Responsible Design and Delivery of the Constructed Project
Edited by Abdul-Malak, M., Khoury, H., Singh, A., and Yazdani, S.

ISBN: 978-0-9960437-5-5

RESPONSIBLE DELIVERY OF THE BUILT PROJECT: WHOSE RESPONSIBILITY IS IT?

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Several procurement approaches have evolved over the years to suit the delivery of the ever increasing complexity and size of construction projects, coupled with the increasing pressure to embrace green methodologies as part of any such approach. Many of these available approaches reflect various levels of integration that may be desired to achieve in respect of critical project aspects, including: design, construction, operation, and finance. Decisions as to the most suitable delivery approach are to be made by project owners/developers, while being often assisted by market analysts, project management professionals, and other specialty consultants. While it is established that such a decision-making process does not follow an exact science, this paper tackles the issue of where responsibility truly rests for ensuring that the preferred or adopted project procurement strategy is consciously argued for with the interests of all involved stakeholders in mind. It touches on (1) the roles of the public and development policies and regulations prevailing in the locality of the intended project as well as (2) the capabilities and readiness of concerned project participants in enforcing, or at least, promoting more environmental, social, and economic consciousness into the procurement approach decision-making process.

Keywords: Integration, Project procurement, Green policies, Sustainability.

1 BACKGROUND

The construction industry makes a vital contribution to the social and economic development of every country and has a major impact on its environment. To set the elements of sustainable development in an engineering context, twelve guiding principles were published by the Royal Academy of Engineering (RAE). Such principles advocate forward looking advices such as: "Innovate and be creative", "Seek engagement from all stakeholders", "Make sure you know the needs and wants", and "Do things right, having decided on the right thing to do" (Dodds and Venables 2005). Aiming for a successful built project, owners/developers are increasingly realizing that focusing on the delivery process of the project may be as important as focusing on its technical aspect. A project delivery system is defined as a system that determines (1) the relationships between the different project stakeholders and (2) their timing of engagement in the process of providing the intended built facility (El Asmar *et al.* 2013). To suit the delivery of the ever-increasing complexity and size of construction projects, several procurement approaches have evolved over the years to replace the conventional Design-Bid-Build (DBB) method. These methods include the fast-track oriented methods (i.e., the Construction Manager at Risk (CMR) and the Design-Build (DB) method) and the Integrated Project Delivery (IPD). As for the DBB and the CMR, in both methods the owner contracts separately with the designer and the contractor for design and construction services. However, the CMR approach is characterized by

an early involvement of the general contractor (GC) during the design stage to enhance constructability, in contrast to the DBB where the contractor is involved upon 100% design completion. The DB method, on the other hand, is characterized by a single contractual relationship between the owner and the design builder for design and construction services. In fact, the old concept of a master builder is resurfacing with the partial integration of design and construction under the DB approach and the more contemporary methodology of IPD. The latter approach, which is a relatively new concept is distinguished by a multiparty agreement including the owner and the very early involvement of key participants (El Asmar *et al.* 2013), i.e., at the pre-design stage.

The traditional comparison of cost, time and quality metrics of the different project delivery methods (PDMs) have been the subject of many construction research studies. For instance, El Asmar *et al.* (2013) evaluated the performance of 35 IPD projects in comparison to projects delivered using other PDMs and showed statistically significant performance outcomes in the case of IPD. Sullivan *et al.* (2017) analyzed two decades of literature covering different PDMs comparison (namely DBB, CMR and DB). The results showed that: (a) no single delivery method consistently performs better on unit cost, (b) CMR and DB were the most accurate in controlling the schedule variation of a project, and (c) DB was superior in delivery speed in all explored studies and continues to increase its advantage over time. However, such comparison metrics govern the traditional decision-making process regarding the most suitable delivery method of the built project (Sullivan *et al.* 2017).

Unlike conventional building development where the environmental effects of a built project are often disregarded, green building (GB) strategies focus on the improved environmental performance. A recent study by Ahmad *et al.* (2017) explored the effect of different PDMs on the green performance of GB projects using a systematic research review. To this end, the study defined GB projects as innovative projects and their level of green performance as an indication of their level of innovation. The authors argued that coordination among project team members is strongly influenced by the PDM which by itself impacts project innovation. Depending on the extent of innovative features incorporated, each PDM was found to have the capacity to produce successful results (Ahmad *et al.* 2017).

As for a responsible delivery process, it is believed to address what is beyond embracing green methodologies, to manifest as a holistic decision-making process addressing the constraints of economic, social and environmental factors and embracing the needs of all involved stakeholders, resulting in a sustainable investment. As such, more criteria than what are often adopted in the traditional decision-making process need to be considered and evaluated. Based on how the owner chooses to put into effect integration/concurrency/etc., the choice made can end up better serving the social, economic, and/or environmental dimension(s) of sustainable (responsible) development. On one hand, different project delivery approaches reflect various levels of integration that may be desired to achieve in respect of critical project aspects. On the other hand, different approaches cater for different needs, constraints and priorities, all affecting final project outcomes, particularly sustainability goals. While it is established that a decision-making process regarding the most suitable delivery approach does not follow an exact science, this paper tackles the issue of where responsibility truly rests for ensuring that the preferred or adopted project procurement strategy is consciously argued for with the interests of all involved stakeholders in mind.

2 RESEARCH SCOPE AND METHODOLGY

While it is evident that the project owner (whether public or private) has the upper hand as to selecting the project delivery approach that better suits his interests, this paper sheds light on how

such choices could be made responsibly. To this end, considerations for a responsible investment are first identified. Then, an extensive review on the impact of different attributes of PDMs on project performance is carried out and different relationships are identified accordingly. As such, when weighing the options as to the delivery approach coupled with associated strategies (partnering, alliancing, full integration, other relational contracting choices, green building, etc.), this paper explores how the owner should take into account social, economic, and environmental issues/factors/benefits, in order to end up delivering the intended facility with sustainability in mind. Consequently, a conceptual framework is presented illustrating the responsibility share/assignment for the different participants illustrating (1) the roles of the public and development policies and regulations prevailing in the locality of the intended project as well as (2) the capabilities and readiness of concerned project participants in enforcing or, at least, promoting more environmental, social, and economic consciousness into the procurement approach decision-making process.

3 CONSIDERATIONS FOR A RESPONSIBLE INVESTMENT

For a responsible investment, several considerations, as presented in Figure 1, should be evaluated. Starting by the underlying drivers (i.e., owner, project, and market drivers) behind such an investment, these are presented as driving the selection of potential procurement strategies. In fact, the selection process of the most suitable PDM often follows a "process of elimination", i.e., paring away obviously inappropriate methods until reasonable alternatives prevail. To eliminate inappropriate organizations, Gordon (1994) specified three types of drivers that must be assessed: (a) project drivers (e.g., time constraints, flexibility needs, preconstruction service needs, design process interaction and financial constraints), (b) owner drivers (e.g., construction sophistication, current capabilities, risk aversion, restriction on methods and other external factors) and (c) market drivers (e.g., availability of appropriate contractors, current state of the market and package size of the project). The type of investment - be it public, private, or a combination of both (i.e., public private partnership, PPP), and irrespective of the underlying driver - is conceptualized to be serving either the priorities of a national development or that of a private investment portfolio. For instance, in addressing the complexity of sustainable development, Fenner *et al.* (2006) emphasized that sustainability is observed differently when viewed from individual perspectives or from national or global levels, and a holistic approach in respect of the financial consideration requires that the interests of individual parties are at least viewed in the light of the wider project interests and wider community needs. However, a responsible investment, while it is normally expected to be overshadowed by the consideration of meeting the desired financial viability and regardless of the priorities it serves, should be satisfying the three pillars of sustainability, i.e., the environmental, the social and the economic aspects. As for the environmental considerations, Mukherjee and Muga (2009) studied the decision-making driving the individual adoption of sustainable technology and its diffusion in the architecture, engineering and construction (AEC) industry by presenting a combined “top-down” and “bottom-up” approach. The “top-down” perspective, i.e., that of the individual stakeholder, aids in the decision-making process (individual level) by providing comparisons between alternative designs; it develops a definition of value that can aid individual stakeholders to adopt sustainable alternatives. The “bottom-up” perspective investigates how individual adoption of green technology drives diffusion of green thinking (systems level) through different industry sectors and stakeholder groups. On one hand, the rate at which the industry is shifting towards the adoption of green technology and more sustainable practices is shaped by the diversity of priorities and differing perceptions of risk among industry stakeholders (Mukherjee and Muga

2009). On the other hand, risk management in construction projects is influenced by the procurement options (Osipova and Eriksson 2011). To this end, Osipova and Eriksson (2011) clarified how to improve risk management by adopting appropriate procurement options in terms of project delivery method, form of payment, and use of collaboration or partnering arrangements. As for the economic considerations, several studies from around the world demonstrated a growing interest in green building and sustainable design; this can be attributed to the recognition by clients that there are direct economic benefits from green buildings (e.g., higher rents or sale prices) (Ochieng *et al.* 2014). In contrast, the industry's size and fragmentation and the increased first cost associated with sustainable buildings were identified as major barriers for owners to pursue and promote sustainable construction (Ochieng *et al.* 2014). As for the social aspect of a development and its impact, Esteves *et al.* (2012) defined the social impact assessment (SIA) as the process of managing the social issues of a development. A 'good' SIA practice was therefore defined as one that: (a) is participatory, (b) supports affected peoples, proponents and regulatory agencies, (c) increases understanding of change and capacities to respond to change, (d) seeks to avoid and mitigate negative impacts and to enhance positive benefits across the life cycle of developments, and (e) emphasizes enhancing the lives of vulnerable and disadvantaged people (Esteves *et al.* 2012).

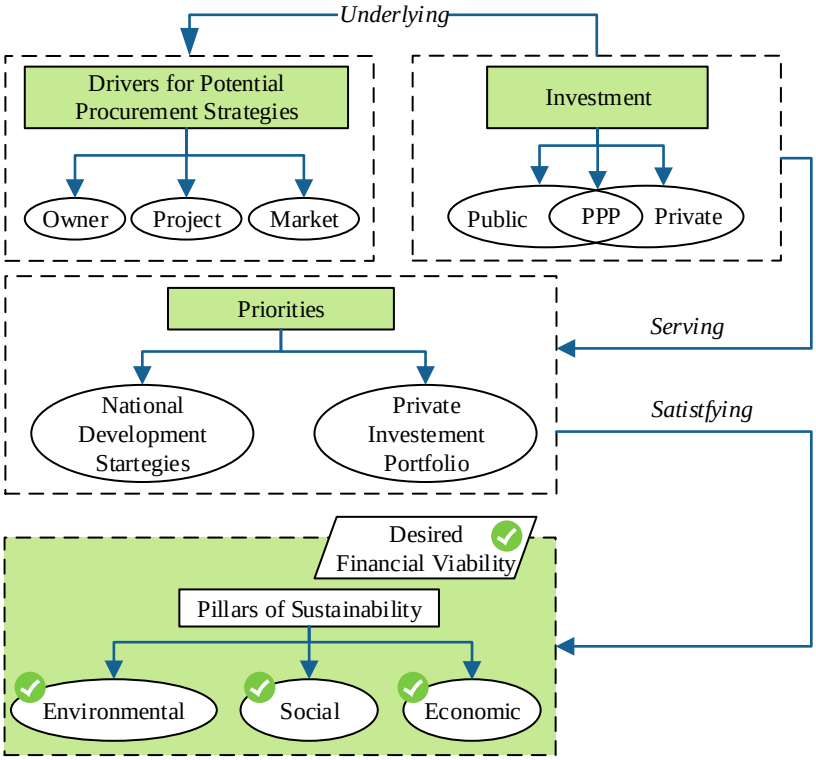

Figure 1. Considerations for a responsible investment.

4 RESPONSIBLE DELIVERY PROCESS

Different pooling of functions can be used to deliver a built facility (Figure 2). This pooling defines the basket of functions that a specific team is held responsible for. For instance, pooling design and construction under one contract refer to the DB method. Pooling construction,

operation and finance designates the Build-Operate-Transfer (BOT) approach. Moreover, a team could be assigned early on to be responsible for some extent of residual planning in addition to other functions. As for financing the job, it could be either short-term or long-term financing. As such, it is presented as dashed, as it could encompass the whole process from planning till operation or stop at any level. In defining attributes for a responsible delivery process, decision makers are advised to weigh the options as to the pooling of functions coupled with associated strategies (partnering, alliancing, full integration, other relational contracting choices, green building, etc.) in order to end up delivering the intended facility with sustainability in mind. The strategies, as presented in Figure 2, are defined by: (a) the concurrency of functions, (b) the timing of involvement of the general contractor (GC) or the construction manager (CM) and (c) the level of participants' integration through the type of contract adopted.

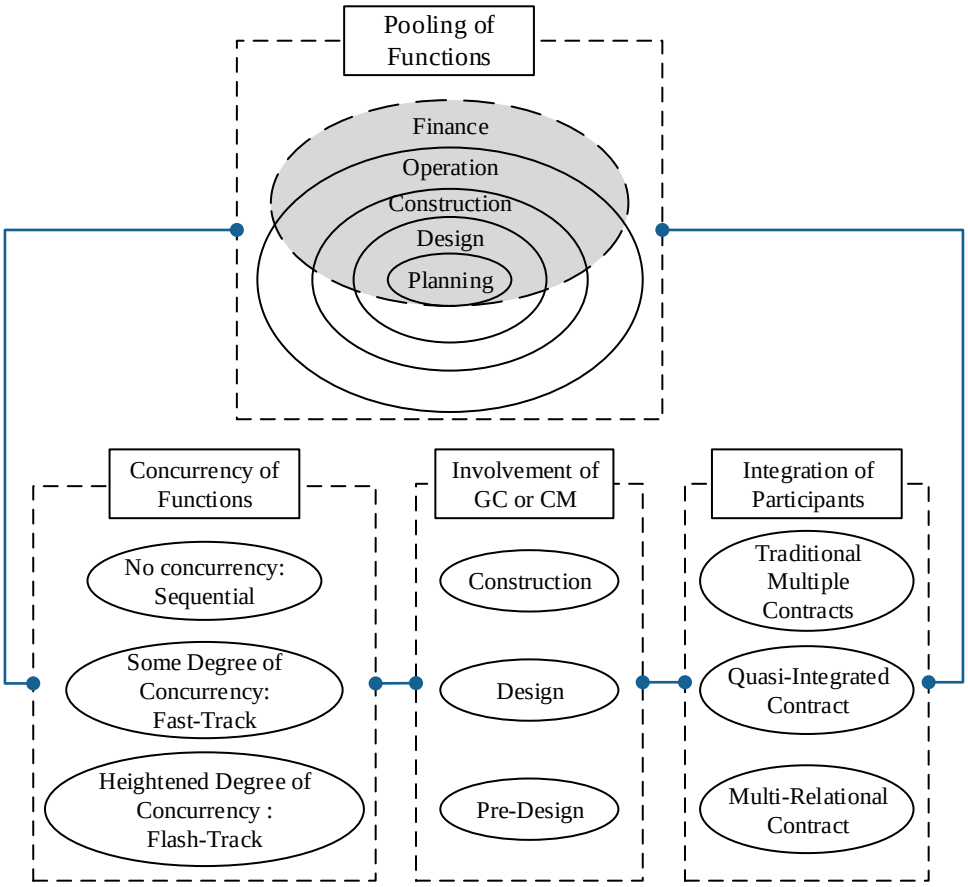

Figure 2. Selecting attributes of a responsible delivery process.

An improved environmental performance could be achieved using any delivery method. For instance, Molenaar *et al.* (2009) found that all PDMs could lead to all levels of LEED certification. However, success differs for each PDM. This is supported by the research findings of Ahmad *et al.* (2017), concluding that early involvement of key project participants, collaboration, and the use of technology are important attributes responsible for enhanced environmental performance. However, although these attributes can be incorporated into any PDM, IPD facilitates the use of technology and incentivizes early participant involvement and

collaboration. Thus, using IPD tends to provide higher assurance that project performance targets (e.g., LEED certification) will be met or even exceeded (Ahmad *et al.* 2017).

As for the concurrency of functions, the sequential or "linear approach to procure, design, build, operate, (decommission) can lead to a failure to recognize the wider context in which engineering takes place as part of a series of complex systems with feedback loops involving society and the environment" (Fenner *et al*. 2006). Inherent with the fast-track alternative is the time saving resulting from the compressed schedule due to the degree of overlap between design and construction providing the salient advantage over the sequential option. Moreover, the pursuit of faster fast-track or "flash-track" alternative could be deemed necessary in certain circumstances such as emergency rebuilds, competitive market advantage, and regulatory compliance (Austin *et al*. 2015). Whereas fast tracking can be defined as a time-driven process that by necessity requires some degree of concurrency between engineering, procurement, and construction, flash tracking is defined as a time-driven project, which by necessity requires a heightened degree of concurrency between these functions (Austin *et al.* 2015). To be noted that not all organizations can pursue executing flash-track projects. That is, readiness assessment algorithms were developed by Pishdad-Bozorgi *et al.* (2016) to enable an organization to assess its readiness to execute time-critical or flash-track projects.

On one hand, through focusing on the relationships and interdependencies between 47 essential flash-track practices, it was identified that personnel selection, contractually aligning project participants and establishing fully integrated teams, as being from the most central and core flash-track enablers (Pishdad-Bozorgi *et al.* 2017). On the other hand, integration of participants (a) holds the potential to mend construction industry fragmentation, which often results in poor performance (Mesa *et al.* 2016) and (b) leads to innovative solutions thereby presenting a better project environmental performance (Ahmad *et al.* 2017). In contrast, traditional lump-sum contract is the most detrimental to innovation, involving the highest cost risk, the highest occurrence of adversarial relationships, lowest integration level across the supply chain, and poorest innovation outcomes (Ahmad *et al*. 2017). Moreover, disintegration of the construction process and the resulting adversarial relationship associated with the traditional multiple contracts have caused construction professionals to advocate for more relaxing relational contracts that incorporate higher levels of cooperation and integration. Collaboration under a relational contracting arrangement involves an equitable sharing of risks and rewards in order to reduce adversarial relationships and align the interests of different parties. The establishment of long-term partnership agreements has been an example of developing trust between organizations who work repeatedly together (Fenner *et al.* 2006, Ahmad *et al.* 2017). Lahdenperä (2012) compared the three-different relational contracting (RC) arrangements: 1) Project Partnering (PP), 2) Project Alliancing (PA), and 3) Integrated Project Delivery (IPD). It was concluded that all incorporate common features but to a varying degree, such as the early involvement of the main parties, transparent financial system, shared risks and awards, joint decision-making, and collaborative agreement among multiple parties. Moreover, the core philosophy in these types of relational contracting is to generate a cooperative and trustful climate for the benefit of the project. Besides, early involvement of participants and availability of opportunities for open dialogue and collaboration was proved to enhance the risk management process (Osipova and Eriksson 2011). However, while PDMs define risk allocation formally, the use of incentives and collaboration or partnering arrangements helps in establishing a collaborative approach to risk management (Osipova and Eriksson 2011). To this end, Boukendour and Hughes (2014) suggested a fair risk-sharing formula that incentivizes the partners to truthfully propose their target costs. The importance of such incentive formula is to remove any suspicion as well as

increase trust and collaboration among the contracting parties during advanced stages of the project (Boukendour and Hughes 2014).

As such, integration of participants, as shown in Figure 2, covers the full spectrum from the lack of integration using traditional multiple contracts (e.g., DBB) to the quasi-integration when signing relational contracts but excluding the owner, to the full integration using multi-relational contracts, where all the key participants, including the owner, signs one contract and agree to gain/pain sharing formulas. However, project delivery methods influence an owner's ability to achieve its sustainability goals mediated through the level of integration achieved in the delivery process. Research by Mollaoglu-Korkmaz *et al.* (2013) involving 12 in-depth case studies showed that the level of integration in the delivery process affects final project outcomes, particularly sustainability goals. However, although DB and CMR have better chances of facilitating integration, results show that DBB also has the potential to provide higher levels of integration if it informally involves the constructor in the earlier phases of the project.

As such, involvement of the GC or CM at a stage earlier than construction, either at the design stage like in the DB approach or at the pre-design stage like in IPD will lead to an increased potential for achieving integration and leading to improved performance. For instance, Swarup *et al.* (2011) emphasized that early involvement of the constructor and the early inclusion of green strategies are attributes crucial for the delivery process and can have altering effects on project outcomes, especially on sustainability goals. Design charrette, compatibility of team members, and commitment to project sustainability goals were also found to be crucial in achieving team integration and overall project success and innovation (Swarup *et al.* 2011, Mollaoglu-Korkmaz *et al.* 2013, Ahmad *et al.* 2017).

5 RESPONSIBILITY SHARE/ASSIGNMENT FRAMEWORK

Shifting the construction sector away from its current mode toward a more responsible one necessitates a clear identification of the responsibility share/assignment of each party of the process as per the assigned duties/participation. "Clearly, every decision does not have to address the global issues of climate change, global poverty, and so on. However, where the boundaries are drawn must be acknowledged as having a profound effect on the decisions taken" (Fenner *et al.* 2006). Addressing the term sustainability requires new ways of thinking, practices and attitude. Therefore, it requires practical change in our ethics and behavior (Fenner *et al.* 2006, Ochieng *et al.* 2014). To move towards sustainable construction, key drivers such as commitment by leadership (Swarup *et al.* 2011, Ochieng *et al.* 2014), incentives, strategies and stricter environment policies are needed (Ochieng *et al.* 2014). To this end, the framework presented in Figure 3 highlights the responsibility share/assignment of each party including: (a) the responsibility share of the government, (b) the responsibility share of the owner/developer (c) the responsibility shared between the owner and other participants, and (d) the responsibility share of other project participants. It also shows the actions deduced to be made by each party.

Starting by the roles of the public and development policies and regulations prevailing in the locality of the intended project, governments have responsibilities through mandating and/or enforcing policies, legislations, regulations and incentives/penalties, at least in respect of environmental compliance. Fines and penalties for non-compliance with regulations lead to more cautious attitude (Ochieng *et al.* 2014).

Having the ultimate power over the project, owners/developers carry a substantial level of responsibility. Through their involvement in the building delivery process, they can lead innovation practices, incentivize and foster positive interaction among team members (Kilinc *et al.* 2015, Olanipekun *et al.* 2017). They undertake an important role in terms of: (a) creating and

promoting the right project conditions for the realization of innovation and (b) understanding and sharing the needs of both end-users and stakeholders (Kilinc *et al.* 2015). Their involvement in the delivery of green building projects is regarded as owner commitment (OC) (Olanipekun *et al.* 2017). Through carrying out a systematic literature in the area of project delivery of green building projects, Olanipekun *et al.* (2017) identified nine indicators of OC. As these indicators were found to influence project performance such as cost, time, quality and sustainability rating metrics- thereby ensuring successful delivery of green building projects - they are added to the presented framework. By virtue of this commitment, project owners can ensure not only successful projects in term of green performance, but a responsible delivery of the built project.

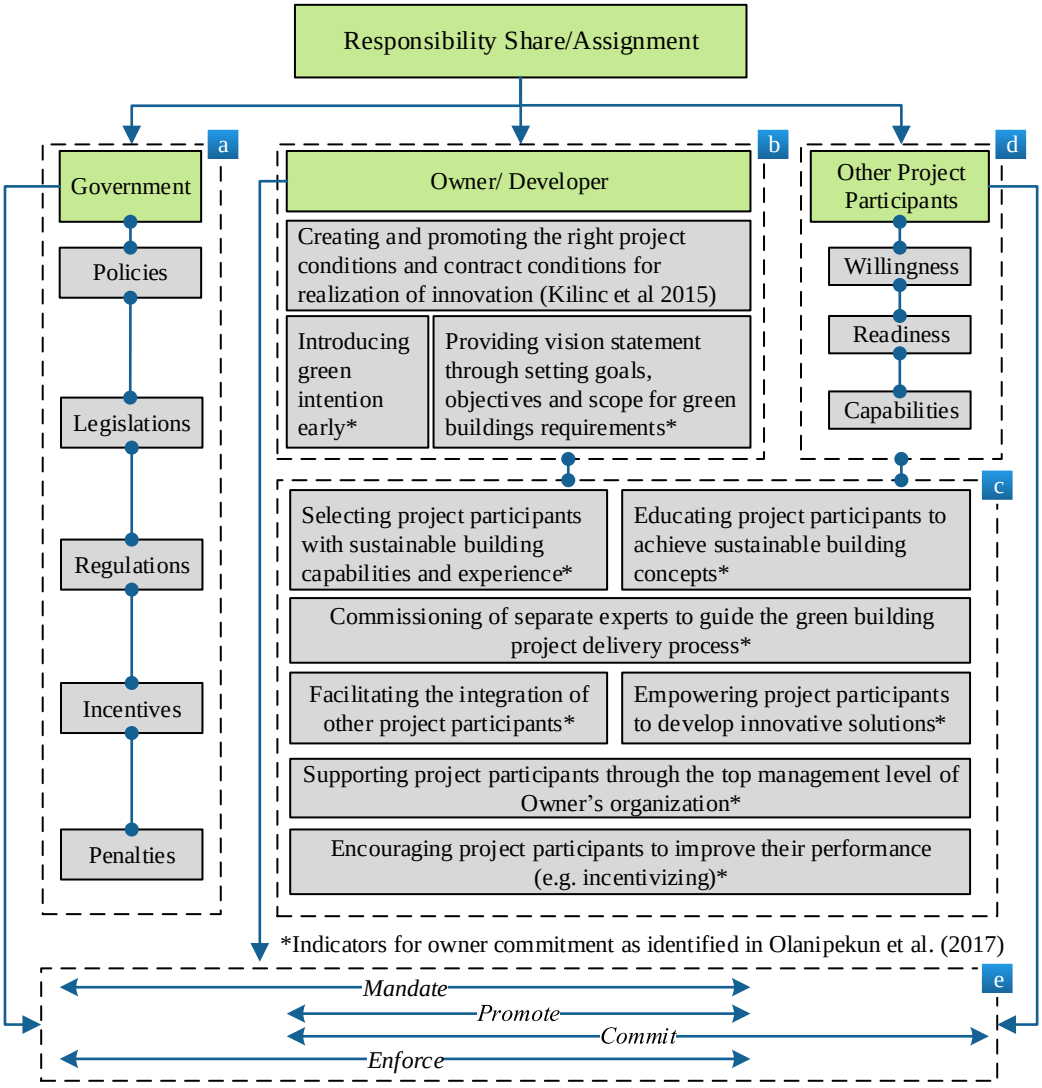

Figure 3. Responsibility share/assignment framework.

As for other project participants, their share of responsibility should be prevalent at least through their commitment. Their willingness, capabilities, and readiness to commit to injecting more environmental, social, and economic consciousness into their share of duties in the

construction project, are regarded as forming a responsible attitude. Therefore, the deduced actions for acting responsibly are presented in the last box in Figure 3 (i.e., box "e"). As such, mandating and enforcing are the responsible actions related to the government and the owner, committing is the responsible action related to the owner and other participants, and promoting is the responsible action regarded as solely that of the owner.

6 CONCLUDING REMARKS

The following concluding remarks can be stated:

- Responsible project delivery thinking and strategies, as illustrated throughout this paper, address what is beyond embracing green building methodologies.
- The paper argues for a holistic decision-making process which starts by identifying the underlying drivers behind the concerned investment, all while satisfying the constraints of economic, social and environmental factors.
- While it is evident that project owner (whether public or private) has the upper hand as to selecting the project delivery approach that better suits his interests, this paper identified how such choices could be made responsibly.
- The paper offers a process model encompassing the attributes of PDMs, whose impact of on project performance has been identified from the literature and different relationships accordingly emphasized.
- The paper finally presents a conceptual framework that addresses where responsibility ultimately rests, and it illustrates the responsibility share/assignment for the different participants along with the actions deduced as being critical to be fulfilled by each.

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