EXAMINING THE BARRIERS TO SUCCESSFUL ONSITE CONSTRUCTION ENVIRONMENTAL MANAGEMENT OPERATIONS

Kim Maund[1], Thayaparan Gajendran and Graham Brewer

School of Architecture and Built Environment, University of Newcastle, Callaghan, New South Wales, Australia

With the introduction of ecologically sustainable development (ESD) and subsequent legislative regulations throughout Australia, effective environmental management across the construction sector should occur. In reality, construction operations continue to have detrimental environmental impacts. Within New South Wales the primary legislation governing development control, for the purpose of ESD, has produced a complex legislative system that its ability to achieve the objectives of environmental protection remains questionable. Large scale development projects may evoke need for associated environmental regulatory controls; however, such rules are generally not applicable to small and medium scale developments. Yet, these types of projects make up a significant amount of the development market and collectively a major contribution to detrimental environmental impacts. Given each construction project is unique, the application of complex regulatory controls may result in notably different levels of environmental protection between developments. Inconsistency may be seen with regulatory interpretation, implementation, monitoring and associated processes of enforcement. Using a systemic lens this research linked the efficacy of regulation, monitoring, and information flow to explain variability in the outcomes of onsite environmental management operations. The paper reports preliminary findings of a two stage qualitative study involving semi-structured interviews with key project stakeholders (e.g. government regulatory officers, construction managers) and case study examination of four medium scale development projects. Using a phenomenological coding approach, preliminary analysis identified a number of themes that impact effective onsite environmental management including: environmental interpretation and assessment, compliance and enforcement, external influences, collaboration and engagement.

Keywords: ecologically sustainable development, environmental planning, development planning, government regulation, qualitative analysis.

INTRODUCTION

Internationally, construction operations continue to be acknowledged as a significant cause of environmental degradation (Fuertes *et al*., 2013; United Nations Environment Programme Division of Technology Industry and Economics, 2003; Walbaum & Buerkin, 2003). Adverse impacts that result from industry operations lead to the exhaustion of natural resources, and contribute to greenhouse gas emissions (Fuertes *et al*., 2013). Other causes of environmental degradation from onsite operations include: construction and demolition waste generation; land contamination; surface and underground water contamination; and toxic atmospheric emissions (Chen, Li, &

[1] Kim.Maund@newcastle.edu.au

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Wong, 2005; Gangollels *et al*., 2009; Shen & Tam, 2002). Attempts to legislate the mitigation of these negative impacts were subsequently introduced in jurisdictions around the world, with varying levels of success. This research investigates the Australian experience, using a phenomenological lens to explore environmental preservation during construction operations as an emergent feature of the interaction between various regulatory systems designed to protect the environment. The underlying intent is to understand barriers and enablers of good policy practice.

UNDERSTANDING REGULATORY POLICY

Within the literature it has been stated that 'most existing approaches to regulation, are seriously sub-optimal…they are not effective in delivering their purported policy goals, or efficient, in doing so at least cost, nor do they perform well in terms of other criteria such as equity or political acceptability' (Gunningham & Sinclair, 1998, p. 1). Internationally, the Organization for Economic Co-operation and Development (Organization for Economic Co-operation and Development, 2010) explained that the changing financial and natural climates have strained emerging regulatory systems. During 2011, they advised of 'evidence of serious regulatory failures' given the current state of both economic and environmental climates (Organization for Economic Co-operation and Development, 2011, p. 3).

Today, governments worldwide are commissioned to solve extremely complex policy problems. The degree of complexity has evolved to a point where they have been considered highly resistant to resolution: often identified as 'wicked' problems (Australian Government & Australian Public Service Commission, 2007). Although there are many obstacles when tackling such problems (e.g. there may be no ability to test a policy apart from implementation) there are governing rules to assist good policy practice. Six areas of consideration that impact upon policy development and subsequently interpretation and implementation are now presented.

1. Academic information

Reliability of information within policy may be questioned where academic literature has not have underpinned its development (Holmes & Clark, 2008). There may be access restrictions, timeframe limitations, ignorance of its necessity, or it may be technically complex and not open for interpretation. A lack of understanding as to who is considered an expert on the subject topic or how to access technical professionals may further impact development. In addition, those responsible for formulation of policy may not have the academic knowledge to undertake appropriate methodological assessment (Holmes & Clark, 2008).

2. Science and statistics

Science may be viewed as a mechanism to justify policy and guide its development. Therefore, scientific professionals can assist with development of sound methodologies, provide informed scientific knowledge and facilitate mechanisms for assessment of policy effectiveness (Holmes & Clark, 2008). Literature has identified that science and methodology need to play more of a role within the policy system commencing with formulation (Ballinger & Stojanovic, 2010) and supported by statistical analysis to ensure appropriate development and outcome rationalisation (Srebotnjak, 2007). However, it is often sought at later stages (e.g. interpretation of results), which hinders accurate analysis (Srebotnjak, 2007).

3. Collaboration and stakeholder engagement

Ineffective intergovernmental collaboration may significantly impede the ability of an objective to be achieved (Burby & May, 1998). Without appropriate collaboration

high level policy objectives may not be adequately understood, accepted or given the appropriate degree of importance (Keijzers, 2000). Similarly, without stakeholder engagement, objectives may be viewed as rigid and lacking flexibility. Collaboration and engagement allow for consideration of respective economic and social interests in policy formulation which may encourage participation and commitment to implementation (Keijzers, 2000).

4. Interpretation and Ambiguity

There is often a degree of complexity surrounding policy problems that may render it difficult to clearly define a situation (Australian Government & Australian Public Service Commission, 2007). However, a well written policy has the potential to remove ambiguity (Keijzers, 2000), and with detailed definitions may assist to provide structure (Onate & Peco, 2005). Although the areas of development and regulation attempt to achieve a set outcome, clear and well defined policy is needed as interpretation and implementation of can result in a misalignment between policy intention and policy outcomes (Clement & Amezaga, 2009).

5. External influences: politics and economics

Policy may be influenced by external variables such as politics and economics that contribute to policy complexity: development and interpretation (Srebotnjak, 2007). Complexity is exasperated by the multitude of stakeholders with differing agendas (Australian Government & Australian Public Service Commission, 2007). The desire for good environmental outcomes may not be the driver for change. Consumer demand and economic indicators may be the motivators for adoption of good environmental management practices, rather than a conscience effort towards improved environmental performance (Cary & Roberts, 2011).

6. Enforcement

Government administration of enforcement: command and control, has been identified as a strong mechanism to achieve compliance (Shi, Peng, Liu, & Zhong, 2008; Shimshack & Ward, 2007). Enforcement alters behaviour by identifying how stakeholders must perform (Organization for Economic Co-operation and Development, 2010). Enforcement methods are typically associated with penalties and these have been shown to result in significant environmental improvement. The threat associated with potential non-compliance, particularly if economic based, is often seen as the motivator for improved environmental performance (Shimshack & Ward, 2007).

NATIONAL REGULATORY POLICY

In 1992, a report entitled ‘Our Common Future” (also known as the Brundtland Report) was tabled at the United Nation Conference on Environment and Development (United Nations, 1992), where principles of sustainable development were first ratified and incorporated into Agenda 21: ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (World Commission on Environment and Development, 1987).

Subsequently Australia introduced an array of regulatory policy in an attempt to achieve the principles of Agenda 21. Ecologically Sustainable Development (ESD), was introduced to legislation and defined as ‘using, conserving and enhancing the community’s resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased’ (Australian Government Department of Environment, 1992).

ESD was incorporated into governing environmental legislation: *Environment Protection and Biodiversity Conservation Act* 1999. Within the Act, guidance was given on how to achieve ESD through adhering to specified principles, *inter alia*, precautionary principle, considering biological diversity and ecological integrity in decision making (Australian Government Department of Environment, 1999). Subsequently, ESD became entrenched in State and Territory Legislation such as the New South Wales (NSW) *Protection of the Environment Administration Act,* 1991 responsible for establishing the Environmental Protection Authority and providing environmental reports on the State of the Environment, and the *Environmental Planning and Assessment Act* (EP&A Act), 1979 the primary Act that governs development processes. ESD principles continued to filter through the government hierarchy to regional and local level authorities to be included regulatory and non-regulatory (e.g. development control plans) policy.

NEW SOUTH WALES REGULATORY POLICY

Within NSW introduction of ESD policy created a particularly complex and multifaceted legislative system. In 2005 a State government review of the EP&A Act identified a need to '…eliminate unnecessary and complicated red tape' (NSW Government Department of Planning and Infrastructure, 2005a). The Act and its processes were described as '…a confusing web of conflicting plans and instruments' (NSW Government Department of Planning and Infrastructure, 2005b). A governmental review during 2007 highlighted that policy, in particular the EP&A Act, '…remains lengthy, complex and confusing…' (NSW Government Department of Planning and Infrastructure, 2007).

Change of State government in 2011 brought a strong focus upon transformation of the EP&A Act and the related development system. The Planning System Review Issues Paper identified the Act remained overly legalistic and complicated, making interpretation and application difficult (Moore & Dyer, 2011). However the State government's system reforms have yet to be implemented, largely as a consequence of a lack of political will. Most observers acknowledge the Act has received little more than minor tweaking (e.g. the deletion of certain clauses). Nevertheless, some minor changes have evolved into a new part within the Act or established themselves as a new policy. Although ESD has established its place in State regulatory policy the system still remains largely ineffective and fraught with complexity which may be impacting upon its ability to achieve ESD principles.

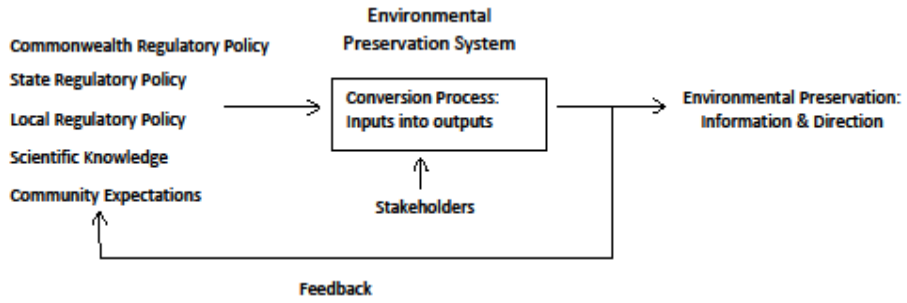
RESEARCH CONTEXT

The intent of the research is to examine regulatory policy – specifically the EP&A Act – to determine how it impacts upon onsite construction environmental management operations. Although it may be responsible for meeting ESD principles it does not operate in isolation. Inadequate information flows between stakeholders and processes within the construction management system can result in destructive onsite operations. Given their impact there is a pressing need to understand interrelationships to identify barriers and enablers of effective onsite environmental management operations.

The research context was conceived as a system encompassing an array of relationships, communications, information exchanges, collaborations that contributed to attaining environmental preservation during construction operations (FitzGerald, FitzGerald, & Stallings, 1981; Smith, 1982). It was believed that by

understanding the system and interactions within it, system efficacy itself could be explained (Mbiti, Blismas, Wakefield, & Lombardo, 2011). During design of the research, various inputs such as State and local policy were identified; however, it was recognised that environmental preservation occurred at the interface between these influences. To move beyond inputs and examine interactions within this system (refer Figure 1) stakeholders were identified since they contribute to outcomes associated with environmental preservation (Stewart & Ayres, 2001).

Figure 1: Interactions within the environmental preservation system (Maund & Brewer, 2012).



METHODS

The research employed a qualitative exploratory design where data collection involved two (2) stages. Stage 1 used interviews to enable exploration of stakeholder perspectives and understandings of regulatory policy and its impact upon onsite construction operations. Recruitment was conducted through third party organisations who met specific inclusion criteria. For example, Councils who approved the most number of development applications from the 2010-2011 period as identified in the NSW Department of Planning and Infrastructure 'Local Development Performance Monitoring 2010-2011' report. Participants were selected due to knowledge and experience of development processes (e.g. lodgement or assessment of applications) and/or construction operations (either onsite operations or certification). Twelve (12) interviews were conducted with key stakeholders including regulatory officers such as local government town planners and non-regulatory professionals such as developers and site supervisors.

Stage 2 employed a case study approach to further examine specific projects, looking at documentation, information flow, environmental and policy knowledge to assist in development of a framework of understanding onsite environmental management operations. To further determine whether consideration was given to environmental onsite impacts at the design/consent stage of the project and if so, whether they were implemented in accordance with the consent and/or whether additional environmental measures were administered.

Four (4) medium sized construction projects were elected based upon criteria including type of development. Specific documentation for each construction project was analysed (e.g. development consent) and assessed in terms of coverage of environmental issues, Interviews were also conducted with key stakeholders from each project (refer Table 1). Selection process followed that of Stage 1. Twenty four (24) interviews were conducted and recordings transcribed and analysed using qualitative methods. Analysis involved thematic exploration of data using a three (3) step coding process (Morse and Richards, 2002) to enable full use of the richness of data and increase robustness the analysis.

Table 1. Examples of Stage 2 questions.

What paperwork did you have onsite for this project and how would you assess it? (e.g. statement of environment effects, environmental management plan).
Who was responsible for onsite operations for this project and how did you ensure environmental measures were implemented? (e.g. construction/site manager/building certifier/engineer).
Did you have an internal or external auditor on this project?

RESULTS AND DISCUSSION

Stage 1 interviews explored the issues associated with environmental regulations influencing project environmentally sustainable outcomes. Using an open coding process, preliminary analysis of transcripts identified a number of environmental issues to be further explored in the context of actual construction projects during Stage 2. Table 2 provides an example of the coding structure for Stage 1.

Table 2. An example of the coding system structure for Stage 1.

Open Code	Axial Codes			
Environmental Theme	Pre-construction	Green building	Sedimentation	Government firms
	Post-construction	Energy efficiency	Erosion	Regulators
		Green star	Waste Mgt	Contractors
		BCA Section J	Water Mgt	Policy makers
			Tree Mgt	Construction Mgrs

Stage 2 documentation review revealed minimal inclusion of environmental conditions of consent. The focus being sedimentation and erosion control, with waste management plans occasionally noted. Themes including electricity usage and atmospheric emissions were not identified in documentation for any projects. Preliminary Stage 2 interview coding enabled examination of variables impacting upon onsite environmental management practices to better understand construction management operations: intent versus actual (refer Table 3). Preliminary analysis from Stage 2 data revealed a number of issues impacting upon policy practice. These are now discussed.

Table 3. An example of the Stage 2 coding system structure.

Open Code	Axial Codes			
Enforcement	Policy	Politics	Misdirection	Government
	Legislation	Economic impacts	Confusion	Developers
	Law	Penalties	Ambiguity	Policy makers
	Delegations	Environment	Clarity	Regulatory officer
	Regulations	Sustainability	Understanding	Construction firms

Environmental interpretation and assessment

Interpretation of an environmental issue was often skewed by what non-regulatory policies (e.g. development control plans) and the projects regulatory approval documentation (conditions of consent), stated. There was often an inability to look for environmental issues beyond those stated in this paperwork. Interpretation of the EP&A Act, by regulatory offices undertaking assessment of projects is an extremely subjective process. The need for professional expertise has been identified by Holmes and Clark (2008). This has impact throughout the policy cycle from formulation to implementation. Professional expertise of regulatory officers developing non-regulatory policy, conducting regulatory assessments and writing regulatory conditions of consent to achieve EP&A Act requirements, may be questioned (we note that no regulatory assessment officer had environmental qualifications: they came from town planning backgrounds). Without professional expertise and knowledge there may be an inability to understand full development implications and as described by Clement and Amezga (2009) interpretation impacts implementation and may result in misalignment between intention and outcomes.

Environmental themes

Stakeholders understanding of the term environmental management related to design and/or post-construction operations: manipulating design to achieve regulatory assessment and/or post construction compliance. For example, areas regulated such as energy efficiency, where there are negative impacts from non-compliance including project completion delays due to an inability to receive final regulatory project sign off. Atmospheric emissions from operation of heavy plant equipment, water and energy consumption during construction activities were not a consideration. In addition, three predominant environmental themes being sedimentation and erosion control, waste management and water management (e.g. in relation to mitigating contamination rather than water and energy usage) were highlighted as important to achieve environmental management. Without appropriate academic literature, science and clear structure supporting policy development, it may be flawed (Holmes & Clark, 2008; Keijzers, 2000) with officers make subjective decisions based upon their interpretation, without necessary consideration of policy intent (e.g. influenced by politics).

Compliance and enforcement

It was identified by regulatory officers that they believed the Act was formulated in a manner that prevented them from including conditions of consent related to many environmental areas. A number of regulatory officers identified that once development consent had been approved their ability for further regulatory control was limited, particularly if construction inspection processes went to a private building certifier, over their in-house professional, as it was no longer their site to monitor. With most projects, there were minimal regulatory inspections undertaken. When the building regulator attended the site for construction inspections, they were often the primary source of regulatory environmental monitoring.
Otherwise, regulatory environmental inspections were generally a result of a major environmental incident or need to investigate a community complaint. Stronger regulatory enforcement procedures have been shown as beneficial (Shi *et al*., 2008; Shimshack & Ward, 2007). Improved regulatory mechanisms and education on the importance of ESD may contribute to providing appropriately qualified and experienced inspection officers.

Collaboration and engagement

Internal regulatory assessment processes were identified as dysfunctional by many officers. Town planners were responsible for development application control, dictating whether internal specialists (i.e. environmental officers) were required to attend pre-lodgement meetings, along with when and if referrals to specialist regulatory officers were necessary. Suitability of town planners in making environmental determinations was often questioned. This was seen as problematic: input by appropriate environmental professionals at later stages may mean mitigation measures are missed or given the later stage of the project may be unable to be implemented. Srebotnjak (2007) identified a need to have appropriate professionals involved at the beginning of the process to avoid such issues and environmental management is no different. There is the inability of assessing officers to engage with fellow officers who have professional expertise with subject areas to appropriately identify issues and this highlights the importance of stakeholder collaboration identified by Burby and May (1998) and Keijzers (2000).

Significant transfer blockages were evident through the system. There was minimal interaction between policy makers, regulators and private specialists with those responsible for onsite operations. For the private sector, questioning development consent conditions was generally avoided due to involvement of many regulatory officers presenting different subjective opinions at various stages, possibly with new requirements. Similarly, local government seldom conversed with their state government counterparts, primarily as information was not readily offered. There was a belief that officers did not have sufficient knowledge and understanding to assist with inquiries, and information was not offered due to legal implications of providing advice. These issues again identify the importance of clear policy direction to establish parameters for stakeholders and the need for collaboration in development of policy (Keijzers, 2000).

External influences

Occupational health and safety (OH&S), quality assurance and environmental management were the three (3) themes identified as onsite priorities by construction teams. However, OH&S, followed by quality assurance, were given precedence over environmental management due to ramifications associated with non-compliance. In most cases, their environmental inspections were undertaken as part of the OH&S regime. Given the lack of regulatory inspections, this may contribute to emphasis being placed upon the other two areas. Stronger enforcement powers within the Act as described Srebotnjak (2007) may assist to promote more emphasis upon environmental issues.

CONCLUSION

Modifications to regulatory policy concerning ESD provide the context for effective environmental management. Presently, there is insufficient research linking onsite environmental construction management practices and environmental management to the effectiveness of regulatory policy enforcement and information flow. Examining these practices within a policy context has divulged a range of barriers impacting upon good environmental practice.

Given the limited guidance of the EP&A Act, local government has developed a range of guideline documents and checklists. These are relied upon as if regulatory in nature and encompass all salient environmental impacts, when ultimately they remain inadequate.

Government internal systems are problematic with town planners responsible for development applications and determination of internal referrals. In many cases environmental officers were not requested to review applications, nor invited to attend pre-development application meetings. Their input often came at later stages; whereby, new requirements were sometimes introduced. This brought into question, often inadequate knowledge and experience of assessment officers.

There remains a strong focus upon meeting government requirements to ensure approval is forthcoming. In turn this has led to a belief that government documentation considers all environmental impacts from development, where this is clearly not the case. There was a strong focus upon sedimentation and erosion control, waste management (to meet development assessment requirements), water management (in terms of contamination over usage) and post construction requirements (energy efficiency). There was a clear lack of consideration into all environmental impacts such as onsite water, energy usage and atmospheric emissions.

Minimal interaction was displayed between policy makers, regulators and private specialists with those responsible for onsite operations. The subjective nature of development assessment by regulatory officers was often questioned. Caution was displayed in contacting government for advice as the subjective nature of the process could introduce further constraints. There was often a communication blockage between government tiers due to the legalities associated with providing advice.

Although it was necessary to submit development applications with certain management plans (i.e. waste) there were rarely any regulatory consent conditions that addressed the need for monitoring or reporting. Minimal onsite regulatory inspections were undertaken, often left to professionals undertaking construction inspections.

The next phase of this research involves further development into a theoretical framework within which exploration into onsite construction activities and environmental management against the effectiveness of regulation, monitoring and information flow can be determined. Bridging the knowledge gap and learning about these processes can ultimately assist in achieving the objectives of ESD during construction operations.

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