35] highlighted that EI involved in the development and introduction of new products and process with the use of green technology innovation. Whereas process EI refers to the improvement of existing production processes or the addition of new processes to reduce environmental impact [35].

In the construction industry, Tatum [36] observed that process innovation is an improvement in construction methods that are designed or developed for the accomplishment of usual construction operations or the improvement in the efficiency of the construction process. Suprun & Stewart [37] also viewed the process EI as the introduction of new design and modern method of construction. Meanwhile, organisational EI refers to upgrading the organisation’s management processes through a new and eco-method in business practices. Organisational EI generally does not reduce environmental impacts directly but facilitates the implementation of process and product EI [38]. All these EI practices aforementioned are able to change the paradigm of the indigenous construction industry [6, 14][21]. The clarification of each practice needs to clearly explain to allow a creative and thorough transformation of a contractor firm in improving the EI practices that able to improve the firm performance.
3. Conceptual framework
The conceptual framework of this study adopts the concept of dynamic capability theory. According to Teece et al. [30][39], the concept of dynamic capability theory consists, the capacity to sense external opportunities and challenges, seize them and maintain competitiveness through reconfiguring or transforming the business firm’s intangible and tangible capabilities. Many studies were done in integrating EI with business strategy for instance in automotive, chemical, electronic sector and many more [17-24][40]. Unfortunately, very few research has done in the construction sector. Whereas, the concept of EI has the potential to be introduced and applied in individual contractor firms to promote sustainable development. In fact, many developed countries have integrated the EI concept in every process of their construction development [12-13][15].

Understanding the current status of a firm is the first crucial steps. Garcés-Ayerbe et al. [40] and Adam [41] stated that, in order to comprehend how resources can be created or altered to address changes, it becomes compulsory to look at the firm’s past and how its history and the actions it has implemented may have influenced its current practice. Thus, as this paper looks into a contractor firm, technically, the need to understand what is the EI level of implementation within their firm is indispensable. Nevertheless, most of the contractor firms still unable to blend the suitable EI practices in embedding the environmental requirement in their business strategy due to a misconception of EI term. Therefore, there is a necessity for a clear understanding of EI components and its integration within the construction process to effectively satisfy environmental and economic performance.

The contractor firm has operational capabilities and resources that are involved directly in the EI process by converting inputs into outputs. In the context of contractor firm, activities of sensing involve scanning, learning and interpretation of new green knowledge and technology that is able to improve the process, product and management of construction project towards embracing sustainability. It typically requires investments in R&D works and other related innovation activities [39]. In green development, the contractor firm, sensing basically is about understanding the environmental requirement and their challenges. Meanwhile, seizing refers to the determining and implementing of new opportunities that have been identified as conducive to competitive advantages [39][41] which consists of mobilising resources in order to address an opportunity and capture its value. Lastly, transforming is the activity by which the firms continuously reconfigures its resource base by adjusting internal and/or external resources and operating capabilities as needed to transform the firm’s strategies towards embracing the EI practices [39][42]. For examples, one of the challenges contractors may face in venturing to a green development project is lack of knowledgeable and skilled human resources. Because of these lacking, the contractor is able to plan and to seize opportunities on how to improve their human resources by having the training to ensure them to have the adequate environmental knowledge, able to learn and undertake new environmental practices. As a result, the contractor is able to transform their human resources towards embracing green practices.

Therefore, this study adopts a dynamic capability theory to develop a framework for EI practices in contractor firms. EI which has been linked to a business strategy can enhance a firm’s capabilities and reduce negative impacts on the environment during the construction process [24]. This framework will take into consideration on the current dependency of the contractor firms, examines the EI components and the capabilities of the contractor firms towards developing the EI strategies through dynamic capability theory, with respect to the activities of sensing, seizing and transforming. This EI framework perhaps would be beneficial to contractor firms to remain competitive and success especially in complex, large-scale management of green development projects based on Malaysian context.
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**Figure 1.** A conceptual framework of eco-innovation practices in contractor firms; adapted and modified from [30, 32, 39, 41,]

4. Conclusion
This study assists contractor firms to understand the concept of EI in improving the current construction practices by enhancing resource efficiency by learning the implications of the EI, which is linked to sustainable firm performance. It is increasingly impossible to deny that the current construction market environment is complex and uncertain coupled with client and customer pressure and government regulation towards embracing environmental sustainability. Thus, under this condition, the survival and development of the contractor firm are critical. The contractor firm must adapt and lead the external environment changes to make itself in an invincible position by means of EI practices through dynamic capability theory to be competitive and survive in local and global competition.

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