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Performance-based building and innovation: balancing client and industry needs

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One reason for the interest in performance-based building is that it is commonly advocated as a powerful way of enhancing innovation performance by articulating building performance outcomes, and by offering relevant procurement actors the discretion to innovate to meet these performance requirements more effectively and/or efficiently. The paper argues that the current approach to performance-based building assumes that relevant actors have the capacity, ability and motivation to innovate from a business perspective. It is proposed that the prevailing conceptualization of PBB is too restrictive and should be broadened explicitly to accommodate the required business logic that must be in place before actors will innovate. The relevant performance-based building and innovation literature is synthesized to support the assertion. The paper concludes with an innovation-focused definition of performance-based building.

Keywords: building performance, business logic, innovation, performance-based building, procurement

L'une des raisons de l'intérêt manifesté pour les bâtiments basés sur la performance réside dans le fait qu'ils sont couramment présentés comme un moyen puissant d'amélioration des performances et de l'innovation en organisant les résultats des performances des bâtiments et en offrant aux intervenants chargés des approvisionnements la liberté d'innover pour satisfaire de façon plus efficace les exigences de performance. Pour l'auteur, la méthode actuelle concernant les bâtiments basés sur la performance suppose que les acteurs en jeu ont la capacité, l'aptitude et la motivation nécessaires pour innover dans une perspective commerciale. L'auteur estime que la conceptualisation qui prévaut en matière de bâtiments basés sur la performance est trop restrictive et devrait être élargie, en particulier pour tenir compte de la logique commerciale requise qui doit être mise en place avant que les acteurs puissent innover. L'auteur fait la synthèse des documents parus consacrés aux bâtiments basés sur la performance et à l'innovation pour étayer ses affirmations. Il conclut avec une définition axée sur l'innovation des bâtiments basés sur la performance.

Mots clés: performance des bâtiments, logique commerciale, innovation, bâtiments basés sur la performance, approvisionnement

Introduction

Performance-based building (PBB) is very much intertwined with the present interest in, and momentum toward, PBB codes and standards (e.g. Foster, 1972; Loeszkiewicz, 1997; Foliente, 1998a,b; CRISP, 2001; Fairclough, 2002). The key driver for this trend is the view that traditional prescriptive approaches act as a

barrier to innovation in that 'improved and/or cheaper products may be developed, yet their use might not be allowed if construction is governed by prescriptive codes and standards' (Foliente, 2000, p. 12). Innovation, however, does not occur in a vacuum; rather, it is embedded and nourished in specific building, organization and industry contexts.

The espoused, generic benefits of PBB over prescriptive approaches do not automatically equate to their meaningful adoption and development within specific situations. The relationship between PBB and the creation, management and exploitation of innovation within and between firms is dynamic and has received little explicit treatment in the literature. This paper will take a correspondingly dynamic approach and will move back and forth between the PBB and innovation literatures, with each shift in perspective providing additive insights. The literature-based approach of this paper is predicated on the assumption that literature is a secondary source of data (Strauss and Corbin, 1990) and forms a basis for theory building (Lewis and Grimes, 1999). From this methodological standpoint, the present paper provides a broad overview of the relevant literature (Clarke, 1991, pp. 245–251), but with a particular endeavour to identify gaps and assumptions within and between the different bodies of literature (Zikmund, 1997) and, in so doing, unearth research questions (Strauss and Corbin, 1990). This will culminate in a synthesis that will identify key issues and propositions to stimulate the development of the innovation aspects of the blossoming PBB research agenda. The paper addresses, in part, this gap in understanding and practice, and is structured as follows:

- Concept of PBB will be defined, and the advantages and disadvantages of the approach discussed. This reveals key assumptions in the PBB approach that relevant actors (defined as parties with a direct involvement in the procurement process) have the capacity, capability and motivation to innovate.
- The assumptions are then explored through the prism of the relevant innovation literature. The discussion offers a number of insights that usher in a dynamic, contingency-based view on the relationship between PBB and innovation activity.
- Implications of this dynamic, contingency-based view on the connections between performance objectives and innovation activities are articulated and synthesized.
- Key issues and propositions are identified.

Background to performance-based building

The performance-based approach is defined in broad terms as: ‘the practice of thinking and working in terms of ends’ (Gibson, 1982, p. 4) through the

quantification of the level of performance which a building material, assembly, system, component, design factor, or construction method

must satisfy in order that the building meet all the goals established by society and the client.

(Averill, 1998, p. 18)

The focus on normative, holistic performance outcomes is a departure from the traditional approach of developing prescriptive, analytical codes and standards. Gibson (1982, p. 4) articulates that the performance approach

is concerned with what a building or building product is required to do, rather than prescribing how it is to be constructed.

Hattis (1996)

offers a fruitful distinction between the prescriptive and performance approaches through the conceptualization of a building as a matrix of parts and attributes. In the prescriptive approach (Figure 1), the building parts are described, specified and procured, resulting in a building with an implicit set of attributes.

In the performance approach (Figure 2), the criteria that define the level of performance required of the building attributes are defined, described or specified, and many combinations of different building parts can be innovatively created and/or procured for which it can be demonstrated that the specified attributes will satisfy the required level of performance.

Advocates of PBB claim that the motivation for this shift in thinking and practice is to overcome the inherent barriers within current prescriptive codes and standards that erode the willingness, scale and scope of actors to create and exploit technological and organizational innovation. Haberecht and Bennett (1999, p. 4), for example, argue that:

performance-based building codes offer the opportunity for superior building quality. This is because the end-user of the product, through the designer, can specify from a larger range of approved materials, building systems, or innovative approaches with fewer restrictions.

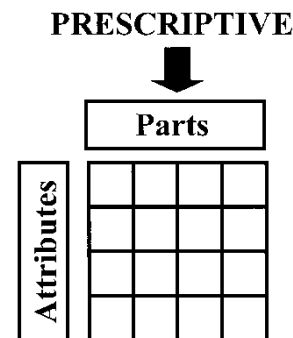


Figure 1 Prescriptive approach to linking building attributes and parts

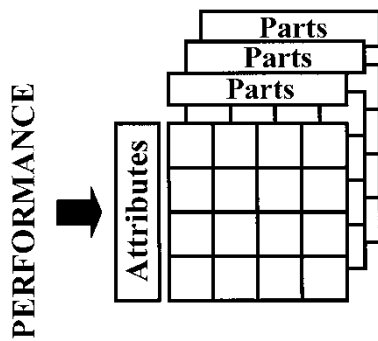


Figure 2 Performance approach to linking building attributes and parts

Similarly, Bowen and Thomas (1997, p. 3) stress that performance-based codes enables designers and contractors

... the freedom to choose one of several possible means to achieve the required performance and therefore provides for flexibility and innovation.

The performance-based approach, for example, is evidenced in the UK building regulations, where it is argued that they

... are underpinned by a set of Approved Documents providing non-prescriptive and increasingly performance based design guidance that is open to interpretation and encourages the uptake of innovation.

(Fairclough, 2002, p. 18)

There are concerns, however, that the adverse externalities of PBB approaches often outweigh any potential benefits in certain situations. Bowen and Thomas (1997, p. 3) stress, for example, that for 'routine' designs:

... there are real and perceived costs to [performance-based codes]. For many, prescriptive codes provide a simple 'cook-book' approach and for the majority of construction projects ... they provide the least costly method of ensuring that an acceptable level of health and safety etc. – are achieved without placing an undue burden of proof upon the contractor for meeting the required performance.

In contrast, Baark (2001, p. 13) notes the high cost of managing risk intrinsic to novel solutions with the argument that:

...considerable obstacles in pushing forward innovations related to construction projects arise from the existence and interpretation of [performance-based] building codes and regulations.

When a new technology is proposed for a construction project, getting government approval turns out to be decisive ... [and] that many engineering consultants regard the efforts required to provide justifications for innovative solutions as excessive. The money and time involved in such endeavours can certainly be a discouraging factor for the engineers during their thinking process.

These opposing arguments challenge a number of prerequisite conditions for PBB that are generally and unreflectively assumed by the proponents of the approach, i.e. that relevant actors have the capacity, capability and motivation to innovate individually and collectively across the supply chain. The implications of these prerequisite conditions not being in place are significant and transparent; actors will, at worst, resist PBB, or, at best, will engage the approach in a passive, minimalist fashion. The authors argue, therefore, that the potential benefits of PBB, with respect to innovation, can only be envisaged and developed if the design and implementation of the approach is appropriately embedded in the business logic and organizational management of innovation activity; rather than be superficially bolted on to it.

The next section introduces relevant ideas from the innovation literature that will provide pointers to the development of appropriate meshing between PBB and innovation activity.

Insights from the innovation literature

Performance-based building as a form of regulation

The capability of PBB approaches to deliver improved innovation is supported by the regulation strands of the innovation literature. The traditional prescriptive building approach can be useful viewed as procedural, rule-centred 'regulation', which brings about a culture that stifles innovation (Eisenhardt, 1989). In effect, prescribing the solution and imposing decisions increase stakeholder resistance and reduce the quality of design and implementation decisions (Guth and Macmillan, 1986). Such prescriptive approaches negatively affect the dispositions of actors (Van Meter and Van Horn, 1975), who then engage in routine and mechanical implementation (Fidler and Johnson, 1984). PBB offers a more flexible approach that allows relevant actors to move beyond compliance to identification and internalization (Kelman, 1961). When those who implement requirements play an active role in their design, the results are better. Relevant actors to an activity, given greater flexibility have greater knowledge of contradictory demands and conflicting imperatives at the delivery point (Thomas, 1979). Drawing upon the general regulation literature, therefore, the difference between PBB and prescriptive approaches can be discerned as '...the

extent to which the regulations set challenging goals and grant firms compliance discretion' (Majumdar and Marcus, 2001, p. 178). One recurring rationale for the PBB approach is the improvement of innovation performance and, thus, building performance. But what is innovation? This obvious question is often overlooked, but an answer is crucial if PBB is to have an appropriate focus. The term 'innovation', therefore, will be explicitly discussed below.

What is innovation?

Successful innovation is defined as 'the effective generation and implementation of a new idea, which enhances overall organisational performance' (Barrett and Sexton, 1998, p. 5). The following assumptions in this definition are emphasized and illustrated (Barrett and Sexton, 1998; Sexton and Barrett, 2003):

- *Idea*: ideas are taken to mean the starting point for innovation. They can be administrative in nature (e.g. the organizational restructure and process changes to support partnering) and technical in character (e.g. the computerization of quantity surveying computation and report generating tasks).
- *New*: not all ideas are recognized as innovations and it is accepted that newness is a key distinguishing feature. The idea only has to be new to a given firm rather than new to the 'world'. Further, the newness aspect differentiates innovation from change. All innovation implies change, but not all change involves innovation. For a contractor, for example, a change in a materials supplier is not necessarily an innovation but a change in the relationship between the contractor and the supplier from a project-to-project open tender situation to a long-term 'partnering' type of relationship would constitute an innovation for the two organizations concerned.
- *Effective generation and implementation*: innovation requires not only the generation of an idea (or transfer of a 'new' idea from outside the company), but also its successful implementation. The implementation aspect differentiates innovation from invention.
- *Overall organizational performance*: innovation must improve organizational performance, either individually or collectively through the supply chain. Innovations that improve some isolated aspect at the expense of overall performance are undesirable. Innovation in the design phase, for example, might result in unanticipated buildability problems during the construction phase, i.e. the impact of the design innovation might adversely affect overall performance, from the perspective of the client, due to increased construction costs and/or time.

The key implication of this definition of innovation is that not all innovation *per se* is beneficial, rather, appropriate innovation is beneficial. To iterate the earlier proposition, appropriate innovation must balance and integrate the owners and users of the building *and* the business needs of other actors in the supply chain. This dynamic tension is discussed below.

Performance-based building and the need to improve overall organisational performance

Linking building and business performance

The PBB approach, as discussed in the second section, is dedicated to enhancing innovation at the building level. The second section also highlighted that there was concern by a number of commentators that the business implications of PBB have not been adequately appreciated. The argument of this paper is that PBB approaches must positively link building and business innovation. This challenge is explicit in the definition of innovation set out below, i.e. innovation must improve *overall* organizational performance. PBB-driven innovations that improve some isolated aspect of building performance at the expense of overall performance are undesirable.

Appropriability conditions

Appropriability conditions determine companies' ability to profit from their innovation by protecting their innovations from imitators. The degree of protection depends on the degree to which the core knowledge in a given innovation can be understood and replicated by competitors, and the level of legal protection, be it in the form of intellectual property rights, copyrights or patents. The appropriability conditions in which actors operate in have a significant influence on the motivation to make the necessary investment to generate PBB-driven innovation. The appropriability process is where a stakeholder's rewards for innovating are adequately protected to reflect the required investment incurred by the organization. The most suitable appropriability conditions for construction innovation are unclear. If the appropriability conditions are too weak (i.e. the economic benefit cannot be adequately captured and protected by the innovating firm), there is insufficient incentive for firms to innovate. In contrast, too strong appropriability conditions by one stakeholder at the expense of others will erode the ability of supply chains as a whole to innovate.

Teece (1986) argues that the capacity of the firm to appropriate the benefits of its investment in innovation depends on two factors: (1) the firm's capacity to translate its organizational and technological advantage into commercially viable products and processes; and (2) the firm's capacity to defend these advantages against imitators. From a business perspective, for

example, Tushman and Anderson (1986) depict innovation as being either competence destroying (i.e. the innovation is sufficiently radical to make existing knowledge and practice obsolete) or competence enhancing (i.e. the innovation builds from, and further develops, existing knowledge and practice). The type of innovation – whether it is competence destroying or competence enhancing – significantly determines the likelihood of firms being sufficiently motivated to invest in innovation activity. Given that competence-destroying innovations, for example, render an incumbent's existing knowledge base associated with a particular product or service obsolete, an incumbent may be reluctant to invest in the innovation for fear of cannibalizing its existing sources of competitive advantage (Henderson, 1993). The very real business implications of whether PBB-driven innovation is competence destroying or enhancing can be appreciated, for example, in the case of a component manufacturer not wanting to sacrifice the economic returns from its patent protected products; or a design practice that might view a PBB challenge as an opportunity to develop a new area of competency that can be leveraged in subsequent commissions.

Role of the business and project environments in establishing appropriability conditions

Appropriability conditions are very much shaped by general business and project environments. Research results conclude that there are two principal modes of innovation (Figure 3) (Sexton and Barrett, 2003). The two modes of innovation are shown in the centre portion of Figure 3. Mode 1 innovation focuses on progressing single-project, cost-orientated relationships between the client and the firm – this mode of innovation is more driven by rapid change and uncertainty in the interaction environment. (The interaction

environment is that part of the business environment with which firms can interact and influence. This is in contrast to the given environment that is that part of the business environment by which firms are influenced, but which they cannot influence themselves; e.g. Duncan, 1972). Mode 2 innovation concentrates on progressing multiple-project, value-orientated relationships between the client and the firm – this mode of innovation is more aligned to improving the effectiveness of a firm's relationship with its clients.

The right-hand side of Figure 3 reinforces the notion that the mode of innovation is substantially determined by the nature of the *interaction environment*: an enabling interaction environment encourages Mode 2 innovation; and a constraining environment is conducive to Mode 1 innovation. An enabling interaction environment is one that the firm can influence to a significant extent, *enabling* the firm to innovate within a longer term and more secure context. A constraining interaction environment is one that a small construction firm can only influence to a limited extent, *constraining* the firm to innovation activity undertaken within a shorter and more insecure context.

The left-hand side of Figure 3 identifies which factors of the organizational model are the primary focuses of (and levers for) innovation activity: Mode 2 innovation involves innovation in the 'business strategy/market positioning' variable (denoted as 'BS'), which, in turn, will have implications for the remaining variables; Mode 1 innovation is where the 'business strategy/market positioning' variable is relatively fixed, and the focus of the activity is in the 'organization of work', 'technology' and 'people' variables (denoted as 'OW', 'T' and 'P', respectively). The variables that make up the organizational factors of the

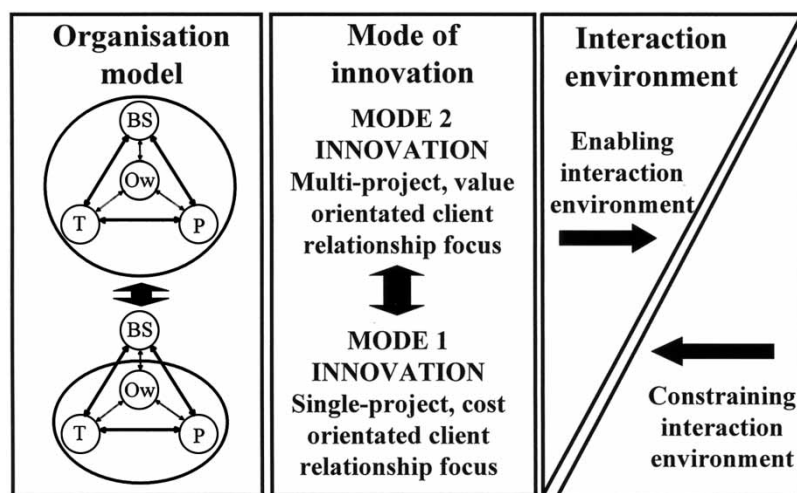


Figure 3 Mode 1 and mode 2 innovation

innovation model proposed by the authors are defined as follows:

- *business strategy* is concerned with the overall purpose and longer-term direction of the firm and its financial viability
- *market positioning* is the chosen (or emergent) orientation towards desired target markets for the purpose of achieving sustainable profitability
- *technology* is the machines, tools and work routines used to transform material and information inputs (e.g. labour, raw materials, components, capital) into outputs (e.g. products and services)
- *people* are viewed as possessing knowledge, skills and motivation to perform a variety of tasks required to do the work of the firm
- *organization of work* involves the creation and coordination of project teams and commercial networks both within the firm and across its business partners

The Modes 1 and 2 innovation model is located within the contingency view of organization that advocates that the degree of change or uncertainty in a firm's environment, and how this is interpreted and acted upon through managerial choice (e.g. Miles and Snow, 1994; Child, 1997), determining the optimal strategic positioning (e.g. Porter, 1985) and organizational structure (e.g. Burns and Stalker, 1961; Lawrence and Lorsch, 1967).

The key implication for PBB is that firms operating in a constraining interaction environment are less likely to be motivated to invest in innovation due to weak appropriability conditions, which increases the risk of the economic returns not flowing adequately to the innovator. In contrast, firms in an enabling interaction environment are more likely to be motivated to invest in innovation, as the stronger appropriability conditions will help ensure that the benefits return adequately to the innovator.

In summary, this section proposes that the PBB approach must explicitly deliver appropriate business and building level benefits if it is to generate and sustain sufficient appeal and self-momentum to become dominant practice in the construction industry.

Conclusions

PBB enhances innovation performance by articulating building performance outcomes and by offering relevant actors the discretion to innovate and meet these performance requirements more effectively and/or efficiently. The PBB approach, however, is arguably too focused at the building level and it unreflectively

assumes that relevant actors have the capacity, ability and motivation to innovate at a business level. Following this line of enquiry, the discussion then moved to the business environment and organization aspects of innovation. It was argued that PBB-driven innovation requires enabling interaction environments. This has clear implications for the development of supportive procurement and partnering arrangements to ensure adequate appropriability conditions to give relevant actors the confidence and motivation to make the necessary investment in innovation.

The authors propose that the prevailing conceptualization of PBB is too restrictive and should be broadened explicitly to accommodate the required business logic that must be in place before actors will innovate. The following innovation-focused definition is thus proposed:

Successful performance-based building guides and encourages the generation and implementation of appropriate new ideas by relevant actors throughout the building life cycle, which enhances overall building performance and satisfied actors' needs.

In conclusion, PBB requires strategic focus that integrates building, business performance and innovation if it is to flourish. PBB needs to balance appropriately the requirements of clients and users with industry actors' demand for sufficient and enduring return on investment from PBB-driven innovation activity. Without this mutually beneficial balance, PBB might well stay on the periphery of innovation activity because it cannot meaningfully influence it.

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