

2009

# Mixed method research to inform regulatory reform: the case of rail environmental regulation

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## Publication details

von der Heide & Charles, MB 2009, 'Mixed method research to inform regulatory reform: the case of rail environmental regulation', *Managing for unknowable futures: Proceedings of the 24th Annual ANZAM Conference*, Adelaide, SA, 7-10 December, Australian and New Zealand Academy of Management & Macquarie University Graduate School of Management, Sydney, NSW & Wellington, NZ. ISBN: 0859018520

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### Mixed method research to inform regulatory reform: The case of rail environmental regulation

Journal:	<i>23rd Annual Australian and New Zealand Academy of Management Conference</i>
Manuscript ID:	ANZAM2009-482.R1
Manuscript Type:	Paper
Keywords (Select the keywords for the Track(s) which you have selected on the previous step):	stakeholder theory and analysis < 14. Sustainability and Social Issues in Management, change (organisational) < 10. Organisational Behaviour, environmental sustainability < 11. Public Sector and Not-for-Profit, industry analysis < 13. Strategic Management, triangulation < 12. Research Methods

**Mixed method research to inform regulatory reform: The case of rail environmental regulation****ABSTRACT**

For the Australian rail industry environmental regulation is a regulatory hotspot. It initiated a project to investigate the case for rail environmental regulatory reform. Research was undertaken in a integrated three-phase research involving mixed methodologies, including in-depth interviewing of 36 rail and government stakeholders across Australia. This paper reports the key findings from each phase. The discussion follows a three-step framework for regulatory reform as a tool to i) map and assess existing regulatory regimes and ii) develop sound reform options. The quantitative and qualitative findings from all three research phases suggest that the time is ripe for a more co-regulatory approach to rail environmental regulation. The paper is of interest to managers and regulators striving for more sustainable regulatory approaches.

## INTRODUCTION

The volume and reach of the regulation of business activities, including their environmental impacts, has expanded rapidly over recent years. While regulation is an important vehicle for achieving national economic, social and environmental (i.e., triple-bottom-line) objectives, the Regulations Taskforce (2006) argued that much regulation is poorly justified and implemented. The thorniest problem emanating from the rise in environmental policy enthusiasm is that it may result in regulatory over-burdening or unilateral decision-making on the part of regulators, with the potential result of reducing confidence levels with respect to doing business or investing in Australia. This situation could add further levels of complexity in dealing with sustainability issues and thereby reduce efficiency and discourage investment in key sectors, such as transport and utilities that see to the realisation of important public values (de Bruijn & Dicke 2006; 2008).

The need for general regulatory reform in Australia has been widely acknowledged. The Council of Australian Governments (COAG) is committed to regulatory and red-tape reduction under the National Reform Agenda and to a simpler and consistent national system of economic regulation for nationally significant infrastructure under the Competition and Infrastructure Reform Agreement (2006). Likewise, the Productivity Commission (2006; 2007a) recognised a need for much greater national consistency in economic and non-economic regulatory frameworks. In a broad-based review of national regulation undertaken by the Taskforce on Reducing Regulatory Burdens on Business (2006), a number of priority reforms to existing regulation were identified. Furthermore, business is also closely monitoring governments' regulatory performance using the Business Council of Australia's (BCA) Scorecard of State Red Tape Reform (2007).

This paper outlines the research undertaken to explore and assess the case for environmental regulatory reform in the Australian rail industry. The methodologies employed and some key results from each of the three research phases are presented in turn. This is followed by a brief discussion of the implications for rail environmental regulatory reform and business regulatory reform in general.

### **The rail transport environmental regulation context**

The Australian rail industry consists of a complex network of urban, regional and interstate operations and owners and has been profiled in a range of recent publications (e.g. BTRE - Bureau of Transport and Regional Economics 2006; CRC for Rail Innovation 2008a; NTC - National Transport Commission with Booz and Company 2009). Ranged against this background are separate regulatory regimes for safety, access and economic functions and environmental impacts, all of which are overseen by a mix of State government agencies and the Commonwealth. Within the rail industry,

these various regimes are regarded as leading to inefficiencies, while the need to comply with different and sometimes contradictory laws is believed to create unnecessary red tape.

The Australian Transport Council (ATC)<sup>1</sup> agreed that there is a need for a national approach to transport policy and thus endorsed the National Transport Policy Framework (ATC - Australian Transport Council 2008). The National Transport Commission (NTC) was established as an independent body to assist Australian governments in leading transport regulatory reform nationally in order to meet the needs of transport users and the broader community for safe, efficient and sustainable land transport. To this end, the NTC has undertaken a number of rail initiatives, most of which relate to safety, worker health and productivity.

The latest rail-related regulatory reform development is currently in the area of rail safety. In 2006, COAG identified rail safety regulation as a cross-jurisdictional 'regulatory hotspot' where overlapping and inconsistent regulatory regimes were impeding economic activity. As directed by the ATC, the NTC (2009) recently prepared and published a regulatory impact statement (RIS) for the single, national rail safety and investigation framework.

The handling of rail safety regulation reform may be instructive for rail environmental regulation. Like rail safety regulation, it is perceived by the industry to be in thorough need of improvement. As discussed elsewhere (von der Heidt et al. 2008), the desire for environmental regulator reform arises from the problem of allocating regulation under the framework of Australian federalism and the diffuse nature of regulation to abate environmental externalities. Yet no government or industry initiative had fully investigated the nature and burden of environmental regulation imposed on Australian business.

To investigate this need and to, potentially, influence the structure of regulation to increase the rail industry's competitive position (Jaworski, Kohli & Sahay 2000), the Cooperative Research Centre (CRC) for Rail Innovation initiated a project to examine the case for reforming environmental regulation pertaining to rail. To gain a more complete picture of rail environmental regulation, a triangulated mixed method study<sup>2</sup> was designed (see, for example, Babbie 1989; Neumann 2003). The project was conducted in three phases over approximately 18 months:

1. A review of academic and industry literature as well as pilot case studies to develop initial insight into the nature of rail environment regulation and the business case for change.

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<sup>1</sup> The ATC consists of transport ministers from federal, state and territory governments. It is the ministerial forum for the coordination and integration of transport policy issues at a national level.

<sup>2</sup> Triangulation is conventionally defined as the purposive gathering of multiple sources of data and the use of these data sources in the reporting of results.

2. A review of internal rail firm documents, government and academic literature to map (inventory) and evaluate current rail environmental regulations in Australia
3. Qualitative in-depth interviews with key rail and regulator stakeholders to gain insight into their assessments of current rail environmental regulation and reform possibilities.

In terms of Hanson and Grimmer's (2005) continuum of quantitative and qualitative research, the first project phase adopted a 'softer' version of positivism, i.e. objective reality exists but epistemologically the techniques used produce uncertain understandings. Although not conventionally quantitative, the second phase was dominated by a 'harder' positivist ontology. An objective reality regarding the quantity and distribution of rail environmental regulation was inferred with knowledgeable degrees of certainty. A qualitative style of research, in which there is a concentration on understanding and interpretation, was undertaken for the third project phase. With its relativist ontology (each person has his or her own identity) and rejection of objectivity, this methodology is best described as constructionism (Carson et al. 2001).

The outcomes of each of these three phases go toward developing a case for rail environmental regulatory reform. This will assist the rail industry in strategically managing not only its environmental impacts but also its stakeholder relationships with regulators and the public, which is critical to business success (Donaldson, T & Preston 1995; Freeman 1984). Together the research phases address the requirements of the simple three-step process for achieving environmental regulatory reform in Australia (von der Heidt et al. 2008): (1) Mapping out the regulatory environment, (2) evaluating regulations, and (3) developing, appraising and implementing regulatory reform options.

### **INVESTIGATING THE CASE FOR CHANGE**

An in-depth review of the rail industry, regulation and environmental literature indicated that there was little published information and understanding regarding the nature and extent of inconsistencies in environmental legislation and regulation that impact on Australian railway operations (CRC for Rail Innovation 2008a). However, some inroads could be made toward mapping the key environmental regulatory areas of interest (e.g., greenhouse gas emissions, air pollution, noise, dust, site contamination, biodiversity conservation) as per Step 1 of the regulatory reform framework. This stage of the research involved exploring the distinctions between the three forms of regulation (government, self-regulation and mixed regulatory strategies, namely co-regulation), as well as their relative costs and benefits.

### Recapping regulation concepts

Since there is no immediate profit incentive, private corporations have traditionally tended to provide too little self-regulation, while governments have sometimes provided too much, thereby reducing the competitiveness of certain industry sectors and discouraging adequate levels of investment (Majone 1994). A balance between these two outcomes may be achieved by requiring firms within an industry to provide their own regulation (self-regulation), i.e., control their collective behaviour through a voluntary association of firms (Lennox & Nash 2003), or through the adoption of operational and technical standards, working practices or processes (PC 2006). Typically, government does not participate in regulatory development, implementation and enforcement, which (in this case) is carried out by means of social control at an industry and/or organisational level (Gunningham, N. & Rees 1997). Environmental self-regulation may take a number of forms, including internalisation of externalities (e.g., investing in lower emission technology), organisation-wide environmental management policies and environment management plans for particular projects and developing and promoting industry standards for environmental impacts.

The range of regulatory strategies can be arrayed in a systematic and more finely calibrated way, as shown in Figure 1. Those at the top of the figure have the smallest government role, while those at the bottom have the largest. The strategies lying midway across the spectrum represent mixed systems of various kinds, including forms of co-regulation. Co-regulatory strategies can be arrayed in terms of the degree of government and firm involvement.

#### *Figure 1 Regulatory spectrum*

Co-regulation is a system in which some of the responsibilities for regulatory development, implementation and/or enforcement are *shared* between industry groupings and governments (BTRE - Bureau of Transport and Regional Economics 2006)<sup>3</sup>. It is also referred to as meta-regulation, whereby the regulator sets the goals and the regulated entity determines how it will achieve the goals (NTC - National Transport Commission with Booz and Company 2009). Gunningham (2004a) describes co-regulation as “risk-managing the risk management of individual enterprises” (p. 11). Regulated entities are best placed to look after safety in their operations, but governments have a legitimate interest in ensuring acceptable levels of safety that meet community expectations and maintain public confidence.

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<sup>3</sup> Greenhouse Challenge Plus (GCP) (DEWR - Department of the Environment and Water Resources & AGO - Australian Greenhouse Office 2007a) was an example of a voluntary industry-government national environmental co-regulatory initiative.

Finding the appropriate mix of government regulation, self-regulation and co-regulation in environmental matters is a function of their respective costs and benefits (von der Heidt et al. 2008). All three forms of regulation offer benefits. Co-regulation has considerable appeal, because it helps overcome chronic challenges associated with regulation such as problems of rigidity with an overabundance of prescriptive rules by government, and reduction in procedures and outcomes that tend to accompany self-regulation by industry (Haines 2006). Across many industries, there have been calls for more co-regulation, e.g., by European petroleum producers (Walker 2000), automobile insurance (Gambrell 2008), the entertainment industry (Hemphill 2003), alcohol advertising (Hemphill 1998), US securities industry (Donaldson, WH & Pitt 2007), the UK accounting profession (Canniffe 1998), UK financial services (Goddard 1997), and the Canadian banking sector (McInnes 1996).

### **Building a preliminary case for change**

The available literature was supplemented by first-hand industry insights using pilot case studies (Yin 1984). Five rail operators and track owners provided concrete examples of problems caused by current rail environmental regulation. These provided evidence that there is a multiplicity of regulatory regimes and styles of regulation covering rail operations (both train and track). There also appears to be a multiplicity of regulation and regulatory practice for different individual environmental aspects (such as noise, vibration, dust, emissions, etc).

To provide an initial understanding of the general pressures for and against changing current rail environmental regulation, force-field analysis was used. This is a method proposing that two sets of forces operate in any system – forces that operate for change (driving forces) and forces that operate against change (resisting forces). If the two sets of forces are equal in strength, the system is in equilibrium (Robbins et al. 2003). Figure 2 below characterises the main forces for and against rail environmental regulatory change. The length of the arrows for driving and resisting forces indicates their relative strength.

*Figure 2 Force field analysis of rail environmental regulation*

An important part of applying this analysis is arriving at specific ideas regarding how resisting forces can be reduced. Each situation is unique, so creative solutions are required. These would need to be developed subsequently by industry and regulators, preferably in an inclusive manner.

Clearly, forces outside the industry tend to be more difficult to manage, such as Australia's federal system, government policy on environmentalism and transport, government's responsibility for regulating environmental externalities, and recognised difficulties in the abatement of environmental externalities. Internal (industry) factors are more controllable and hence more conducive to change.



The best chance of achieving desired change is to increase the driving forces for change and reduce the resisting forces. Therefore, an interim conclusion was that harmonisation of environmental regulations can potentially be achieved by the following means:

- Strengthening industry's calls for more optimal government frameworks, processes and regulations.
- Strengthening industry's capacity to self-regulate by moving beyond quantitative regulatory targets.
- Working toward overcoming industry fragmentation through appropriate forms of industry cooperation on the matter of regulation.

### **MAPPING OUT RAIL ENVIRONMENTAL REGULATION**

The second phase of the research project involved mapping out or quantifying rail environmental regulations to complete Step 1 of the regulatory reform framework. Data was drawn from a range of sources, including the websites of the government environmental regulator in each jurisdiction and, where available, the environmental legal and other requirements register or compliance register for rail industry members.

As a result, the first comprehensive inventory of rail environmental self-regulation, government regulation and co-regulation pertaining to fifteen environmental impacts of rail across all Australian jurisdictions was developed (CRC for Rail Innovation 2008b). Overall, 151 pieces of environmental primary and subordinate legislation were identified. In addition, 56 pieces of quasi-legislation (e.g., guidelines and strategies) relating to rail's environmental impacts were found. An overview of regulation by type and jurisdiction is shown in Table 1; by type and environmental issue in Table 2. Only nine examples of co-regulation (industry/government cooperation in developing regulation) of environmental issues pertaining to rail were found. In terms of self-regulation, around half of rail organisations are in the process of completing and implementing an environmental management system (EMS) and claim to comply with ISO 14001: 2004, or an equivalent.

*Table 1 Overview of rail environmental regulation by type and jurisdiction*

*Table 2 Overview of rail environmental regulation by type and environmental issue*

In addition, a preliminary assessment of the regulation in accordance with Step 2 of the regulatory reform framework was undertaken. Regulation was evaluated in terms of regulatory burden, regulatory quality and isolated regulatory activity as per the Regulatory Taskforce (2006). The Inventory provided quantitative evidence of a multiplicity of Commonwealth and State-based environmental

regulatory regimes for most of rail's various environmental impacts, indicating considerable scope for improvement in working toward a more effective environmental management and performance framework for Australia's rail industry.

In the spirit of Step 3 of the regulatory reform framework (developing, appraising and implementing regulatory reform options), fourteen possible improvements to rail environmental regulation were recommended as being worthy of further investigation. These recommendations were classified within (1) strengthening industry's ability to self-regulate, (2) strengthening co-regulation by industry and state/federal government regulators, and (3) improving government regulation (CRC for Rail Innovation 2008b).

### **STAKEHOLDER VIEWS ON RAIL ENVIRONMENTAL REGULATION**

To gain a decent understanding of individual rail and government regulators' viewpoints on rail environmental regulation that may yield lessons for others, a qualitative style of research was called for. The qualitative research interview attempts to understand the world from the subject's point of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations (Kvale & Brinkmann 2009). Because it allowed for knowledge to be constructed in the interaction between the interviewer and the interviewee, the 'inter-view' was an appropriate way to explore with the participant the problems associated with the efficacy of the current regime of environmental regulation, opportunities to reform the regime in terms of the three regulatory models (self-regulation, government regulation and co-regulation) and any other 'wish list' items with regard to rail environmental regulation.

The interview research followed Kvale and Brinkmann's (2009) recommended systematic, seven-step progression to ensure that it lives up to scientific criteria, taking into account the ethical aspects of the investigation: (1) thematising, (2) designing, (3) interviewing, (4) transcribing, (5) analysing, (6) verifying and (7) reporting. A total of 36 sixty to ninety minute face-to-face interviews were conducted with 41 people (some interviews involved two or more interviewees) at senior or middle-management levels from 28 organisations across Australia of which 16 (24 interviews) were rail organisations and 12 (12 interviews) were government organisations. The person/persons interviewed was/were recommended as the most knowledgeable within that organisation on the subject of environmental regulations pertaining to rail. The transcribed interviews were analysed by coding of meaning through categorisation, which was facilitated by NVIVO software. The results obtained are extensive and rich presenting a challenge to concise reporting<sup>4</sup>. Selected key findings are set out below

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<sup>4</sup> As with the other research phases, for complete findings, the reader is referred to the original research report.

to give readers a flavour of the qualitative research undertaken (for full results, see CRC for Rail Innovation 2009 (forthcoming)).

### **Views on effectiveness of current regime**

The need for improved rail environmental regulation was mentioned by just over half of the participants (52%). Indeed, it was strongly advocated by rail track owners/operators (7 cases), government environmental regulators (5 cases), other rail (4 cases) and rail operators (3 cases). Both environmental and transport government regulators and agencies expressed some indecision as to the exact nature of the regulatory problems experienced by rail. Within five of the six stakeholder groups, at least two interviewees indicated that there was no need for improving the present regime.

Five key areas of strength of existing regulation were described by participants, these being: (1) some good working relationships between rail and environmental regulators and between some environmental and transport regulators, (2) competence of regulators, (3) good regulatory tools, (4) better environmental outcomes, and (5) a more holistic transport perspective. On the other hand, eighteen problem areas or weaknesses were identified by interviewees. Table 3 presents a ranked list of the top ten issues in terms of the number of interview cases and the total number of references mentioning each weakness.

*Table 3 Weaknesses and contextual problems with rail environmental regulation*

### **Preferred rail environmental regulatory model**

Some of the notable views expressed by participants with regard to each of the three main forms of regulation are as follows.

#### *Self regulation*

A range of self-regulatory initiatives are currently practised by the rail industry, which reflects the view that the industry is probably best placed to manage its own impact on the environment; yet it needs to put in place environmental management systems that effectively manage risk and meet State-based legislation. However, there is also a view that the environmental regulatory regime is beyond self-regulation.

Overall, codes of practice (COP) or guides to leading practice as a form of self-regulation were generally viewed favourably by government and rail organisations. However, half the participants (18 - 12 rail and 6 government) expressed misgivings about self-regulation in general, and COPs in particular. As set out below, there was a variety of reasons for this perception, such as lack of market

drivers to correct third party effects, difficulty in reaching agreement on standards, poor implementation, legal implications, lack of currency, and fear of inoperably high standards.

A wide range of considerations for improving industry self-regulation, including COPs and industry forums were volunteered by rail and government participants – level of standards to be applied (high or low), leadership (industry or government), national application, extent of representation, level of detail and implementation issues.

### *Co-regulation*

Most participants were aware of the basic concept of co-regulation as regulation involving some degree of self-regulation, with government providing some measure of oversight. The philosophical approaches to this idea did not vary significantly across governments and between industry and government, as found by the NTC in preparing the rail safety regulation regulatory impact statement (NTC - National Transport Commission with Booz and Company 2009). Some participants, however, struggled to categorise a particular regulatory initiative as either co-regulatory or government regulation. Another State government participant suggested that, regardless of whether the regulation is classified as self- or co-regulatory, there will always be some overarching legislation as a fall-back.

A significant finding was that the majority of participants (26 out of 36 cases or 72%) stated that their preferred model of rail environmental regulation was co-regulation. A breakdown of these cases provided in Figure 3 shows that support for co-regulation can be found across all stakeholder groups and jurisdictions. This suggests that any improvement of rail environmental regulation involving all parties is likely to succeed.

### *Figure 3 Pro co-regulation cases – by stakeholder type and jurisdiction*

Four key reasons were given for favouring co-regulation, these being that it (1) promotes better understanding between rail and regulator, (2) represents a middle-ground between self-regulation and solely government regulation, (3) permits more flexibility, and (4) is appropriate given the present degree of maturity of industry and industry structure.

More than half of the participants (19 cases) – mostly rail and state environmental government departments – could name or describe examples of current co-regulatory efforts. A range of examples were cited by participants, including forums (e.g., Rail Industry Environment Committee), guidelines (e.g., Interim Guidelines on the Abatement of Noise from Rail Infrastructure), state planning policies, conferences, and close working relationships between the individual rail organisation and the regulators.

Participants offered a range of views regarding how to address the problems with some of the current co-regulatory efforts and improve co-regulation of rail's environmental impacts in general. One group of suggestions related to the characteristics of appropriate co-regulatory forums, such as representation, scope and leadership. Another set of suggestions considered the values inherent in co-regulation and how rail could better demonstrate its worthiness as a partner in co-regulation.

#### *Government regulation*

Five government and rail participants spoke out in favour of government-led rail environmental regulatory change. On the other hand, four rail participants rejected the idea. They pointed to the lack of government proactiveness and understanding of the rail industry, as well as reduced opportunities for rail involvement in regulation.

Participants were asked which level of government – state, federal or both – should drive rail environmental regulatory change. The majority of participants who responded to this question preferred government-led rail environmental regulatory reform at the national level. Some participants preferred a combined State/Local and Commonwealth government approach. Several interviewees were more in favour of State-level regulation. Opinions expressed by rail tend to have resulted from disappointing experiences with national approaches. State government participants also tended to be pro State-based regulation. Hence, the continuation with regulation at the State level appears to be more pragmatic, while national regulation is more idealistic.

A Commonwealth participant suggested that any regulatory reform is likely to proceed incrementally, will need to pass cost-benefit analysis, and will need to involve Federal and State governments. The comments by participants also indicated that the process of bringing a public case for regulatory reform (e.g., via a regulator or State/Federal Minister) needs to be better understood by industry and State governments.

#### **Wish list for rail environmental regulatory reform**

When asked to outline their wish list for improving rail environmental regulation, the participants identified fifteen main types of suggestions, which complement the suggestions made in relation to the preferred regulatory model described in the previous section. The top five 'wishes' ranked by number of cases for (1) a more wholistic and long-term approach to transportation, (2) more standardisation, (3) more industry competence, (4) more rigorous regulation, and (5) better noise regulations. Notable is that some wish list items are to do more with the transportation context than with rail environmental regulation. For instance, half of the participants wished for a more long-term and national view of all

transport modes, which was the subject of a recent NTC study into improving the co-modal supply chain (NTC - National Transport Commission and Booz&Co 2009).

### **DISCUSSION AND CONCLUSION**

With limited prior data in relation to the phenomenon of existing rail environmental regulation and possibilities for reform, the research problem faced by the research team was complex and ill-defined. This paper has highlighted how a triangulated mixed method, multi-stage design was used to address the research objective. The research has delivered quantitative and qualitative outcomes for the spectrum of regulatory options (self-regulation, co-regulation, government regulation) and represented the range of stakeholder types (rail and government at both state and national levels) with an interest in the issue. This paper has also outlined how the three-step framework for regulatory reform – mapping out the regulatory environment, evaluating regulations and developing, appraising and implementing regulatory reform options – was applied in the context of rail environmental regulation.

By drawing on multiple sources of data and using these data sources in reporting of the results, a genuinely mixed method, triangulated study has been achieved. The picture of rail environmental regulation in Australia is more complete. While each method produced its own unique insights, it is notable that all three research phases point to the opportunity for more rail environmental co-regulation. Government regulation tends to dominate the regulatory landscape, especially in the field of environmental regulation (where regulation exists at local, state and federal levels). Yet there appears to be considerable opportunity for organisations and industries to improve self-regulation and for industries and government to coordinate regulatory initiatives. Such self- and co-regulation initiatives are likely to more effective drivers of regulatory harmonisation and leading practice in industry than multi-jurisdictional government regulation (Eisner 2004). The incentive, here, is for industry to pre-empt regulatory change that could manifest itself in a potentially unpalatable form, and at the same time set the basis for a future regulatory response that has widespread industry and regulator acceptance, thereby ensuring high levels of compliance.

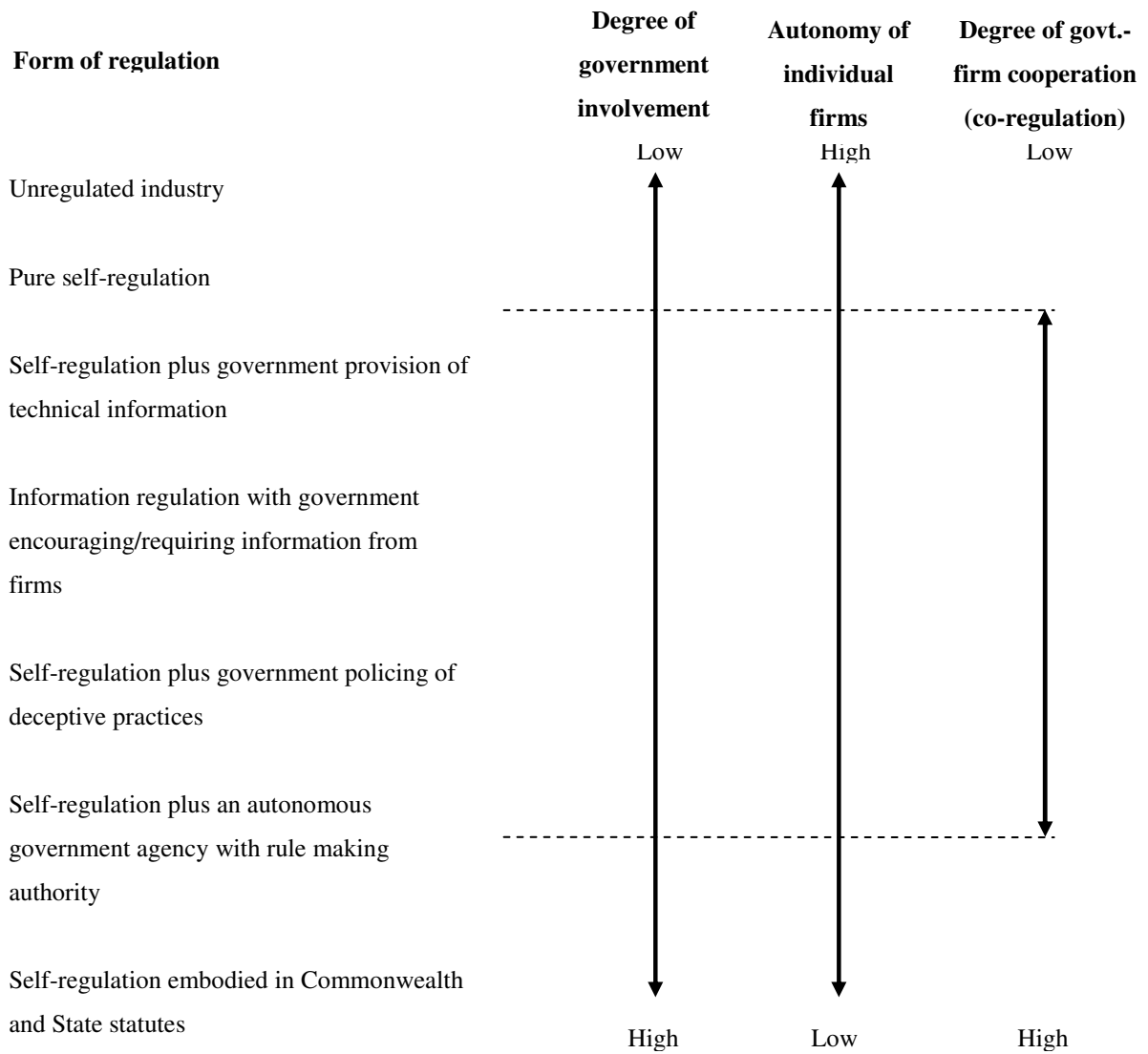
If it is assumed that the results are properly communicated to stakeholders, this approach should meaningfully inform the industry case for rail environmental regulatory reform and provide useful policy direction to industry and government decisions. For instance, the research results can feed in to a cost-benefit analysis of regulatory reform and a possible regulatory impact statement for a single, national rail environmental framework, as has recently been proposed by the NTC for rail safety and investigation regulation.

The three-step regulatory reform framework is a generic process, which may be applied in any regulatory environment. It is our hope that this illustration of research for rail environmental reform will be used by other sectors or for other aspects of rail transport regulation. Clearly, the ability of industry participants to work through the issues collaboratively within the industry and, later, with appropriate regulators will determine the degree of success in any change initiatives. Indeed, the majority of participants from both regulator and industry groups preferred, in principle, a co-regulatory model of regulatory reform. They expressed a keen interest in trying to work more cooperatively towards a more synthesised, nationally-consistent approach to environmental regulation.

A potentially optimal scenario would be for industry to initiate the regulatory reform process by developing guides to leading practice that overcome regulatory inconsistency among various jurisdictions. This done, these principles of leading practices can form a convenient normative benchmark for subsequent governmental regulatory reform, including overarching national regulation. Here, the challenge is to ensure that regulatory agencies, as crucial stakeholders, endorse industry-led reform before it is implemented, not only because this has the potential to generate greater overall industry commitment than might otherwise be the case, but also because it commits the regulators to being part of an industry-led regulatory reform that is pleasing to all stakeholders, in as much as this is possible.

**TABLES AND FIGURES**

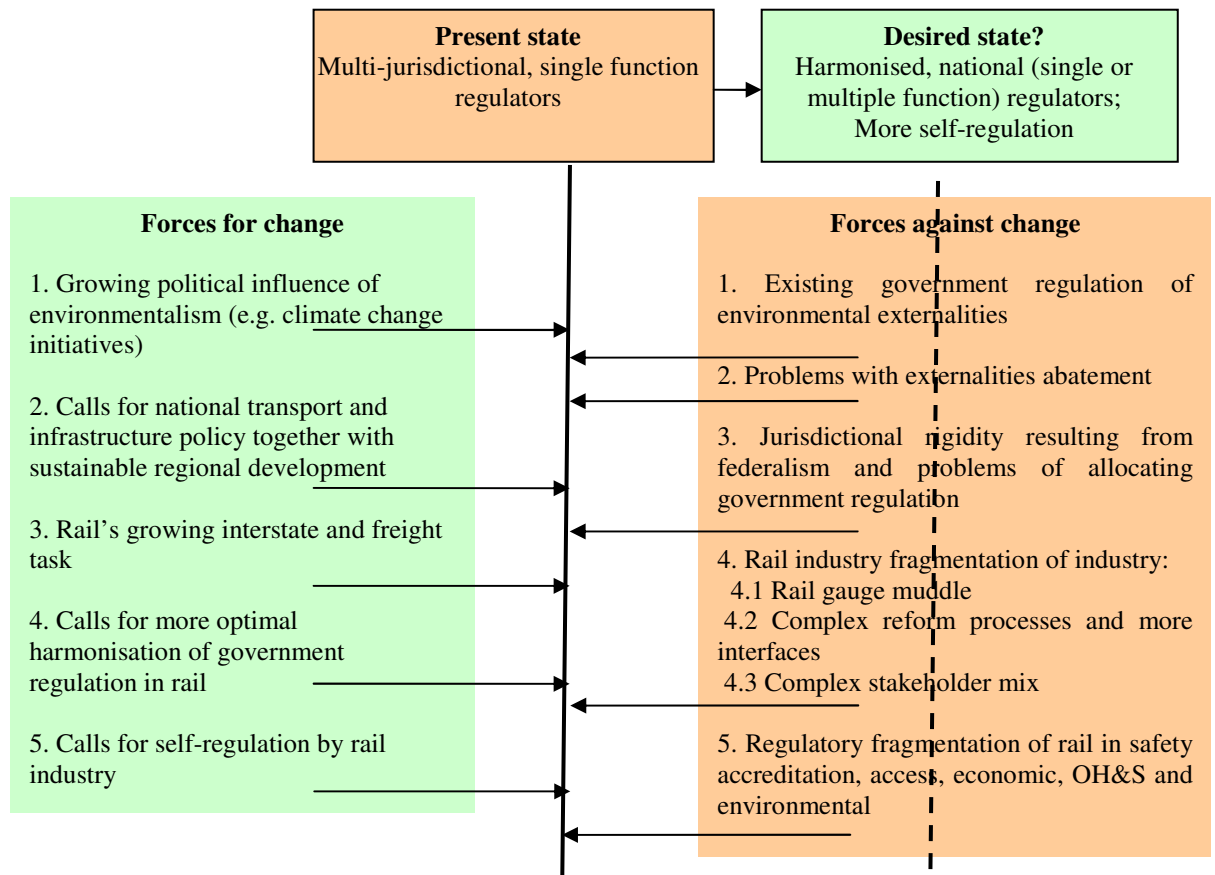
*Figure 1 Regulatory spectrum*



(Adapted from Garvin 1983; Gunningham, Neil 2004b)



Figure 2 Initial force field analysis of rail environmental regulation



(CRC for Rail Innovation 2008a)

Table 1 Overview of rail environmental regulation by type and jurisdiction

Jurisdiction	Legislation	Quasi-legislation	Co-regulation	Self-regulation
Western Australia (WA)	26	22	0	2
New South Wales (NSW)	24	9	3	5
Victoria (VIC)	24	7	2	3
Queensland ((QLD)	21	2	0	3
South Australia (SA)	17	2	1	0
Tasmania (TAS)	10	3	1	0
Australian Capital Territory (ACT)	8	0	0	0
Northern Territory (NT)	6	1	0	0
Commonwealth	15	10	2	14
<b>Total</b>	<b>151</b>	<b>56</b>	<b>9</b>	<b>27</b>

*Table 2 Overview of rail environmental regulation by type and environmental issue*

<b>Environmental issue</b>	<b>Legislation</b>	<b>Quasi-legislation</b>	<b>Co-regulation</b>	<b>Self-regulation</b>
General	21	5	-	1
Air pollution emissions	20	4	-	1
Waste efficiency	18	4	-	1
Flora and fauna (biodiversity)	16	4	1	1
Sustainable development	16	17	1	2
Land contamination	14	3	-	1
Water efficiency	11	3	1	1
Noise emissions	10	3	4	3
Water quality	9	1	-	1
Pest management	5	2	1	1
Ozone	4	-	-	1
Land degradation	4	-	-	1
Energy use	2	4	-	1
GHG emissions	1	2	1	1
Visual amenity	-	2	-	2
EM and compliance	-	-	-	8
<b>Total</b>	<b>151</b>	<b>56</b>	<b>9</b>	<b>27</b>

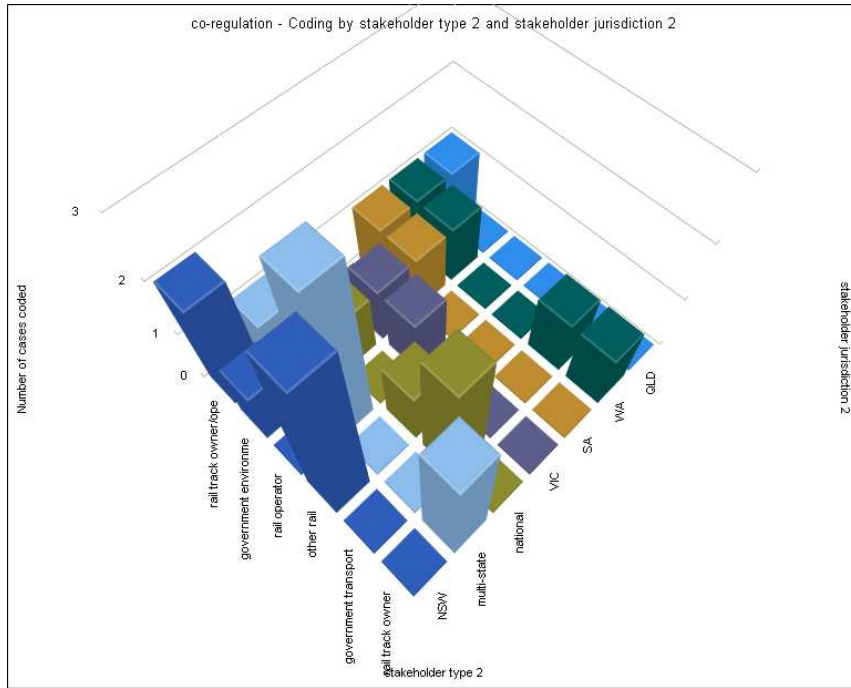
(CRC for Rail Innovation 2008b)

*Table 3 Weaknesses and contextual problems with rail environmental regulation*

	<b>Weakness</b>	<b>Number of cases referring to weakness (out of 36)</b>	<b>Number of total references</b>
1	Different standards for each state	25	64
2	Poor regulation of noise	16	28
3	Lack of understanding between rail and regulators	15	29
4	Severity of legislation	14	33
5	Lack of long-term infrastructure planning	14	23
6	Inequitable treatment of road vs. rail	13	25
7	Lack of regulatory rigour	13	22
8	Lack of industry competence	11	30
9	Excessive cost to industry	9	23
10	Poor interagency cooperation	9	17

(CRC for Rail Innovation 2009 (forthcoming))

Figure 3 Pro co-regulation cases – by stakeholder type and jurisdiction



(CRC for Rail Innovation 2009 (forthcoming))

## REFERENCES

- ATC - Australian Transport Council 2008, *National Transport Policy Framework: A new beginning*, February, <<http://www.ntc.gov.au/DocView.aspx?documentid=01639>>.
- Babbie, E 1989, *The Practice of Social Research*, 5th edn, Wadsworth/Thompson, Belmont, CA.
- BCA - Business Council of Australia 2007, *A Scorecard of State Red Tape Reform*.
- BTRE - Bureau of Transport and Regional Economics, ARA 2006, *Report 114: Optimising Harmonisation in the Australian Railway Industry*, September.
- Canniffe, M 1998, 'Winds of change sweep across regulation', *Accountancy Ireland*, vol. 30, no. 1, pp. 6-7.
- Carson, D, Gilmore, A, Perry, C & Gronhaug, K 2001, *Qualitative Marketing Research* Sage, London.
- COAG - Council of Australian Governments 2006, *Communique 10 February*, <<http://www.coag.gov.au/meetings/>>.
- CRC for Rail Innovation 2008a, *Environmental regulations pertaining to rail: Toward a case for change*, T. von der Heide, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, R. Piamsa-Art, Brisbane, August, <<http://www.railcrc.net.au/>>.
- 2008b, *An inventory of environmental regulation pertaining to rail in Australia*, T. von der Heide, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, Brisbane, October, <<http://www.railcrc.net.au/>>.
- 2009 (forthcoming), *Stakeholder views on rail environmental regulation in Australia*, T. von der Heide, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, Brisbane, <<http://www.railcrc.net.au/>>.
- de Bruijn, H & Dicke, W 2006, 'Strategies for safeguarding public values in liberalised utility sectors', *Public Administration*, vol. 84, no. 3, pp. 717-35.
- DEWR - Department of the Environment and Water Resources & AGO - Australian Greenhouse Office 2007a, *Greenhouse Challenge Plus Reporting Guidelines*, January, <<http://www.environment.gov.au/>>.
- Donaldson, T & Preston, LE 1995, 'The stakeholder theory of the corporation: Concepts, evidence, and implications', *Academy of Management Review*, vol. 20, no. 1, pp. 85-91.
- Donaldson, WH & Pitt, HL 2007, 'Outdated and inefficient', *The Wall Street Journal*, no. January 6, p. A.7.
- Eisner, MA 2004, 'Corporate environmentalism, regulatory reform and industry self-regulation: Toward genuine regulatory reinvention in the United States', *Governance: An International Journal of Policy, Administration and Institutions*, vol. 17, no. 2, pp. 145-67.
- Freeman, RE 1984, *Strategic Management: A Stakeholder Approach*, Pitman, Marshfield, MA.
- Gambrill, D 2008, 'Need for speed', *Canadian Underwriter*, vol. 75, no. 5, pp. 10-8.
- Garvin, DA 1983, 'Can industry self-regulation work?' *California Management Review*, vol. 25, no. 4, pp. 37-52.
- Goddard, S 1997, 'Lloyd's self-regulation on way out?' *Business Insurance*, vol. 31, no. 21, pp. 21-2.
- Gunningham, N 2004a, 'Best practice rail safety regulation', National Research Centre for OHS regulation, <<http://ohs.anu.edu.au/publications/pdf/wp%2031%20-%20Gunningham.pdf>>.
- 2004b, 'Reconfiguring environmental regulation: Next generation policy instruments', *Regulatory Institutions Network, Australian National University*, <[http://www.idrc.ca/en/ev-110171-201-1-DO\\_TOPIC.html](http://www.idrc.ca/en/ev-110171-201-1-DO_TOPIC.html)>.
- Gunningham, N & Rees, J 1997, 'Industry self-regulation: An institutional perspective', *Law and Policy*, vol. 19, no. 4, pp. 363-414.
- Haines, F 2006, 'Regulatory failures and regulatory solutions: A characteristic analysis of meta-regulation', paper presented to In Proceedings Annual Meeting, Law and Society Association, Baltimore, MD, <<http://eprints.infodiv.unimelb.edu.au/archive/00004200/>>.
- Hanson, D & Grimmer, M 2005, 'The mix of qualitative and quantitative research in major marketing journals, 1993-2002', *European Journal of Marketing*, vol. 41, no. 1/2, pp. 58-70.

- Hemphill, TA 1998, 'Harmonising alcohol ads: Another case for industry self-regulation', *Regulation*, vol. 21, no. 3, pp. 55-62.
- 2003, 'Self-regulation, public issue management and marketing practices in the US entertainment industry', *Journal of Public Affairs*, vol. 3, no. 4, p. 338.
- Jaworski, B, Kohli, AK & Sahay, A 2000, 'Market-driven versus driving markets', *Journal of Academy of Marketing Science*, vol. 28, no. 1, pp. 45-54.
- Koppenjan, J, Charles, M & Ryan, N 2008, 'Managing competing public values in public infrastructure projects', *Public Money & Management*, vol. 29, no. 3, pp. 131-4.
- Kvale, S & Brinkmann, S 2009, *Interviews: Learning the Craft of Qualitative Research Interviewing*, second edn, SAGE Publications, Thousand Oaks, CA.
- Lennox, MJ & Nash, J 2003, 'Industry self-regulation and adverse selection: A comparison across four trade association programs', *Business Strategy and the Environment*, vol. 12, no. 6, pp. 343-56.
- Majone, G 1994, 'The rise of the regulatory state in Europe', *West European Politics*, vol. 17, no. 3, pp. 77-101.
- McInnes, D 1996, 'Can self-regulation succeed', *Canadian Banker*, vol. 103, no. 2, pp. 30-6.
- Neumann, WL 2003, *Social Research Methods*, 5th edn, Pearson Education, Boston, MA.
- NTC - National Transport Commission and Booz&Co 2009, *Final Report - Towards Co-modalism: Capacity constraints & supply chain performance - Intermodal*, Melbourne, 27 January.
- NTC - National Transport Commission with Booz and Company 2009, *Single, national rail safety and regulatory investigation framework: Regulatory Impact Statement*, Melbourne.
- PC - Productivity Commission 2006, *Road and Rail Infrastructure and Pricing*, Inquiry Report 41, AGPS, Canberra, 22 December.
- 2007a, *Performance benchmarking of Australian business regulation*, Productivity Commission Research Report, Melbourne, 19 February.
- Regulation Taskforce 2006, *Rethinking Regulation: Report of the Taskforce on Reducing Regulatory Burdens on Business*, Report to the Prime Minister and the Treasurer, Canberra, January
- Robbins, S, P., Bergman, R, Stagg, I & Coulter, M 2003, *Management*, 3rd edn, Pearson Education, Frenchs Forest NSW.
- von der Heide, T, Charles, M, Ryan, R & Hughes, B 2008, 'Managing environmental regulations for the 21st century: Challenges and opportunities in an Australian industry context', in M Wilson (ed.), *Australian and New Zealand Academy of Management (ANZAM) Conference Auckland*, p. 23.
- Walker, M 2000, 'The three Cs', *Chemical Market Reporter*, vol. 258, no. 14, pp. 16-8.
- Yin, RK 1984, *Case study research*, Sage Publications, Beverly Hills.

## **Mixed method research to inform regulatory reform: The case of rail environmental regulation**

### **ABSTRACT**

*For the Australian rail industry environmental regulation is a regulatory hotspot. A project was initiated to investigate the case for rail environmental regulatory reform. The three-phase, mixed-methodologies project included pilot case studies, review of academic literature and industry records and in-depth interviewing. This paper reports the key findings from each phase. The discussion also addresses a three-step framework for regulatory reform, which aims to map and assess existing regulatory regimes and develop sound reform options. The quantitative and qualitative findings from all three research phases suggest that the time is ripe for a more co-regulatory approach to rail environmental regulation. The paper is of interest to managers and regulators striving for more sustainable regulatory approaches.*

**Keywords:** sustainability and social issues in management, strategic management, organisational change, self-regulation; government regulation; co-regulation, qualitative research interview, stakeholder theory

### **INTRODUCTION**

The volume and reach of the regulation of business activities, including their environmental impacts, has expanded rapidly over recent years. While regulation is an important vehicle for achieving national economic, social and environmental (i.e., triple-bottom-line) objectives, the Regulations Taskforce (2006) argued that much regulation is poorly justified and implemented. The thorniest problem emanating from the rise in environmental policy enthusiasm is that it may result in regulatory over-burdening or unilateral decision-making on the part of regulators, with the potential result of reducing confidence levels with respect to doing business or investing in Australia. This situation could add further levels of complexity in dealing with sustainability issues and thereby reduce efficiency and discourage investment in key sectors, such as transport and utilities that see to the realisation of important public values (de Bruijn & Dicke 2006; 2008).

The need for general regulatory reform in Australia has been widely acknowledged. The Council of Australian Governments (COAG) is committed to regulatory and red-tape reduction under the National Reform Agenda and to a simpler and consistent national system of economic regulation for nationally significant infrastructure under the Competition and Infrastructure Reform Agreement (2006). Likewise, the Productivity Commission (2006; 2007a) recognised a need for much greater national consistency in economic and non-economic regulatory frameworks. In a broad-based review

of national regulation undertaken by the Taskforce on Reducing Regulatory Burdens on Business (2006), a number of priority reforms to existing regulation were identified. Furthermore, business is also closely monitoring governments' regulatory performance using the Business Council of Australia's (BCA) Scorecard of State Red Tape Reform (2007).

This paper outlines the research undertaken to explore and assess the case for environmental regulatory reform in the Australian rail industry. The methodologies employed and some key results from each of the three research phases are presented in turn. This is followed by a brief discussion of the implications for rail environmental regulatory reform and business regulatory reform in general.

### **The rail transport environmental regulation context**

The Australian rail industry consists of a complex network of urban, regional and interstate operations and owners and has been profiled in a range of recent publications (e.g. BTRE - Bureau of Transport and Regional Economics 2006; CRC for Rail Innovation 2008a; NTC - National Transport Commission with Booz and Company 2009). Ranged against this background are separate regulatory regimes for safety, access and economic functions and environmental impacts, all of which are overseen by a mix of State government agencies and the Commonwealth. Within the rail industry, these various regimes are regarded as leading to inefficiencies, while the need to comply with different and sometimes contradictory laws is believed to create unnecessary red tape.

The Australian Transport Council (ATC)<sup>1</sup> agreed that there is a need for a national approach to transport policy and thus endorsed the National Transport Policy Framework (ATC - Australian Transport Council 2008). The National Transport Commission (NTC) was established as an independent body to assist Australian governments in leading transport regulatory reform nationally in order to meet the needs of transport users and the broader community for safe, efficient and sustainable land transport. To this end, the NTC has undertaken a number of rail initiatives, most of which relate to safety, worker health and productivity.

The latest rail-related regulatory reform development is currently in the area of rail safety. In 2006, COAG identified rail safety regulation as a cross-jurisdictional 'regulatory hotspot' where overlapping and inconsistent regulatory regimes were impeding economic activity. As directed by the ATC, the NTC (2009) recently prepared and published a regulatory impact statement (RIS) for the single, national rail safety and investigation framework.

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<sup>1</sup> The ATC consists of transport ministers from federal, state and territory governments. It is the ministerial forum for the coordination and integration of transport policy issues at a national level.

The handling of rail safety regulation reform may be instructive for rail environmental regulation. Like rail safety regulation, it is perceived by the industry to be in thorough need of improvement. As discussed elsewhere (von der Heidt et al. 2008), the desire for environmental regulator reform arises from the problem of allocating regulation under the framework of Australian federalism and the diffuse nature of regulation to abate environmental externalities. Yet no government or industry initiative had fully investigated the nature and burden of environmental regulation imposed on Australian business.

To investigate this need and to, potentially, influence the structure of regulation to increase the rail industry's competitive position (Jaworski, Kohli & Sahay 2000), the Cooperative Research Centre (CRC) for Rail Innovation initiated a project to examine the case for reforming environmental regulation pertaining to rail. To gain a more complete picture of rail environmental regulation, a triangulated mixed method study<sup>2</sup> was designed (see, for example, Babbie 1989; Berg 2007; Neumann 2003). The project was conducted in three phases over approximately 18 months:

1. A review of academic and industry literature as well as pilot case studies to develop initial insight into the nature of rail environment regulation and the business case for change.
2. A review of internal rail firm documents, government and academic literature to map (inventory) and evaluate current rail environmental regulations in Australia
3. Qualitative in-depth interviews with key rail and regulator stakeholders to gain insight into their assessments of current rail environmental regulation and reform possibilities.

In terms of Hanson and Grimmer's (2005) continuum of quantitative and qualitative research, the first project phase adopted a 'softer' version of positivism, i.e. objective reality exists but epistemologically the techniques used produce uncertain understandings. Although not conventionally quantitative, the second phase was dominated by a 'harder' positivist ontology. An objective reality regarding the quantity and distribution of rail environmental regulation was inferred with knowledgable degrees of certainty. A qualitative style of research, in which there is a concentration on understanding and interpretation, was undertaken for the third project phase. With its relativist ontology (each person has his or her own identity) and rejection of objectivity, this methodology is best described as constructionism (Carson et al. 2001).

The outcomes of each of these three phases go toward developing a case for rail environmental regulatory reform. This will assist the rail industry in strategically managing not only its environmental impacts but also its stakeholder relationships with regulators and the public, which is critical to business success (Donaldson & Preston 1995; Freeman 1984). Together the research phases

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<sup>2</sup> Triangulation is conventionally defined as the use and reporting of multiple data gathering techniques (usually three) to investigate the same phenomenon.



contribute to the simple three-step process for achieving environmental regulatory reform in Australia (von der Heide et al. 2008): (1) Mapping out the regulatory environment, (2) evaluating regulations, and (3) developing, appraising and implementing regulatory reform options.

### **INVESTIGATING THE CASE FOR CHANGE**

An in-depth review of the rail industry, regulation and environmental literature indicated that there was little published information and understanding regarding the nature and extent of inconsistencies in environmental legislation and regulation that impact on Australian railway operations (CRC for Rail Innovation 2008a). However, some inroads could be made toward mapping the key environmental regulatory areas of interest (e.g., greenhouse gas emissions, air pollution, noise, dust, site contamination, biodiversity conservation) as per Step 1 of the regulatory reform framework. This stage of the research involved exploring the distinctions between the three forms of regulation (government, self-regulation and mixed regulatory strategies, namely co-regulation), as well as their relative costs and benefits.

#### **Recapping regulation concepts**

Since there is no immediate profit incentive, private corporations have traditionally tended to provide too little self-regulation, while governments have sometimes provided too much, thereby reducing the competitiveness of certain industry sectors and discouraging adequate levels of investment (Majone 1994). A balance between these two outcomes may be achieved by requiring firms within an industry to provide their own regulation (self-regulation), i.e., control their collective behaviour through a voluntary association of firms (Lennox & Nash 2003), or through the adoption of operational and technical standards, working practices or processes (PC 2006). Typically, government does not participate in regulatory development, implementation and enforcement, which (in this case) is carried out by means of social control at an industry and/or organisational level (Gunningham & Rees 1997). Environmental self-regulation may take a number of forms, including internalisation of externalities (e.g., investing in lower emission technology), organisation-wide environmental management policies and environment management plans for particular projects and developing and promoting industry standards for environmental impacts.

The range of regulatory strategies can be arrayed in a systematic and more finely calibrated way, as shown in Figure 1. Those at the top of the figure have the smallest government role, while those at the bottom have the largest. The strategies lying midway across the spectrum represent mixed systems of various kinds, including forms of co-regulation. The respective costs and benefits of the three main regulatory forms are summarised in Table 1.

*Figure 1 Regulatory spectrum**Table 1 Regulatory spectrum*

As the least understood, but potentially most promising form of regulation, co-regulation warrants further attention. Co-regulation is a system in which some of the responsibilities for regulatory development, implementation and/or enforcement are *shared* between industry groupings and governments (BTRE - Bureau of Transport and Regional Economics 2006)<sup>3</sup>. Typically, the regulator sets the goals and the regulated entity determines how it will achieve the goals (NTC - National Transport Commission with Booz and Company 2009). Co-regulation has also been described as “risk-managing the risk management of individual enterprises” (Gunningham 2004a, p. 11), hence ‘meta risk management’ or ‘meta-regulation’ (Haines 2006; Parker 2002). It is only if the self-regulation and risk management of the industry is closely scrutinized by government with the threat of more direct intervention if it fails, that an enterprise is likely to take effective action (Gunningham 2004a).

Co-regulation is based on an interorganisational collaborative process, rather than a ‘top-down’ edict by senior management (Haines 2006) or a single organisation. Personnel within organisations, together with key stakeholders, develop processes and procedures for risk management while engendering ‘pro-compliance’ motivational postures within the regulated site, so that the risk reduction goal of the regulator will be achieved, if not exceeded (Parker 2002). The ultimate aim of such an approach is that risk reduction in areas specified by the regulator will become institutionalised within the company, and thus will become part of the nature and culture of the particular organisation or worksite. By influencing the system of internal self-regulation, ‘reflexive regulation’ is facilitated and encouraged (Gunningham 2004a). A co-regulatory regime and its innovative nature and success can also be seen as an indicator of a high level of trust between government and industry (Dignam 2007). By contrast, in the absence of trusting relationships between independent parties or pro co-regulation motivational postures, a meta-regulatory approach may be unsuited (Gunningham 2004a; Parker 2002).

On the whole, co-regulation has considerable appeal, because it helps overcome chronic challenges associated with regulation such as problems of rigidity with an overabundance of prescriptive rules by government, and reduction in procedures and outcomes that tend to accompany self-regulation by industry (Haines 2006). Hence, across many industries, there have been calls for more co-regulation, e.g., by European petroleum producers (Walker 2000), automobile insurance (Gambrell 2008), the entertainment industry (Hemphill 2003), alcohol advertising (Hemphill 1998), US securities industry

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<sup>3</sup> Greenhouse Challenge Plus (GCP) (DEWR - Department of the Environment and Water Resources & AGO - Australian Greenhouse Office 2007a) was an example of a voluntary industry-government national environmental co-regulatory initiative.

(Donaldson, WH & Pitt 2007), the UK accounting profession (Canniffe 1998), UK financial services (Goddard 1997) and the Canadian banking sector (McInnes 1996).

Clearly, no single regulatory approach can remove the gap between regulatory expectation and the behaviour of the regulated organisation (Haines 2006). Finding the appropriate mix of government regulation, co-regulation and self-regulation is a challenge for policy makers and requires an assessment of their respective costs and benefits (von der Heidt et al. 2008) for any given set of circumstances (Gunningham 2004a).

### **Building a preliminary case for change**

The available literature was supplemented by first-hand industry insights using pilot case studies (Yin 1984). Five rail operators and track owners provided concrete examples of problems caused by current rail environmental regulation. These provided evidence that there is a multiplicity of regulatory regimes and styles of regulation covering rail operations (both train and track). There also appears to be a multiplicity of regulation and regulatory practice for different individual environmental aspects (such as noise, vibration, dust, emissions, etc).

To provide an initial understanding of the general pressures for and against changing current rail environmental regulation, force-field analysis was used. This is a method proposing that two sets of forces operate in any system – forces that operate for change (driving forces) and forces that operate against change (resisting forces). If the two sets of forces are equal in strength, the system is in equilibrium (Robbins et al. 2003). Figure 2 below characterises the main forces for and against rail environmental regulatory change. The length of the arrows for driving and resisting forces indicates their relative strength.

*Figure 2 Force field analysis of rail environmental regulation*

An important part of applying this analysis is arriving at specific ideas regarding how resisting forces can be reduced. Each situation is unique, so creative solutions are required. These would need to be developed subsequently by industry and regulators, preferably in an inclusive manner.

Clearly, forces outside the industry tend to be more difficult to manage, such as Australia's federal system, government policy on environmentalism and transport, government's responsibility for regulating environmental externalities, and recognised difficulties in the abatement of environmental externalities. Internal (industry) factors are more controllable and hence more conducive to change. The best chance of achieving desired change is to increase the driving forces for change and reduce the resisting forces. Therefore, an interim conclusion was that harmonisation of environmental regulations can potentially be achieved by the following means:

- Strengthening industry's calls for more optimal government frameworks, processes and regulations.
- Strengthening industry's capacity to self-regulate by moving beyond quantitative regulatory targets.
- Working toward overcoming industry fragmentation through appropriate forms of industry cooperation on the matter of regulation.

### **MAPPING OUT RAIL ENVIRONMENTAL REGULATION**

The second phase of the research project involved mapping out or quantifying rail environmental regulations to complete Step 1 of the regulatory reform framework. Data was drawn from a range of sources, including the websites of the government environmental regulator in each jurisdiction and, where available, the environmental legal and other requirements register or compliance register for rail industry members.

As a result, the first comprehensive inventory of rail environmental self-regulation, government regulation and co-regulation pertaining to fifteen environmental impacts of rail across all Australian jurisdictions was developed (CRC for Rail Innovation 2008b). Overall, 151 pieces of environmental primary and subordinate legislation were identified. In addition, 56 pieces of quasi-legislation (e.g., guidelines and strategies) relating to rail's environmental impacts were found. An overview of regulation by type and jurisdiction is shown in Table 1; by type and environmental issue in Table 2. Only nine examples of co-regulation (industry/government cooperation in developing regulation) of environmental issues pertaining to rail were found. In terms of self-regulation, around half of rail organisations are in the process of completing and implementing an environmental management system (EMS) and claim to comply with ISO 14001: 2004, or an equivalent.

*Table 1 Overview of rail environmental regulation by type and jurisdiction*

*Table 2 Overview of rail environmental regulation by type and environmental issue*

In addition, a preliminary assessment of the regulation in accordance with Step 2 of the regulatory reform framework was undertaken. Regulation was evaluated in terms of regulatory burden, regulatory quality and isolated regulatory activity as per the Regulatory Taskforce (2006). The Inventory provided quantitative evidence of a multiplicity of Commonwealth and State-based environmental regulatory regimes for most of rail's various environmental impacts, indicating considerable scope for improvement in working toward a more effective environmental management and performance framework for Australia's rail industry.

In the spirit of Step 3 of the regulatory reform framework (developing, appraising and implementing regulatory reform options), fourteen possible improvements to rail environmental regulation were recommended as being worthy of further investigation. These recommendations were classified within (1) strengthening industry's ability to self-regulate, (2) strengthening co-regulation by industry and state/federal government regulators, and (3) improving government regulation (CRC for Rail Innovation 2008b).

### **STAKEHOLDER VIEWS ON RAIL ENVIRONMENTAL REGULATION**

To gain a proper understanding of individual rail and government regulators' viewpoints on rail environmental regulation that may yield lessons for others, a qualitative style of research was called for. The qualitative research interview attempts to understand the world from the subject's point of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations (Kvale & Brinkmann 2009). Because it allowed for knowledge to be constructed in the interaction between the interviewer and the interviewee, the 'inter-view' was an appropriate way to explore with the participant the problems associated with the efficacy of the current regime of environmental regulation, opportunities to reform the regime in terms of the three regulatory models (self-regulation, government regulation and co-regulation) and any other 'wish list' items with regard to rail environmental regulation.

The interview research followed Kvale and Brinkmann's (2009) recommended systematic, seven-step progression to ensure that it lives up to scientific criteria, taking into account the ethical aspects of the investigation: (1) thematising, (2) designing, (3) interviewing, (4) transcribing, (5) analysing, (6) verifying and (7) reporting. A total of 36 sixty to ninety minute face-to-face interviews were conducted with 41 people (some interviews involved two or more interviewees) at senior or middle-management levels from 28 organisations across Australia of which 16 (24 interviews) were rail organisations and 12 (12 interviews) were government organisations. The person/persons interviewed was/were recommended as the most knowledgeable within that organisation on the subject of environmental regulations pertaining to rail. The transcribed interviews were analysed by coding of meaning through categorisation, which was facilitated by NVIVO software. The results obtained are extensive and rich presenting a challenge to concise reporting. Selected key findings are set out below to give readers a flavour of the qualitative research undertaken (for full results, see CRC for Rail Innovation 2009 forthcoming).

#### **Views on effectiveness of current regime**

The need for improved rail environmental regulation was mentioned by just over half of the participants (52%). Indeed, it was strongly advocated by rail track owners/operators (7 cases), government environmental regulators (5 cases), other rail (4 cases) and rail operators (3 cases). Both

environmental and transport government regulators and agencies expressed some indecision as to the exact nature of the regulatory problems experienced by rail. Within five of the six stakeholder groups, at least two interviewees indicated that there was no need for improving the present regime.

Five key areas of strength of existing regulation were described by participants, these being: (1) some good working relationships between rail and environmental regulators and between some environmental and transport regulators, (2) competence of regulators, (3) good regulatory tools, (4) better environmental outcomes, and (5) a more holistic transport perspective. On the other hand, eighteen problem areas or weaknesses were identified by interviewees. Table 3 presents a ranked list of the top ten issues in terms of the number of interview cases and the total number of references mentioning each weakness.

*Table 3 Weaknesses and contextual problems with rail environmental regulation*

### **Preferred rail environmental regulatory model**

Some of the notable views expressed by participants with regard to each of the three main forms of regulation are as follows.

#### *Self regulation*

A range of self-regulatory initiatives are currently practised by the rail industry, which reflects the view that the industry is probably best placed to manage its own impact on the environment; yet it needs to put in place environmental management systems that effectively manage risk and meet State-based legislation. However, there is also a view that the environmental regulatory regime is beyond self-regulation.

Overall, codes of practice (COP) or guides to leading practice as a form of self-regulation were generally viewed favourably by government and rail organisations. However, half the participants (12 rail and 6 government) expressed misgivings about self-regulation in general, and COPs in particular. As set out below, there was a variety of reasons for this perception, such as lack of market drivers to correct third party effects, difficulty in reaching agreement on standards, poor implementation, legal implications, lack of currency, and fear of inoperably high standards.

A wide range of considerations for improving industry self-regulation, including COPs and industry forums were volunteered by rail and government participants – level of standards to be applied (high or low), leadership (industry or government), national application, extent of representation, level of detail and implementation issues.

### *Co-regulation*

Most participants were aware of the basic concept of co-regulation as regulation involving some degree of self-regulation, with government providing some measure of oversight. At this basic level, the meaning of co-regulation appears to have been understood in a similar way by rail and government participants, unlike the initial findings on co-regulation reported in the NTC's (2009b) rail safety regulation regulatory impact statement. Some participants, however, struggled to categorise a particular regulatory initiative as either co-regulatory or government regulation. A government participant suggested that, regardless of whether the regulation is classified as self- or co-regulatory, there will always be some overarching legislation as a fall-back. These findings suggest that any differences are more likely to be due to definitional issues than to differences between the groups.

A significant finding was that the majority of participants (26 out 36 cases or 72%) stated that their preferred model of rail environmental regulation was co-regulation. A breakdown of these cases provided in Figure 3 shows that support for co-regulation can be found across all stakeholder groups and jurisdictions. This suggests that any improvement of rail environmental regulation involving all parties is likely to succeed.

#### *Figure 3 Pro co-regulation cases – by stakeholder type and jurisdiction*

Four key reasons were given for favouring co-regulation, these being that it (1) promotes better understanding between rail and regulator, (2) represents a middle-ground between self-regulation and solely government regulation, (3) permits more flexibility, and (4) is appropriate given the present degree of maturity of industry and industry structure.

More than half of the participants (19 cases) – mostly rail and state environmental government departments – could name or describe examples of current co-regulatory efforts. A range of examples were cited by participants, including forums (e.g., Rail Industry Environment Committee), guidelines (e.g., Interim Guidelines on the Abatement of Noise from Rail Infrastructure), state planning policies, conferences, and close working relationships between the individual rail organisation and the regulators.

Participants offered a range of views regarding how to address the problems with some of the current co-regulatory efforts and improve co-regulation of rail's environmental impacts in general. One group of suggestions related to the characteristics of appropriate co-regulatory forums, such as representation, scope and leadership. Another set of suggestions considered the values inherent in co-regulation and how rail could better demonstrate its worthiness as a partner in co-regulation.

### *Government regulation*

Five government and rail participants spoke out in favour of government-led rail environmental regulatory change. On the other hand, four rail participants rejected the idea. They pointed to the lack of government proactiveness and understanding of the rail industry, as well as reduced opportunities for rail involvement in regulation.

Participants were asked which level of government – state, federal or both – should drive rail environmental regulatory change. The majority of participants who responded to this question preferred government-led rail environmental regulatory reform at the national level. Some participants preferred a combined State/Local and Commonwealth government approach. Several interviewees were more in favour of State-level regulation. Opinions expressed by rail tend to have resulted from disappointing experiences with national approaches. State government participants also tended to be pro State-based regulation. Hence, the continuation with regulation at the State level appears to be more pragmatic, while national regulation is more idealistic.

A Commonwealth participant suggested that any regulatory reform is likely to proceed incrementally, will need to pass cost-benefit analysis, and will need to involve Federal and State governments. The comments by participants also indicated that the process of bringing a public case for regulatory reform (e.g., via a regulator or State/Federal Minister) needs to be better understood by industry and State governments.

### **Wish list for rail environmental regulatory reform**

When asked to outline their wish list for improving rail environmental regulation, the participants identified thirteen main types of suggestions, which complement the suggestions made in relation to the preferred regulatory model described in the previous section. Table 5 presents a ranked list of wish list items in terms of the number of interview cases and the total number of references mentioning each item. Notable is that some wish list items are to do more with the transportation context than with rail environmental regulation. For instance, half of the participants wished for a more long-term and national view of all transport modes, which was the subject of a recent NTC study into improving the co-modal supply chain (NTC - National Transport Commission and Booz&Co 2009a). For further insight into the wishes for improvement, the reader is referred to the final research report (CRC for Rail Innovation 2009 forthcoming).

*Table 5 Wish list for rail environmental regulation reform*



## DISCUSSION AND CONCLUSION

With limited prior data in relation to the phenomenon of existing rail environmental regulation and possibilities for reform, the research problem faced by the research team was complex and ill-defined. This paper has highlighted how a triangulated mixed method, multi-stage design was used to address the research objective. The research has delivered quantitative and qualitative outcomes for the spectrum of regulatory options (self-regulation, co-regulation, government regulation) and represented the range of stakeholder types (rail and government at both state and national levels) with an interest in the issue. By drawing on multiple sources of data and using these data sources in reporting of the results, a genuinely mixed method, triangulated study has been achieved. The picture of rail environmental regulation in Australia is more complete.

While each method produced its own unique insights, it is notable that all three research phases point to the opportunity for more rail environmental co-regulation. Government regulation tends to dominate the regulatory landscape, especially in the field of environmental regulation (where regulation exists at local, state and federal levels). Yet there appears to be considerable opportunity for organisations and industries to improve self-regulation and for industries and government to coordinate regulatory initiatives. Such self- and co-regulation initiatives are likely to more effective drivers of regulatory harmonisation and leading practice in industry than multi-jurisdictional government regulation (Eisner 2004). The incentive, here, is for industry to pre-empt regulatory change that could manifest itself in a potentially unpalatable form, and at the same time set the basis for a future regulatory response that has widespread industry and regulator acceptance, thereby ensuring high levels of compliance.

If it is assumed that the results are properly communicated to stakeholders, this approach should meaningfully inform the case for rail environmental regulatory reform and provide useful policy direction to industry and government decisions. For instance, the research results can feed in to a cost-benefit analysis of regulatory reform and a possible regulatory impact statement for a single, national rail environmental framework, as has recently been proposed by the NTC for rail safety and investigation regulation. Greater analysis of the variations between various themes by participants and groups was undertaken in the final research report (CRC for Rail Innovation 2009 forthcoming). This may provide greater insight into issues and indicate areas for addressing in an industry reform process.

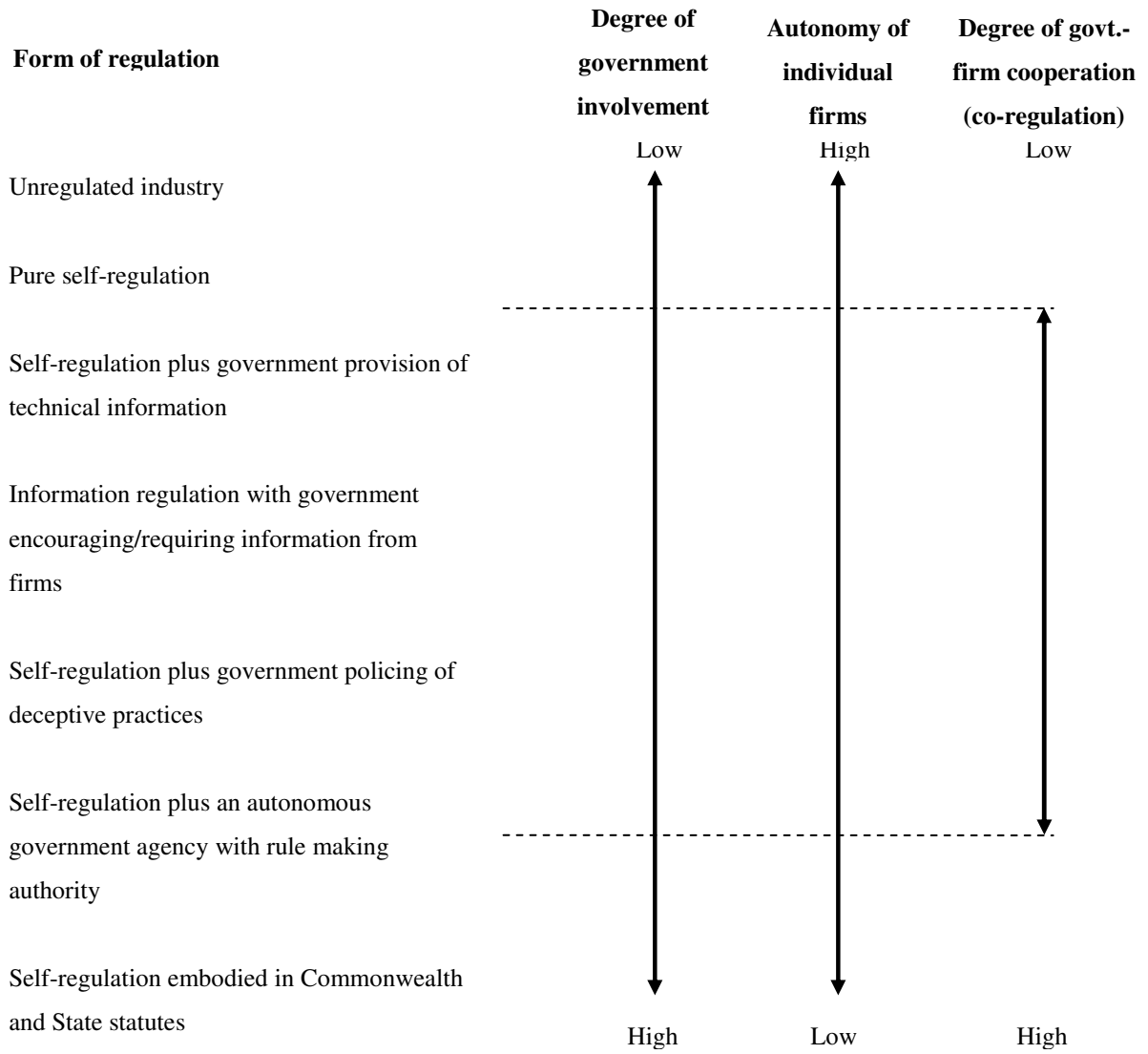
This paper has also outlined how the generic three-step framework for regulatory reform – mapping out the regulatory environment, evaluating regulations and developing, appraising and implementing regulatory reform options – was applied in the context of rail environmental regulation. It is our hope that this illustration of research for rail environmental reform will be used by other sectors or for other aspects of rail transport and environmental regulation. Clearly, the ability of industry participants to

work through the issues collaboratively within the industry and, later, with appropriate regulators will determine the degree of success in any change initiatives. Indeed, the majority of participants from both regulator and industry groups preferred, in principle, a co-regulatory model of regulatory reform. They expressed a keen interest in trying to work more cooperatively towards a more synthesised, nationally-consistent approach to environmental regulation.

A potentially optimal scenario would be for industry to initiate the regulatory reform process by developing guides to leading practice that overcome regulatory inconsistency among various jurisdictions. This done, these principles of leading practices can form a convenient normative benchmark for subsequent governmental regulatory reform, including overarching national regulation. Here, the challenge is to ensure that regulatory agencies, as crucial stakeholders, endorse industry-led reform before it is implemented, not only because this has the potential to generate greater overall industry commitment than might otherwise be the case, but also because it commits the regulators to being part of an industry-led regulatory reform that is pleasing to all stakeholders, in as much as this is possible. Research into strategies for interorganisational collaboration in co-regulation would be useful in transitioning industry initiatives into practice.

**TABLES AND FIGURES**

*Figure 1 Regulatory spectrum*



(Adapted from Garvin 1983; Gunningham 2004b)

Table 1 Costs and benefits of government regulation, co-regulation and self-regulation

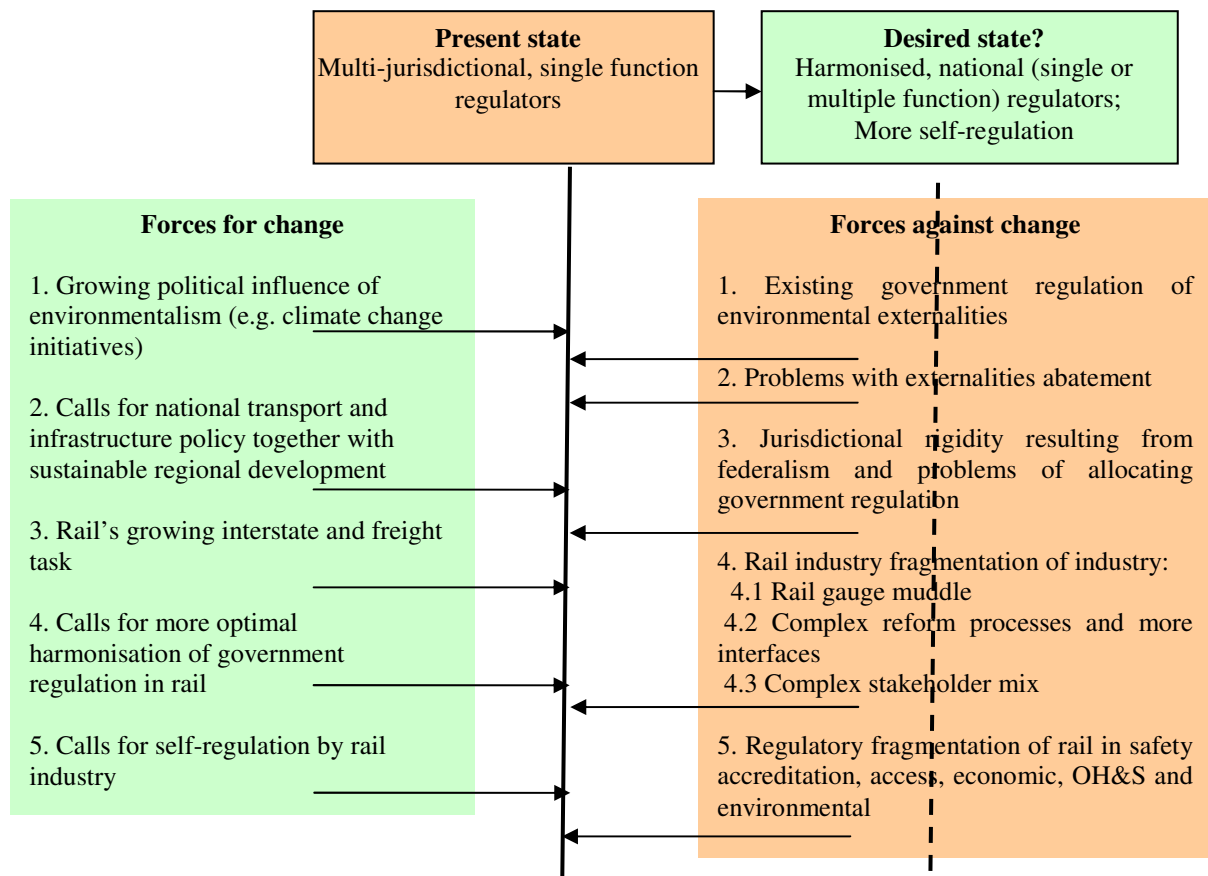
	Government regulation	Co-regulation	Industry self-regulation
Time/cost to develop, implement and enforce	- time-consuming and costly to set-up	+ quick and cheap to set-up for responsibilities delegated to industry  - coordination between government and industry is time-consuming/costly	+ quickest and cheapest to set-up  - may be costly/time-consuming to organise industry members
Industry maturity	+ best suits industries with lower levels of maturity	- requires higher levels of industry maturity	- requires high levels of industry maturity and organisation
Nature of industry-government relationships	+ lowest level of industry involvement	- requires trusting relationships between independent parties and appropriate motivational postures	- strong relationship with industry association required
Effectiveness (in terms of achieving goals)	+ more effective, as compulsory and, ideally, consistent with other industries and broad policies	+ potentially most effective with benefits of government regulation and greater industry commitment to own areas of responsibility	- less effective, as voluntary. - more susceptible to undue influences from large firms and adverse selection <sup>#</sup>

Note: '+' represent areas of potential advantage; '-' represent areas of potential disadvantage

# Lower quality firms join to gain membership benefits without commensurate effort

(Adapted from Garvin 1983; Gunningham 2004a; PC - Productivity Commission 2006; Spriggs & Nevin 1996)

Figure 2 Initial force field analysis of rail environmental regulation



(CRC for Rail Innovation 2008a)

*Table 2 Overview of rail environmental regulation by type and jurisdiction*

<b>Jurisdiction</b>	<b>Legislation</b>	<b>Quasi-legislation</b>	<b>Co-regulation</b>	<b>Self-regulation</b>
Western Australia (WA)	26	22	0	2
New South Wales (NSW)	24	9	3	5
Victoria (VIC)	24	7	2	3
Queensland ((QLD)	21	2	0	3
South Australia (SA)	17	2	1	0
Tasmania (TAS)	10	3	1	0
Australian Capital Territory (ACT)	8	0	0	0
Northern Territory (NT)	6	1	0	0
Commonwealth	15	10	2	14
<b>Total</b>	<b>151</b>	<b>56</b>	<b>9</b>	<b>27</b>

*Table 3 Overview of rail environmental regulation by type and environmental issue*

<b>Environmental issue</b>	<b>Legislation</b>	<b>Quasi-legislation</b>	<b>Co-regulation</b>	<b>Self-regulation</b>
General	21	5	-	1
Air pollution emissions	20	4	-	1
Waste efficiency	18	4	-	1
Flora and fauna (biodiversity)	16	4	1	1
Sustainable development	16	17	1	2
Land contamination	14	3	-	1
Water efficiency	11	3	1	1
Noise emissions	10	3	4	3
Water quality	9	1	-	1
Pest management	5	2	1	1
Ozone	4	-	-	1
Land degradation	4	-	-	1
Energy use	2	4	-	1
GHG emissions	1	2	1	1
Visual amenity	-	2	-	2
EM and compliance	-	-	-	8
<b>Total</b>	<b>151</b>	<b>56</b>	<b>9</b>	<b>27</b>

(CRC for Rail Innovation 2008b)

*Table 4 Weaknesses and contextual problems with rail environmental regulation*

	<b>Weakness</b>	<b>Number of cases referring to weakness (out of 36)</b>	<b>Number of total references</b>
1	Different standards for each state	25	64
2	Poor regulation of noise	16	28
3	Lack of understanding between rail and regulators	15	29
4	Severity of legislation	14	33
5	Lack of long-term infrastructure planning	14	23
6	Inequitable treatment of road vs. rail	13	25
7	Lack of regulatory rigour	13	22
8	Lack of industry competence	11	30
9	Excessive cost to industry	9	23
10	Poor interagency cooperation	9	17

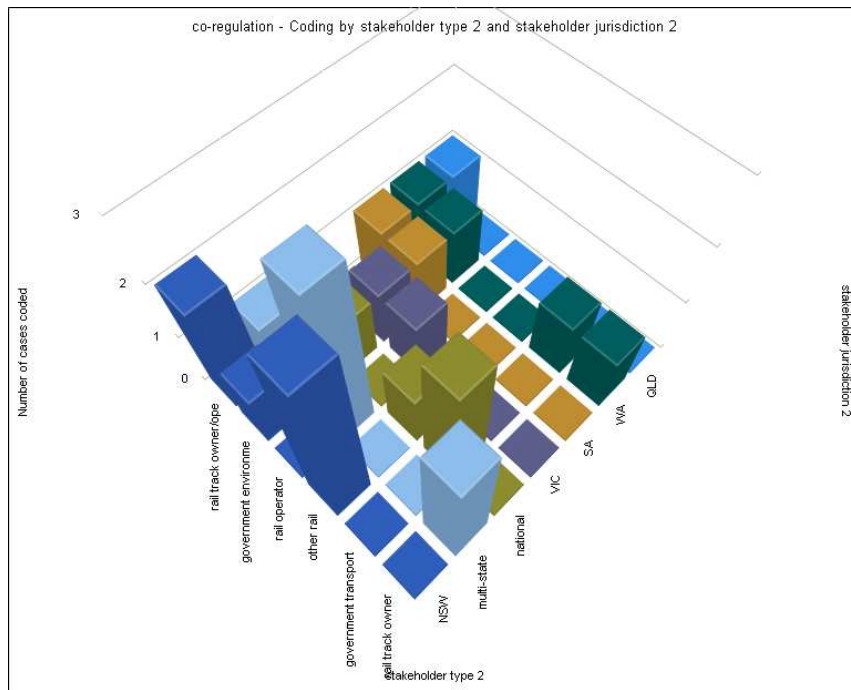
(CRC for Rail Innovation 2009 forthcoming)

Table 5 Wish list for rail environmental regulatory reform

	Wish list item	Number of referring cases	Number of total references
1	More holistic approach to transportation	16	40
2	More industry competence	14	35
3	More standardisation	14	20
4	More rigorous regulation	10	14
5	Better noise regulations	8	14
6	Simplification of regulation	8	13
7	More regulatory flexibility	6	8
8	Better working relationships between rail and regulator	6	7
9	Better horizontal working relationships between regulators	5	8
10	Better vertical working relationships between regulators	2	4
11	Better cost-benefit analysis of regulation	5	7
12	Better resourced regulators	3	4
13	Extension of exemptions for rail	2	3

(CRC for Rail Innovation 2009 forthcoming)

Figure 3 Pro co-regulation cases – by stakeholder type and jurisdiction



(CRC for Rail Innovation 2009 forthcoming)

## REFERENCES

- ATC - Australian Transport Council 2008, *National Transport Policy Framework: A new beginning*, February, <<http://www.ntc.gov.au/DocView.aspx?documentid=01639>>.
- Babbie, E 1989, *The Practice of Social Research*, 5th edn, Wadsworth/Thompson, Belmont, CA.
- BCA - Business Council of Australia 2007, *A Scorecard of State Red Tape Reform*.
- Berg, BL 2007, *Qualitative Research Methods for the Social Sciences*, sixth edn, Pearson Education Inc., Boston, MA.
- BTRE - Bureau of Transport and Regional Economics, ARA 2006, *Report 114: Optimising Harmonisation in the Australian Railway Industry*, September.
- Canniffe, M 1998, 'Winds of change sweep across regulation', *Accountancy Ireland*, vol. 30, no. 1, pp. 6-7.
- Carson, D, Gilmore, A, Perry, C & Gronhaug, K 2001, *Qualitative Marketing Research* Sage, London.
- COAG - Council of Australian Governments 2006, *Communique 10 February*, <<http://www.coag.gov.au/meetings/>>.
- CRC for Rail Innovation 2008a, *Environmental regulations pertaining to rail: Toward a case for change*, T. von der Heidt, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, R. Piamsa-Art, Brisbane, August, <<http://www.railcrc.net.au/>>.
- 2008b, *An inventory of environmental regulation pertaining to rail in Australia*, T. von der Heidt, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, Brisbane, October, <<http://www.railcrc.net.au/>>.
- 2009 forthcoming, *Stakeholder views on rail environmental regulation in Australia*, T. von der Heidt, R. Ryan, M. Charles, R. Zito, C. Collier, B. Hughes, Brisbane, <<http://www.railcrc.net.au/>>.
- de Bruijn, H & Dicke, W 2006, 'Strategies for safeguarding public values in liberalised utility sectors', *Public Administration*, vol. 84, no. 3, pp. 717-35.
- DEWR - Department of the Environment and Water Resources & AGO - Australian Greenhouse Office 2007a, *Greenhouse Challenge Plus Reporting Guidelines*, January, <<http://www.environment.gov.au/>>.
- Dignam, A 2007, 'Capturing corporate governance: The end of the UK self-regulating system', *International Journal of Disclosure and Governance*, vol. 4, no. 1, pp. 24-41.
- Donaldson, T & Preston, LE 1995, 'The stakeholder theory of the corporation: Concepts, evidence, and implications', *Academy of Management Review*, vol. 20, no. 1, pp. 85-91.
- Donaldson, WH & Pitt, HL 2007, 'Outdated and inefficient', *The Wall Street Journal*, no. January 6, p. A.7.
- Eisner, MA 2004, 'Corporate environmentalism, regulatory reform and industry self-regulation: Toward genuine regulatory reinvention in the United States', *Governance: An International Journal of Policy, Administration and Institutions*, vol. 17, no. 2, pp. 145-67.
- Freeman, RE 1984, *Strategic Management: A Stakeholder Approach*, Pitman, Marshfield, MA.
- Gambrill, D 2008, 'Need for speed', *Canadian Underwriter*, vol. 75, no. 5, pp. 10-8.
- Garvin, DA 1983, 'Can industry self-regulation work?' *California Management Review*, vol. 25, no. 4, pp. 37-52.
- Goddard, S 1997, 'Lloyd's self-regulation on way out?' *Business Insurance*, vol. 31, no. 21, pp. 21-2.
- Gunningham, N 2004a, 'Best practice rail safety regulation', National Research Centre for OHS regulation, <<http://ohs.anu.edu.au/publications/pdf/wp%2031%20-%20Gunningham.pdf>>.
- 2004b, 'Reconfiguring environmental regulation: Next generation policy instruments', *Regulatory Institutions Network, Australian National University*, <[http://www.idrc.ca/en/ev-110171-201-1-DO\\_TOPIC.html](http://www.idrc.ca/en/ev-110171-201-1-DO_TOPIC.html)>.
- Gunningham, N & Rees, J 1997, 'Industry self-regulation: An institutional perspective', *Law and Policy*, vol. 19, no. 4, pp. 363-414.
- Haines, F 2006, 'Regulatory failures and regulatory solutions: A characteristic analysis of meta-regulation', paper presented to In Proceedings Annual Meeting, Law and Society Association, Baltimore, MD.

, <<http://eprints.infodiv.unimelb.edu.au/archive/00004200/>>.

- Hanson, D & Grimmer, M 2005, 'The mix of qualitative and quantitative research in major marketing journals, 1993-2002', *European Journal of Marketing*, vol. 41, no. 1/2, pp. 58-70.
- Hemphill, TA 1998, 'Harmonising alcohol ads: Another case for industry self-regulation', *Regulation*, vol. 21, no. 3, pp. 55-62.
- 2003, 'Self-regulation, public issue management and marketing practices in the US entertainment industry', *Journal of Public Affairs*, vol. 3, no. 4, p. 338.
- Jaworski, B, Kohli, AK & Sahay, A 2000, 'Market-driven versus driving markets', *Journal of Academy of Marketing Science*, vol. 28, no. 1, pp. 45-54.
- Koppenjan, J, Charles, M & Ryan, N 2008, 'Managing competing public values in public infrastructure projects', *Public Money & Management*, vol. 29, no. 3, pp. 131-4.
- Kvale, S & Brinkmann, S 2009, *Interviews: Learning the Craft of Qualitative Research Interviewing*, second edn, SAGE Publications, Thousand Oaks, CA.
- Lennox, MJ & Nash, J 2003, 'Industry self-regulation and adverse selection: A comparison across four trade association programs', *Business Strategy and the Environment*, vol. 12, no. 6, pp. 343-56.
- Majone, G 1994, 'The rise of the regulatory state in Europe', *West European Politics*, vol. 17, no. 3, pp. 77-101.
- McInnes, D 1996, 'Can self-regulation succeed', *Canadian Banker*, vol. 103, no. 2, pp. 30-6.
- Neumann, WL 2003, *Social Research Methods*, 5th edn, Pearson Education, Boston, MA.
- NTC - National Transport Commission and Booz&Co 2009a, *Final Report - Towards Co-modalism: Capacity constraints & supply chain performance - Intermodal*, Melbourne, 27 January.
- NTC - National Transport Commission with Booz and Company 2009, *Single, national rail safety and regulatory investigation framework: Regulatory Impact Statement*, Melbourne.
- NTC - National Transport Commission with Booz&Co 2009b, *Single, national rail safety and regulatory investigation framework: Regulatory Impact Statement*, Melbourne.
- Parker, C 2002, *The Open Corporation: Effective Self-Regulation and Democracy*, Cambridge University Press, Cambridge.
- PC - Productivity Commission 2006, *Road and Rail Infrastructure and Pricing*, Inquiry Report 41, AGPS, Canberra, 22 December.
- 2007a, *Performance benchmarking of Australian business regulation -Stage 1*, Productivity Commission Research Report, Melbourne, 19 February.
- Regulation Taskforce 2006, *Rethinking Regulation: Report of the Taskforce on Reducing Regulatory Burdens on Business*, Report to the Prime Minister and the Treasurer, Canberra, January
- Robbins, S, P., Bergman, R, Stagg, I & Coulter, M 2003, *Management*, 3rd edn, Pearson Education, Frenchs Forest NSW.
- Spriggs, MT & Nevin, JR 1996, 'Negative option selling plans: Current forms versus existing regulations', *Journal of Public Policy & Marketing*, vol. 15, no. 2, pp. 227-37.
- von der Heidt, T, Charles, M, Ryan, R & Hughes, B 2008, 'Managing environmental regulations for the 21st century: Challenges and opportunities in an Australian industry context', in M Wilson (ed.), *Australian and New Zealand Academy of Management (ANZAM) Conference Auckland*, p. 23.
- Walker, M 2000, 'The three Cs', *Chemical Market Reporter*, vol. 258, no. 14, pp. 16-8.
- Yin, RK 1984, *Case study research*, Sage Publications, Beverly Hills.