The role of procurement in embedding sustainability along the life cycle of a construction project

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Procurement and Sustainability

Incorporating broader sustainability principles and objectives (not just green building) across the full life cycle for construction is becoming a more common prerequisite, particularly in the government sector, for successful project delivery superimposed upon the time honoured on-time, on-budget, good quality paradigm. This paper contends that the procurement function is in the driver's seat in determining many of the sustainability outcomes of construction projects over their life cycle. Through literature review and an informal workshop with construction industry representatives and procurement professionals, this study will highlight how the procurement function can facilitate the achievement of improved sustainability outcomes in construction.

Keywords: construction, procurement, sustainability, procurement function, lifecycle.

1. Introduction

Procurement or purchasing is often described as bidding or the tendering element in a linear model of the project construction process (see Uhr and Davenport, 2009). However it is also a functional group as well as an activity (Monczka et al, 2011, pp10). While managing a major portion of the procurement process is ultimately in the hands of a client project manager or head contractor, many of the tasks involved in achieving the end result are, or should be, in the domain of the procurement/purchasing officer acting on behalf of various stakeholders in the project – client, contractor, sub-contractor and user.

Project management success and project success are not directly correlated according to Munns and Bjeirmi (1996) as they have different drivers. While project management success is judged principally on time, cost and quality; the factors which might cause failure include poor project scoping, poor project management techniques, lack of commitment and lack of management support (Munns and Bjeirmi, 1996). The success of the project however is dependent upon factors such as client satisfaction, the perceived value of the project and its profitability (Munns and Bjeirmi, 1996). This paper contends that the procurement function merits greater attention not only because it supports the achievement of both project and project management objectives but also because procurement decisions impact on the whole lifecycle of a project and provide an opportunity to influence broad sustainability outcomes. The choice of concept designer, choice of contract method, the articulation of user requirements and key performance indicators through tender and contractor engagement processes, the determination of the governance and collaboration models, the

supply chain for material, maintenance programs and decommissioning are all down to procurement people or a procurement role in the first instance.

2. Study Approach and Method

Through a deductive approach of literature review and an informal workshop with project managers and procurement professionals, this study will highlight the importance of the procurement function to sustainability outcomes in construction projects. The aim of this research is to demonstrate that more attention should be paid to the function of procurement within the *whole* lifecycle of construction projects in order to maximise sustainability objectives.

3. Literature Review

There is a growing body of literature about sustainability and the construction industry (Ortiz et al, 2009; Albino and Berardi, 2012; Lombera and Rojo, 2010; Glass et al, 2011; Sidwell and Budiawan, 2001; Lenferink et al, 2012; Seuring, 2011). Since the report of the Bruntland Commission (Commission on Environment and Development, 1987) and the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988, researchers, governments, citizens and industry have begun to appreciate a connection between the environment, economic and social activity and welfare. This has led to initiatives to limit energy use, waste and associated emissions through various means including voluntary action, regulation, voluntary codes and standards, manufacturer incentive programs, and research and development (IPCC, 1996, pp17-20; Albino and Berardi, 2012, pp387).

Coupled with this is a growing world movement to hold companies to account for their actions and supply chains in terms of social, ethical and environmental principles. Corporate social responsibility and the consideration of broader sustainability principles is now more important and seen in terms of leveraging competitive advantage, managing reputational risk and just good business (Porter and Kramer, 2006; Leonard and McAdam, 2003). In order to compete and be sustainable in this new environment, the construction industry needs to innovate – to seek out new products and processes for doing things. Indeed Fukasaku (2000) noted that not only are new products and processes required but also new means of distribution and use. The OECD has agreed that innovation will play an important role in achieving environmental sustainability (OECD, 2000).

Supporting this sustainability drive, there is also now a body of literature describing innovation and sustainability in construction as well as the barriers to construction innovation (Blayse and Manley, 2004; Williams and Dair, 2007; Albino and Berardi, 2012; Ortiz et al, 2009; Miller et al, 2009). Some have also made the link between procurement activity, innovation and sustainability, for example Sidwell and Budiwan (2011) examined the importance of the tendering process for the encouragement of contractor-led innovation and noted the limitations of traditional methods. Blayse and Manley (2004) identified six drivers/barriers to construction innovation one of which was *procurement systems*. Miller et al (2009) not only identified a similar list of barriers to innovation but also obtained survey results about the significance of the impact of each barrier. Procurement systems rated

moderately highly as having significant impact on innovation. Williams and Dair (2007), in their study of barriers to sustainability in building in England, produced a table of issues cited in their surveys. The list provides a useful method of analysing the barriers and the procurement elements.

Drawing on research by Gann and Salter (1998, 2000) and Marceau et al (1999), Blayse and Manley (2004) described the construction process as a *network* of stakeholders (regulators, suppliers, users, project firms, other technical support institutions) and a *system*, partly manufacturing and partly services in which innovation takes place in a wide variety of areas, *including in procurement*. Blayse and Manley (2004) found that 'procurement systems that tend to discourage construction firms from risking the adoption of non-traditional processes and products' (pp148) were most detrimental to the adoption of innovative approaches. They noted that traditional methods have been found to have the 'highest cost risk for contractors, the highest incidence of adversarial relationships, the lowest level of integration across the supply chain, and the poorest innovation outcomes' leading them to recommend partnering, alliancing and relationship contracting (Blayse and Manley, 2004, pp149).

Blayse and Manley (2004, pp147) and Uhr and Davenport (2009, pp208-212) also drew attention to the typical method of dividing construction work up into separate discrete packages which are separately procured with contracts with cascading performance measures to pass risk down the supply chain. This is usually to the lowest level of sub-contractor and sometimes sub-sub-contractor, with the effect of severely dampening innovation.

Rahman and Kumaraswamy (2005) found that *procurement arrangements* (the sourcing point) which support collaborative working arrangements between clients, suppliers, contractors, consultants and sub-contractors and strike a balance between control and flexibility allow more meaningful interactions, better understanding and lead to more efficient outcomes. Similarly, Kuhlmann et al (2011) noted that 'increased attention for soft aspects matches with the notion that project cooperation enhances project performance. Project performance is here defined in terms of cost, time, quality, environmental impact, work environment and innovation' (pp2). Lenferink et al (2012) also found that integrated and inclusive contract and project working arrangements led to more sustainable infrastructure development in their study of Dutch infrastructure projects. Albino and Berardi (2012) discovered that the realisation of sustainable benefits in residential construction processes requires a higher level of integration of the contractor and suppliers, careful selection of the design team and specialised suppliers, all of which are highly influenced by procurement.

The limitation of these studies is that the procurement function is either regarded narrowly as a single element in the project lifecycle when in fact it pervades the whole lifecycle of a project and is undertaken by different stakeholders at different stages along the process; or it is regarded only as a process and not also as the role of a functional group in an organisation as described by Monczka et al (2011). This is probably because in construction, there is rarely a purchasing area – the role is a one of the many held by project and contract managers.

Contrast this to The Chartered Institute of Purchasing and Supply Australasia (CIPSA) which principally represents the goods and services procurement profession within Australasia and which has observed “One of the difficulties in defining the term ‘procurement’ is that it does not deal with a single action or process. Procurement covers the complete range of events from the identification of a need for a good or service through to its disposal or cessation. Procurement includes activities and events before and after the signing of a contract as well as the general management activities associated with a range of contracts: pre-contract activities such as planning, needs identification and analysis, and sourcing; post-contract activities such as contract management, supply chain management and disposal; and general activities such as corporate governance, supplier relationship management, risk management and regulatory compliance” (CIPSA, 2005, pp5).

Brammer and Walker (2007) in their study of sustainable procurement in the public sector, identified four factors which influence the degree to which organisations implement sustainable procurement practices: the level of skills and competencies that procurement staff possess in terms of sustainable practice; perceptions about the relative financial viability of sustainable procurement methods; organisational attitudes and culture supportive to sustainable practice; and the supply chain of sustainably produced products to enable implementation of sustainability objectives (pp9-10). Glass et al (2011) considered the role of responsible sourcing of materials and products in construction, finding that there is a gap between corporate sustainability goals and operational expertise and that while clients and specifiers of construction projects have the most influence on sustainability outcomes they too lack knowledge and understanding.

Albino and Berardi (2012) found that contractors seeking sustainability outcomes contacted suppliers early, often at the design stage, in order to confirm supply and feasibility of the design and materials. Said and El-Rayes (2011) and Ping Tserng et al (2006) have pointed not only to the optimisation of material supply chain sourcing for construction projects but also the importance of *procurement of materials* to storage and work efficiency on the site (the construction phase). Integrated supply chain management (whereby supply is matched to demand) has been adopted by the manufacturing sector for some time (Ping Tserng et al, 2006, pp395) while the construction industry adopts less optimal methods and tends to store large amounts of inventory and materials on site before they are required reducing the level of efficiency and labour productivity about the site and increasing cost (Ping Tserng et al, 2006, pp395).

Meistad and Valen (2012) have emphasised the importance of involving facility managers in the *early design procurement phases* of construction projects so that they can input knowledge about the operation, cleaning, layout, maintenance, and energy usage during the occupation phase of a building project. After all, while procurement of cleaning and maintenance is not a construction activity, it is part of the lifecycle of the project and decisions on design and materials impact on the success of the project over its life.

At the *end of project life*, demolition or refurbishment become building project owner decisions and involve significant procurement processes and decisions. ‘Building materials account for about half of all materials used and about half the solid waste generated

worldwide. They have an environmental impact at every step of the building process - extraction of raw materials, processing, manufacturing, transportation, construction and disposal at the end of a building's useful life' (Department of Sustainability, Environment, Water, Population and Communities, 2011, pp4).

The literature identifies various points along the lifecycle of construction projects where procurement activity and functions are negatively influencing the level of sustainability outcomes. Other literature examines innovation and specifically innovation in procurement. For example, Miller et al (2009) identified procurement *policies* which focus on lowest up-front cost rather than value for money as key impediments to innovation in construction. This literature enables a link to be made between the procurement activities along the lifecycle, the barriers/drivers of innovation and the way procurement could innovate to support sustainability objectives in construction.

Miller et al (2009) considered construction procurement innovation and developed a simple matrix (Table 1 below) to distinguish between *procurement product* innovations and *procurement process* innovations (pp50). This matrix provides a useful framework for conceptualising procurement innovation. Under this model, the emergence of alliance contracts and public-private partnerships would be seen as a *procurement product* innovation, whereas early contractor involvement or design work-shopping with multiple stakeholders might be seen as *procurement process* innovation. E-tendering and e-procurement could be seen as both a *procurement product innovation* and a *procurement process innovation*.

Table 1: Type of Innovation and procurement (Miller et al, 2009, p50)

	Innovation of procurement	**Innovation within procurement**
Product innovation	New/improved financial instrument/contractual form	Innovation in components/structures of buildings and infrastructures
Process innovation	New/improved organisational forms, structures, sequences, financial arrangements	New/improved processes in construction

The findings in the literature review were subsequently tested in an informal workshop with industry representatives.

4. Informal workshop results

Invitations were sent to a broad cross section of the Australian Capital Territory construction sector (academics, government regulators, government procurement, quantity surveyors, construction companies, peak bodies and industry representative groups, legal advisors). Thirteen respondents participated in the informal workshop representing the industry broadly. The objective was to have a sufficient number to enable meaningful discussion and participation by all present. The workshop was divided into four themes: the definition of

sustainability and sustainable construction; sustainable materials; barriers to sustainability in construction and the role of procurement in sustainable construction.

The participants considered that sustainability objectives were set up in opposition to budget and up-front financial goals. *'Communities need to be liveable, there needs to be housing and environmental sustainability for the long term to support changing needs'*. *'It [sustainability] is set up against another set of values, sometimes in opposition to durability'. 'The economic life of buildings varies from place to place'*. '*Do you want it to last for 30 or 150 years and will you be prepared to pay?'* Drawing on this discussion, the barriers to sustainability were discussed. *'It is seen as a niche'; 'People are expecting to change things, …, they go to IKEA and turn furniture over, there is no sustainability in that'; 'You can write perfect specifications in a tender but when it comes to the QS the builder says I've got to build and sell, I have to cut the cost, and the product goes out the window.'* Participants listed up-front cost; regulations allowing unsustainable or less sustainable options; economic pressures and client pressures to complete works within constrained budgets and time; lack of knowledge of products and suppliers; lack of demand by clients for green or sustainable alternatives and green options being cut from projects by clients due to budget constraints.

Procurement or the procurement function was seen as a major barrier to sustainable building. *'Problem in procurement is cost'; 'You can't have sustainability without whole of life analysis and risk. It needs to be up front, if you leave it until later in the process you have to back track. It is a key procurement right up front'; 'Innovation can be considered in the tender context but we are not looking for innovation'; 'Contracts are like leadership'; 'If you have a model that has too much competition there is not enough profit and industry loses money'.* Here participants cited adversarial contracts and relationships not conducive to innovation, lack of involvement of contractors and suppliers early in design and the lack of skills of both contractors and procurement professionals in sustainable building. Participants also expressed the view that sustainable building is still in its infancy with little demand pull from clients, although there is an increasing level of regulatory push from government. They particularly noted the difficulty in demonstrating and convincing clients of the value of sustainable building alternatives. *'The industry is very conservative. Trades like to do stuff they are used to doing. If you introduce a new product and they have never seen it they will put a premium on that because they are not used to using it'.*

The workshop confirmed many of the findings of the literature, particularly the results from Williams and Dair's (2007) surveys in the UK about barriers to sustainability and innovation. Participants also identified and confirmed the wider the role of procurement in this process.

5. Analysis

The lifecycle of construction projects is typically represented by a number of distinct stages: concept, design, tendering, pre-construction, construction and commissioning (see Uher & Davenport, 2009, pp29). This approach limits the role of procurement, however, despite this, the literature and workshop confirm that there are numerous points where procurement activity takes place. Figure 1 below illustrates the points of involvement of the procurement

function along the *whole* project lifecycle as indicated by the research and the outcomes of the workshop described above. Having established a number of procurement functions across the lifecycle, sustainability outcomes may be enhanced through procurement product and process innovation.

An analysis of the barriers shows that procurement figures prominently in the functions responsible or able to influence sustainability. Linking together, the enhanced project lifecycle model depicting the broader role of procurement to the barriers to sustainability in construction and innovation identified in the literature, Table 2 applies a stakeholder role and responsibility to each listed barrier. It also categorises each issue in terms of whether a procurement product innovation or a procurement process innovation could bring about some improvement identified by the literature and the workshop according to the identifier matrix developed by Miller et al (2009).

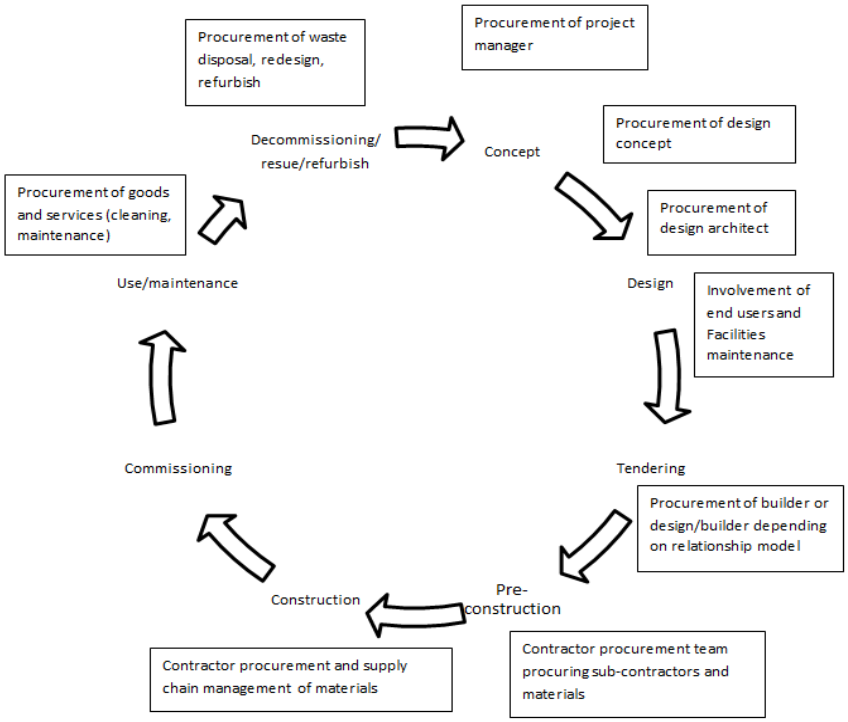

Figure 1: Project Lifecycle with procurement functions and roles over the full cycle

Table 2: The Role of Procurement in mitigating barriers to sustainable construction (Adapted from Williams and Dair, 2007, pp141)

Barrier to acting sustainably	***Lifecycle stage***	***Role/responsibility***	***Procurement product or process innovation***
Sustainability measure not considered by stakeholders	Concept, pre-construction	Procurement function should be able to advise clients about potential sustainability options.	Process
Sustainability measure not required by client	Tendering	Procurement function should include measures in project briefs, statements of requirements and contracts.	Product
One sustainability measure forgone in order to achieve another (traded)	Pre-construction, tendering, construction	Client, Project Manager. Procurement function should be able to assist with making business case for inclusion of sustainability measures.	Process
Sustainability measure restricted, or not allowed, by regulators	Pre-construction	Regulator. Procurement function sets requirements in statements of requirements, in accordance with legislation.	Process
Sustainability measure costs too much. Focus on upfront cost not performance	Pre-construction, tendering, construction	Client, Project Manager. Procurement function should be able to assist with making business case for inclusion of sustainability measures.	Process
Site conditions mitigated against the use of a sustainable measure	Construction	Client, Project Manager, Contractor.	
Inadequate, untested or unreliable sustainable materials, products or systems	Pre-construction, design, tendering, construction	Client procurement, contractor procurement and designer should be able to consult on available tested materials.	Process
Sustainable measure not available	Design, construction	Supplier, supply chain. Procurement function should be able to innovate in sourcing.	Process
Unsustainable measure allowed by regulator (no impetus for a sustainable alternative to be used)	Design, tendering construction	Regulator. Procurement function can set the bar higher in briefs, statements of requirements, quality performance than is set by regulator.	Product
Stakeholder not included, or included too late, in the development process to	Pre-construction, design, tendering, construction	Responsibility of Project Manager and procurement function to include all stakeholders.	Process

implement sustainability measure			
Stakeholder lacked information, awareness or expertise to achieve sustainable measure	Concept, Pre-construction, design, tendering, construction	Client, Project Manager, Contractor and Procurement. Lack of training, knowledge, awareness. Obligation and opportunity for all stakeholders.	Process
Inflexible adversarial procurement arrangements	Tendering	Client however mostly down to Procurement. Contracting models and governance models for projects.	Product and process
Lack of integrated teams and separation of construction portions	Tendering	Procurement role directed by Project Manager/client.	Product and process
Less than optimal supply chain of materials and storage	Construction	Contractor Procurement and Project Manager, suppliers. Integrated team approach would allow collaboration.	Process
Lack of involvement of facility management in early design phase	Pre-construction, design	Client, Project Manager and Procurement.	Process
Lack of consideration of waste during construction	Construction	Client Procurement, Contractor Procurement and Project Manager. Can be a matter of contractual obligations.	Product and process
Lack of consideration of waste at demolition stage.	Demolition	Client Procurement, can be a matter of contractual obligations.	Product and process
Poor communication or complex inadequate communication	Concept, Pre-construction, design, tendering, construction	Project Manager, Client Procurement and all other stakeholders. Clear communication methods can be stipulated as part of project briefs, statements of requirement.	Product and process
Culture not conducive to adoption of sustainability objectives	Concept, Pre-construction, design, tendering, construction	Client Procurement. Responsibility to engage contractors with appropriate culture.	Product and process

6. Conclusions

This study has demonstrated that the procurement function has a strong role over the whole lifecycle of a construction project supporting the project outcomes and the project management function. It has also shown that there is considerable potential to improve the sustainability of construction projects through process and product innovation in construction procurement. Given the increasing importance of projects achieving greater sustainability outcomes into the future, it is difficult to understand why procurement functions, processes and products would not become a priority for research and development serving both the client and the contractor side.

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