Effecting change in construction: the construction project as decision set

It is recognised that change is needed in the construction industry to achieve sustainable development (HMG 2013). The industry is known to be conservative and risk-averse, this is largely because innovation in construction is typically considered on a project by project basis. This limits opportunities for project teams to overcome material lock-in (Unruh 2000; Foxon 2007; Nelson and Winter 1982; Arthur 1989; David 1985) by specifying unconventional material solutions (UMS) which can reduce the impacts of the construction project.

Research exploring how to overcome this material lock-in typically adopt a normative position on the adoption of UMS. This leads researchers to explore the specific barriers to the adoption of UMS (Giesekam et al. 2014 provide a meta-study). Such studies present and categorise the reported barriers. Researchers then propose solutions to overcome the identified barriers to adoption, such as:

- The use of laws, regulations or incentives;
- Programmes of education;
- The provision of information to the decision-maker;
- Expanding the (value) attributes, time horizon or stakeholder base to be taken into account in the decision-making process;
- Coinciding the decision-making processes of the system integrators (IPD);
- Integration / stimulation of the supply chain;
- Behaviour change initiatives.

These interventions attempt to address lock-in, bounded rationality (Simon 1991; North 1990; Gavetti et al. 2007) and human biases in decision-making (Kahneman and Tversky 1979). They do so by influencing the 'non-linear, unsystematic and reactive' (Soetanto et al. 2007) decision-making in construction.

However, these interventions do not account for the highly contingent nature of the construction project. Further, these proposed interventions in decision-making are not located in the context of a theory of construction. As such, it is hard to determine whether the analyses and interventions are sufficient to encourage the adoption of UMS.

Literature searches for "theory of the construction project" and "construction project theory" highlight studies focusing on project and economic management and project governance. These models focus on control and delivery of the project. Delivering these outcomes conflicts with the desire to deliver innovations such as UMS on a construction project (Murphy et al. 2015).

Accordingly, the aim of this paper is to present a model of the construction project in which to locate existing and future research aimed at encouraging the adoption of UMS.

Research Method

Data and insight have been gathered through literature & case review, action research, interviews and reviews of secondary data. These data have been analysed using both inductive and abductive inference to arrive at a middle-range descriptive model (Merton 1968) of the construction project as decision set. A critical realist position has been adopted.

Model of the construction project as decision set.

Decision-making involves arriving at a solution (output) through the consideration of (input) variables relevant to a decision. For a given decision, these input variables might be constrained. If not, the decision is considered to be unconstrained. The outputs from each decisions may become constraining on later decisions, limiting the potential outcomes from those subsequent decisions (Archer 1969). Adopting this view, it is possible to reframe the entire construction project as a multi-level hierarchy of decisions (agency) accounting for constraining variables (structure).

A hierarchy of constraining variables

Each decision in a construction project could take into account a potentially limitless number of variables. However, even before the project is conceived, constraints are imposed by the political, economic, social, technological, legal and environmental (PESTLE) context of development (Boyd and Chinyio 2006). Such constraints are termed here *context variables*. These context variables reflect the societal concerns embedded in laws, regulations, planning requirements and the physical limitations imposed by the site to be developed. Context variables will have a constraining influence on the decisions that can be made on the project by a developer client on a given site. Even with these constraints, there remain a vast number of decisions to be made to bring the project to completion.

The project client will have value drivers - needs and wants - that they would like reflected in their project (Spencer and Winch 2002). The nature of these drivers will vary from project to project, and can be extended by the consideration of requirements a wider group of stakeholders (Storvang and Clarke 2014). These value drivers, termed here *client variables*, act as further constraints on decisions to be taken during the project.

While the client will be competent to make suitable decisions in some circumstances, many will fall outside of their competency (Reve and Levitt 1984; Winch 1989). Exploration of the options available to the client for each decision is, therefore, typically delegated to specialist project based organisations[1] (PBOs). The exploration of the decision space by the relevant specialist will be constrained by both context and client variables.

PBOs then present their view of options for each decision, one of which will be adopted by the client – either as binding or advisory on later decisions. However, these PBOs are not unbiased in their decision-making. They incorporate variables into the decision-making process which, while not considered as context or client variables, are valued by or constrain the PBO in question (Bell 1994; Male et al. 2007). These *PBO variables* will influence the recommendations made to the client.

After incorporating context, client and PBO variables into the decision-making, there remains a vast number of unconsidered variables for each project decision. The process of lock-in and the institutionalisation of processes precludes consideration of these *unconsidered variables*. The attempts to influence decision-making described in the introduction aim to move decision variables from the set of unconsidered variables to one of the other three categories. These four variable types are presented here as a hierarchy (Figure 1).

[1] The client is also considered to be a PBO, and subject to similar pressures.

The relative success of proposals in overcoming material lock-in is dependent upon the extent to, and manner in which the decision variable being targeted is constrained by higher level constraining variables.

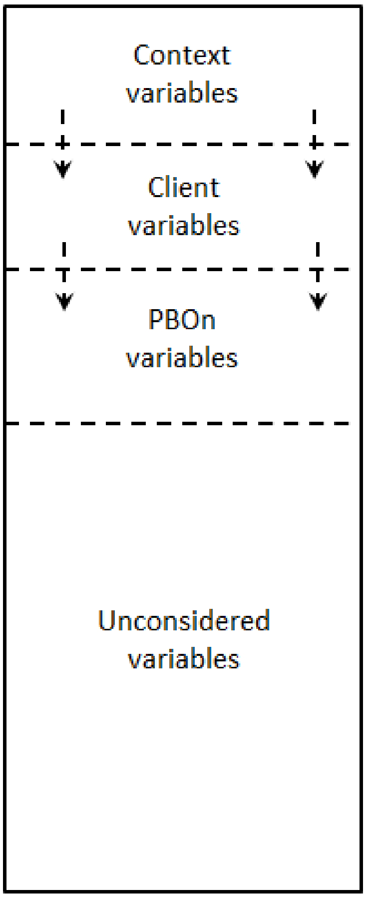

Figure 1 - Hierarchy of decision variables

The dynamic nature of structure and agency in decision-making in construction

The decision constraints imposed by the different tiers of the hierarchy of decision variables have been presented so far without any consideration of the timing of the constraining decision. It is clear though, that the dynamic nature of the project should be considered as it has a significant influence on the agency of project actors.

Before a project has been decided upon the project is constrained only by certain context variables. All else is agency. At this early stage, unconstrained project actors are willing to explore new areas, to posit wild schemes and embrace innovations (Figure 2).

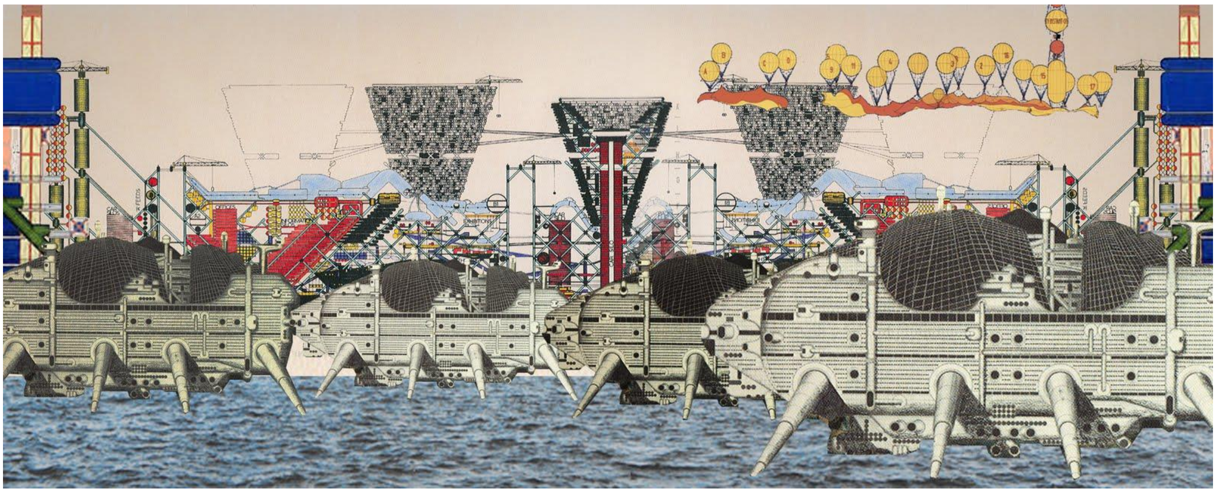

Figure 2 – Unconstrained Architecture: Archigram's Urbanism

Decisions at the project level

When presenting interventions to encourage specification of UMS, it is critical to understand what is already constrained, or constraining. Unconventional approaches to construction typically carry a time / cost premium. Where finances or time have already been constrained, it is unlikely that the provision of information provision to design specifiers will overcome lock-in, unless that specification addresses a superior constraining variable.

The RIBA Plan of Work (RIBA 2013) defines the anticipated order in which decisions on projects are made. While there is an increasing flexibility in the latest version of the Plan of Work, the earliest decisions at stage 0 remain related to the 'business case' and programme for the project. This establishes constraints on costs and time of the project at the earliest opportunity[2], at time when there is least certainty of the project. Concept design follows, eventually, at RIBA stage 2.

Decisions at the PBO level.

In a similar manner, timing is also important when considering PBO variables. Before budgets are set for projects, or tenders submitted, organisations are unconstrained in how they might respond to a given project requirement. In deciding how much to bid for work, a PBO must review context and client variables and make assumptions as to how their work will be carried out to reflect their own value drivers. These

[2] It is interesting to note that in the earliest version of the RIBA plan of work design preceded the development of the budget plan.

assumptions are incorporated into bids and hence the PBO constraining variables. including the time and cost of the work they are to undertake.

Implications

This middle-range model provides a new conceptual framework for locating proposed interventions to encourage the specification of UMS. Further, this view of the construction project challenges PBOs to explore more fully the decision contexts into which they are specifying UMS. Such an exploration might lead to the identification of context or client variables limiting the delivery of client value which in turn could promote specification of UMS.

Conclusion

This paper has presented an outline of a model of the construction project as constrained decision set in which to locate existing and future research on the adoption of UMS. Dependent upon the UMS proposed, these constrained decisions can act as either initiator of, or barrier to innovation.

[1,494 words]

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