Unpacking the Complexity of Environmental Regulatory Governance in a Globalizing World: A Critical Review for Research Agenda Setting

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Abstract

There had been a growing complexity in the study of environmental regulatory governance, owing much to the rapid diffusion of the regulatory regime from industries economies to developing countries and the ever-expanding scope of regulation to different environmental sectors in the last two decades. In term of regulatory approaches, the focus of national styles has gradually shifted to that of local levels down to the street-level regulators with the emergence of co-creating value idea, adding the complexity to the existing dialogue between the legalistic and co-operative/voluntary paradigms. As for the compliance strategies, regulated entities, particularly enterprises, have moved their compliance strategies from simplistic ones of compliance and evasion to more progressive ones of beyond compliance and even internalizing compliance with corporate strategies in face of greater external compliance pressure and more room for using active compliance as competitive advantages and business innovation. As environmental watch-dogs on behalf of the civil society, the eNGOs (environmental non-governmental organizations), particularly those in developing and non-democratic political settings, have increasingly found more space for strategizing their active monitoring efforts on enforcement agencies and polluting enterprises in the regulatory process. The spilling of regulatory regime over developing countries have led to the urgent need of regulatory studies in third world nations with the call for new regulatory and compliance theoretical formulations capable to explain regulatory governance there and at the same time given rise to cross-national analysis for capturing convergence and divergence. Research methodologies adopted have increasingly sophisticated moving from using single method to mixed methods by integrating both qualitative and quantitative ones, with longitudinal studies and panel data analysis as the recent trends. This paper aspires to perform a critical review of existing body of literature on environmental regulatory governance in these major aspects as the basis for research agenda setting.

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Introduction

Environmental regulation has quickly emerged as a major focus in environmental protection research in response to the intensified and organized efforts among nations in the adoption of environmental law as the dominant regulatory instrument to cope with the rapidly deteriorating environmental degradation and deepening ecological crisis emanated from the prior under-regulated but expanding damaging environmental footprints out of industrial activities since the turn of 1960s. Since then regulatory governance has been growing in complexity, due to the rapid diffusion of the environmental regulatory regime from industrialized economies to developing countries and to the ever-expanding scope of regulation in multiple environmental sectors for pollution control and ecological conservation. In terms of regulatory approaches, the focus on the examination of national styles of environmental regulation has gradually shifted to a focus on local levels, down to street-level regulators. Together with the emergence of the progressive ideas about the co-creation of value in regulatory governance, more complexity has been added to existing dialogues between legalistic and cooperative/voluntary paradigms. In respect to strategies for regulatory compliance, regulated entities, particularly industrial enterprises, have moved from a preoccupation with the choice between compliance and evasion to considering compliance as part of a broader sustainability strategy for gaining competitive advantages and achieving business innovations. Serving as the environmental watch-dogs for the civil society, ENGOs (environmental non-governmental organizations), particularly those in developing and non-democratic political settings, have increasingly found more space in the environmental regulatory community for strategizing their active monitoring efforts on enforcement agencies and polluting enterprises to make the regulatory process more stringent. As more developing and emerging countries have adopted their own regulatory regimes under diverse national circumstances under the immediate threats of climate changes and industrial pollution, new theoretical frameworks are needed to account for how cross-national variations affect compelling and emerging issues in environmental regulatory governance.

In addition to complexities, new environmental sectors (e.g. dumping in the outer-space, renewal energies, environmental information disclosure, and green production technologies) have emerged that call for some forms of government or self-initiated regulation. These newly emergent domains in environmental regulation often involve problems that are distinctly different from those in the traditional regulatory domains (e.g., water, air, and solid waste). Even within the traditional domains, changes are occurring because of, for example, climate change, the rise of new green technologies and social media. Adding to these nation-based complexities is the globalization of regulatory governance. As pressures of environmental sustainability grow for the establishment of global environmental regulatory regimes, most notably, the joint effort in the international community to fight against global warming, regulatory norms in different parts of the world will need to be revised accordingly. Concurrent with the dynamic development in the enrichment of environmental regulatory governance research is the witness of the increasing sophistication in the research methodology adopted, moving from using single method to mixed methods by integrating both qualitative and quantitative ones, with longitudinal studies and panel data analysis as the recent trends, in scholarly efforts to improve the integrity of the data collected, increase the credibility and validity of the analyses and generate original and insightful findings. All these developments are generating academic excitement and causing revision on research agendas on environmental regulatory governance in order to accommodate the greater demand for both theoretical advancement and empirical-based problem-solving.

This paper aspires to perform a thorough review of existing body of literature on environmental regulatory governance in these major aspects as the basis for research agenda setting. It will start with the conceptualization of environmental regulatory governance research in its complexity, followed by a close examination of the five aspects of complexity. It will end with a reflection and discussion for setting possible future research agenda in the conclusion of this study.

Conceptualization of the Complexity in the Environmental Regulatory Governance Research

Environmental regulatory research, with the legal regulatory control over industrial enterprises' environmentally destructive operations as the core focus, has begun with the enforcement actions of regulatory agencies, then extended to include the compliance behaviour of regulated enterprises, and eventually incorporated the monitoring strategies of ENGOs in the study of the ability of the environmental regulatory governance regime in the secure of compliance from industrial enterprises with pollution control and ecological conservation regulations. This development path of researching environmental regulatory governance is consistent with the theoretical underpinning of collaborative governance literature, which has increasingly conceived that collaborations among regulatory agencies, non-governmental organizations, and business firms are necessary conditions for the effective enforcement of environmental regulations in the close of enforcement gap and even more progressively the achievement of beyond compliance (Daley, 2009; Gunningham, 2009). Specifically, the World Bank research group developed the "regulatory triangle" model in 2000 that highlights interactions linking four agents in regulatory compliance: plant, state, community and market. This model was based on years of research, policy experiments, and direct observations in pollution control in several developing countries in Asia. Regulators in this model, serve more like mediators rather than dictators in environmental governance (World Bank, 2000). Informed by the "regulatory triangle" model with collaborative governance as the theoretical support, this review paper examines the environmental regulatory governance research by taking a holistic view of the environmental regulatory governance community that includes regulatory agencies, regulated firms and civil organizations, in their separate but interactive efforts for the achievement of legal compliance in the regulatory process, with the added complexities coming from the globalization of the regulatory context and the sophistication of research methodology. The conceptualization of this study is shown in the diagram below:

Diagram 1 inserted here

A Snapshot of Environmental Regulatory Research in JEPP

We perform a close examination of JEPP's historical path in publishing environmental regulatory papers. We use bibliometric analysis as a lens to examine topic status and overtime changes and hence offer a dynamic view of environmental regulatory research published in the journal. We first screened all JEPP issues in the Scopus database to see a general profile of research topics during 1999-2019. Figure 2 shows that regulatory governance is undoubtedly a key topic addressed in JEPP, with the most frequently occurring terms being "regulation" and "compliance". Importantly, research interest under the regulation umbrella gradually shifted from "production", "market", "effectiveness", "ability", to "agency", "information", "regime", "uncertainty", and then "compliance", "comparison", "engagement".

Insert Figure 2 here

We then screened all JEPP issues to take out papers published related to our topic focuses. We first searched the keyword of "environmental regulation" in the journal from same databases, yielding 173 related articles. 83 words occur in 10 or more publication titles or abstracts among the extracted articles. Top 10 most frequently occurring words include "policy" (68 occurrences), "process" (49 occurrences), "approach" (46 occurrences), "governance" (45 occurrences), "management" (45 occurrences), "actor" (40 occurrences), "state" (39 occurrences), "level" (39 occurrences), "regulation" (38 occurrences), and "case" (38 occurrences). Additionally, research interest gradually changed from "policy", "sustainability", "implementation", "governance", to "planning", "participation", and "climate change".

Similarly, a keyword search of "compliance" yields 48 related articles. 31 words occur in 5 or more publication titles or abstracts. Top 10 most frequently occurring words include "policy" (19 occurrences), "process" (16 occurrences), "country" (15 occurrences), "implementation" (14 occurrences), "state" (14 occurrences), "concept" (13 occurrences), "level" (12 occurrences), "development" (11 occurrences), "case" (11 occurrences), and "effect" (10 occurrences). Figure 2b shows that research interest in this field gradually shifted from "approach", "role", "ability", "resource", to "country", "state", "implementation", and then "process", "development", and "practice". In terms of enforcement studies, the keyword search yield only 27 articles, showing that research interests moved from "regulation", "policy", and "implementation", and then "agency", "legitimacy", "instrument", and "evaluation".

While environmental journals like JEPP has evidenced topical shifts in environmental regulatory research, other discipline journals also timely reflect on their historical paths in the field. For example, environmental regulation and governance draw constant attention in the public administration research. A virtual symposium of *Public Administration Review* includes articles published that demonstrate continued explorations of the drivers, design and implementation of environmental policy instruments. This article selection published during 1963 and 2015 showcases scholarly insights on the complex and dynamic process of environmental governance. In particular, it highlights how the use and efficacy of regulatory instruments vary across countries, and hence calls for more contributions from research efforts on comparative and transboundary investigations. A virtual issue of the *Journal of Public Administration Research and Theory*

includes articles in the arena of alternative and nonregulatory approaches to environmental governance. It reflects on scholarly interests and evidence on the "institutional design, organizational structure, and political economy" that shape the adoption and effectiveness of such approaches since their emergence two decades ago (Hsueh & Darnall, 2017). Interestingly, a further comparison shows that scholarly works on the application of these approaches in the environmental governance field, despite its prevalence in practice, remain still limited compared to those in the non-environmental regimes.

Regulatory Approaches in Environmental Regulatory Governance

Contemporary discussion on environmental governance has moved from whether government intervention is needed to how this intervention can be designed for achieving optimal effectiveness (Veugelers, 2012). The literature has extensively studied the motivations, effectiveness and the respective strengths and weaknesses of each regulatory approach. With governments assumed the leadership, environmental regulatory instruments and the logics behind them have evolved from mandatory regulations to organization-initiated voluntary programmes, from a centralized top-down system to value co-creating cooperation with localized supports.

An extensive toolkit of regulatory instruments has emerged to mitigate pollution and encourage green technology adoption. Governments world-wide have used to mainly rely on agency-dominated command-and-control format and enforce environmental regulations by imposing emission limits or adoption of pollution abatement technologies (Arimura, Hibiki, & Katayama, 2008), such as mandatory saving obligations and performance standards. It takes the form of rigid enforcement based on deterrence and punishments to correct certain violation behaviors. Ample evidence has proven the effectiveness of the direct approach (e.g., Burby & Paterson, 1993). However, it has been criticized especially for its economic inefficiency. For example, there are technology mandates that require firms install specific equipment to green the production process. Given the heterogeneity of firms' operation and regulators' information asymmetry, regulators are unlikely to impose the costs of abatement equally across firms (Newell & Stavins, 2003). In addition, the monitoring of mandatory technology adoption, if possible, will generate abundant costs (Goulder & Parry, 2008). Apart from cost-inefficiency, the command-and-control approach has also been criticized for its inflexibility (Arimura et al., 2008) and lack of proper incentives to motivate cleaner inputs and end-of-pipe treatment (Goulder & Parry, 2008). Firms may only strive to obtain the legitimacy by buck-passing the threshold (Al-Saleh & Mahroum, 2014).

With enforcement gap in terms of compliance levels as the focus, a sizable body of literature engages in the exploration of the proper approaches that regulatory authorities could adopt for achieving the effective enforcement of well-intended pollution control and ecological conservation regulations, starting from Vogel's national and agency levels down to May's and Winter's local and inspector levels. In rejecting the classical approach of regulatory deterrents as effective, research on styles of regulations has not led to conclusive findings on the effectiveness of environmental regulatory enforcement. For example, although two separate styles have been identified in different democratic systems of pluralistic and corporatist forms, there is little solid evidence showing whether the more legalistic and adversarial styles that were widely adopted in the USA or the more informal and collaborative ones commonly used in the UK and Sweden were more effective in achieving regulatory compliance. This has resulted in an ongoing debate on whether confrontational or cooperative regulation should be practiced in order to effectively bring

regulated enterprises to conform to regulatory requirements. At the same time, attention has been shifted from national level inquiries to local and street level ones as national styles have proved to be too generic and reductionist to accommodate variations in the regulatory approaches adopted by local environmental agencies and their frontline officials among individual jurisdictions (May and Winter, Lo and Fryxell, 2003).

Conceptual complexity has grown in the contending process as different formulations of taxonomy (Kagan and Scholz, 1984), continuum (May and Winter, 2000) and dimensions (Tang, Lo & Fryxell, 2003) have been raised to capture the essence of environmental regulatory enforcement from contrasting perspectives in terms of styles or approaches. With options of regulatory style available to environmental agencies and their enforcement officials to adopt for carrying out their enforcement duties, there has appeared related enquiries into the institutional factors that shape their conscious choice and the preconditions that facilitate more effective regulatory enforcement. These variations in regulatory styles have been attributed to differences in basic constitutional structures, regime types, stages of economic development and cultures. In the midst of the doubtful effectiveness of routine regulatory enforcement in the control of environmental pollution, there has come the revival of interest in proposing campaign-style, which is the strongest variance of state-centered regulatory enforcement approach that involves "extraordinary mobilization of administrative resources under strong political sponsorship", as a proper alternative to "effectively address the decoupling problems in regulatory enforcement and compliance" (van Rooij, 2003; Liu et al. 2015).

During the last two decades, the traditional enforcement has been gradually supplemented by new approaches (Lehmann, 2012) as there is little sign that the enforcement gap can be effectively narrowed under agency dominated regulatory actions. Leading environmental groups and regulators have increasingly realized that the regulatory power of the market can contribute to the achievement of environmental goals (Tietenberg, 1990). Market-based instruments, for example environmental taxes, tradable allowance and permits, grants and subsidies for pollution abatement, have been significantly increased in adoption in recent decades (Hahn & Stavins, 1991). These instruments award firms with every unit of achieved emission reduction below the baseline level. However, these incentive-based instruments do not target firms' behavioral changes to adopt greener solutions. Organizations may consider the rewarding policy as low-hanging fruits and engage in opportunistic behaviors to obtain short-term gains. The uncontrolled offering awards may generate considerable negative externalities and excess entry that may render the instruments ineffective (Al-Saleh & Mahroum, 2014).

Other market-based instruments include taxes on inputs or goods associated with emissions, for instance, taxes on electricity and gasoline. They allow organizations to reduce environmental impact with greater flexibility in both the time-line and extent of reduction, and they usually impose lower costs on organizations than the standard command-and-control approaches (Cole & Grossman, 2002). Another advantage of these instruments is that they do not require excessive monitoring efforts. The consumers bear the cost of pollution by paying more under the polluter-pay principle. However, these instruments do not directly target at the pollution externalities, but disturb the equilibrium of output and demand (Goulder & Parry, 2008). Consider the case of gasoline tax, the tax scheme does not provide incentives to encourage consumers to shift to new energy in driving a vehicle or powering a facility, but it merely relies on suppressing the normal consumption of gasoline to reduce pollution.

An increasing number of state entities begin to consider combining different regulatory approaches to craft a mix for their own needs and objectives. One typical example is the European Climate Change Programme (European Commission, 2006). The question arises that whether the design of a policy mix can at best avoid contradictions and create synergies among different policies while avoid degrading into a mess. Lehmann (2012) discusses the choice between single instrument and mix ones to tackle single pollution problem. He argues that regulatory mix does not necessarily bring better effectiveness or efficiency than a single policy, which depends on the types of market failures and the net costs to comply with the single policy. Lambin et al. (2014) find that with favorable institutional contexts, the hybrid instrument can bring benefits in terms of sustainable land use. However, there are conflicts in the interaction processes among government, NGOs and firms due to the weak regulatory governance, which echoes the prior studies that how to balance the potential contradictions and to achieve synergies is still not very clear in the current literature.

Apart from mandatory regulatory instruments, governments, industries and third-party organizations have been devoting considerable efforts to promote organizations' participation in voluntary environmental programmes (VEPs) (Darnall & Sides, 2008). VEPs are designed to provide participants with incentives to improve their environmental performance with more flexibility and efficiency. The most prevalent examples of VEPs include the adoption of ISO 14001, 33/50 programme, Green Lights, Leadership in Energy and Environmental Design (LEED) (Baek, 2017). Scholarly attention has been given to the motivations of organizations participate in green activities that go beyond regulatory requirements. Videras and Alberini (2000) found that firms who seek more publicity are more likely to participate in VEPs, especially for the firms who have negative environmental records before. Khanna, Koss, Jones, and Ervin (2007) found that firm size, regulatory pressures and competitive pressures all motivate firms to adopt VEPs. Another strand of literature focuses on examining the effectiveness of the VEPs. Do VEPs lead to better environmental performance? There are mixed findings. By analyzing 33/50 programme participation, McGuire, Hoang, and Prakash (2018) found that firms show increased adoption of source reduction activities and recycling, recovery and treatment to reduce pollution, but the recycling and recovery efforts declined when the programme reaches the end. On the contrary, Darnall and Carmin (2005) argue that the adoption of VEPs does not necessarily signal better environmental performance, since the lack of monitoring and sanctions in the less rigorous VEP programmes create opportunities for participants to free-ride and receive unworthy benefits without meeting the programme's requirements. Delmas and Keller (2005) found free-riding behaviors in the U.S. EPA WastWise programme. By conducting a meta-analysis, Darnall and Sides (2008) found that non-VEP participants actually improve environmental performance more than VEP participants.

Despite the fact that "carrot" without "stick" instrument attracts criticisms regarding the free-riding and excess entry issues, it signals the paradigm shifting of regulatory design that evolves from formal enforcement to a co-operative style. Governments used to play a dominant role in regulating organizations' environmental activities, and now, the sense of decentralizing and cooperating with wider range of social actors becomes prevail. By conducting a survey study in China, Zhan, Lo, and Tang (2013) found that central government support used to be positively associated with environmental enforcement effectiveness in 2000. But in 2006, central government support was no longer a significant factor. Instead, local government support and collaborations with other entities become significant. Their findings shed light on the regulatory gap that environmental regulations may not be well enforced by the local environmental protection bureaus because of the

inconsistency and complexity of goals and resource constraints. This is especially the case when the regulators do not share the same goal with the central policy makers (Luo, Wang, & Zhang, 2017). Even though the policy makers have superior authority, they give insufficient attention to whether the regulation makes sense on the ground. Therefore, the perceived trend of decentralization in environmental regulatory governance and horizontal support mechanisms require more practices as well as research attention.

There is emerging research attention directed to local level even street level environmental governance. As a pathway to confront the enforcement gap, the focus of national styles has gradually shifted to the local levels down to the street-level regulators with the emergence of co-creating value idea. The notion of social innovation and value co-creation emerge in the last years and have been embraced as new modernization or reform strategies for the public sector (Voorberg, Bekkers, & Tummers, 2013). It is perceived by academia and practitioners as an alternative for traditional governing, which requires local communities even local citizens to participate in setting up cooperation to jointly tackle social problems. Lo and Fryxell (2005) found that local government support and social support can mutually enhance the perceived enforcement effectiveness, which highlights the positive effect of the government-endorsed social support. Value co-creation also echoes the voluntary environmental programmes that organizations can take initiatives towards self-regulated environmental governance.

At the street-level, China has set up a frontier example. China has established local Environmental Protection Bureaus (EPBs) to protect local environmental interests. They are responsible for implementations of local municipal environmental regulations, and often attempt to reconcile conflicting goals of economic and environmental performance (Kostka, 2014). However, EPBs' operations sometimes are not as effective as desired. There are studies suggesting that the effectiveness of EPBs are often compromised because they lack authority, administrative rank, and financial and human resources (Swanson, Kuhn, & Xu, 2001; Tang, Lo, & Fryxell, 2003). The weak internal management and risk-averseness nature make them vulnerable when facing higher authority (Van Rooij, 2006). The situation could be worsened for the EPBs to implement environmental policies when the local communities lack general supports (Lo & Fryxell, 2005; Lo & Leung, 2000). Lo, Fryxell, and Van Rooij (2009) point it out that there is no single best regulatory approach to tackle environmental issues, and the effectiveness of regulating environmental performance requires joint efforts from various stakeholder groups, from policy makers, local and street-level agents, the courts, enterprises to the local communities. It is therefore emphasizing more on the value co-creation concept that asks for more investigation of the interactions among different parties and the associated outcomes.

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Corporate Environmental Compliance Strategies under Increasing Regulatory Pressures

A central question in the literature of environmental regulatory governance is whether and how regulated enterprises comply with environmental laws and regulations under increasing stringent regulatory settings. A substantial theoretical and empirical literature has drawn on the economic, political, social, and psychological perspectives to answer the question (Burby & Paterson, 1993; Hoffman, 2005; May, 2004; Shimshack & Ward, 2005; Winter & May, 2001). In a similar vein, the business and environment literature has widely examined how companies behave in response to external pressures and expectations on reducing their negative environmental externality. In this section, we review the theoretical approaches to organization-level variances in dealing with business environmental problems. We start the review by looking at how firms respond to institutional demands in general. This is then followed by a detailed review of firm-level heterogeneity in compliance behaviors and strategies.

The business strategy literature has conceptualized and empirically investigated various typologies to capture corporate responses in responding to institutional demands for regulatory compliance. In her classic work on corporate strategic responses to institutional processes, Oliver (1991) developed a five-dimensional conceptualization, ranging from more responsive strategies such as acquiesce, compromise, and avoidance, to more proactive defiance and manipulation. Various frameworks were further developed to extend this line of work. Among these studies, Kraatz & Block (2008) developed four organizational approached to adapt to pluralistic legitimacy standards, namely resist/eliminate, balancing, detaching, compartmentalizing. Crilly et al. (2012) brings interesting insights of decoupling to the literature by suggesting that among the four configurations of firm responses to institutional pressures, there are two decoupling dimensions (evasive decoupling and emergent decoupling) and two implementation dimensions (strategic implementation and routine implementation).

Works above build a solid foundation to explore how firms differ in their responses to regulatory demands relating to the natural environment. Both regulatory and management studies have developed a variety of frameworks to capture and identify such corporate strategical differences. Table 3 lists the major typologies developed in the existing literature. Two distinct research focuses are identifiable. One strand of literature conceptualizes corporate environmental strategies at the operation level by classifying firm performance along a continuum. For instance, Sharma (2000) adopted a classification of environmental strategy as the continuum of conformance to regulations and standard industry practices, to voluntary actions to further reduce the environmental impacts of operations. Another stream of research focuses on corporate behavioral diversity in responding to specific environmental issues such as the ISO 14001 EMS certification (Boiral, 2007), climate change (Levi & Egan, 2003), or new regulations (King, 2000). In terms of firm responses to regulation, one of the pioneering works that conceptualized the nature of organizational responses to regulation is the theory building paper by Cook et al. (1983), which integrates the adaptation and mutual selection perspectives. Rugman and Verbeke (1998) took a step further and categorized managerial responses towards regulation as either “static” or “dynamic”. In responding to new pollution regulations, King (2000) detected various organizational responses including creating buffers of technology and personnel, initiating changes to improve environmental performance, and (in a very few firms) adopting entirely new corporate strategies.

Insert Table 3 here

Broadly speaking, these prior works largely focused on the of environmental proactivity in developing various typologies. Much less has been written on behavioural diversity to cope with growing regulatory demands in general. Recent research has begun to explore whether there exist distinctive styles rather than a performance continuum. Understanding such heterogeneity is of crucial importance. Just as frontline enforcement officials select from an array of strategies to achieve enforcement efficiency and effectiveness (Bardach & Kagan, 1982; May & Wood, 2003; Tang, Lo, & Fryxell, 2003), regulated firms also develop or adopt various strategies to cope with pressure from compliance. In dealing with regulatory pressure, firms have their own environmental orientations, professional standards, and experiences. They will only select strategies that are compatible with their own situations (Etzion, 2007). The specific coping strategy adopted by a regulated entity not only shapes its environmental protection practices but also communicates to diverse stakeholders its position to upholding environmental responsibility. Drawing on rich survey and interview data collected from manufacturing enterprises in China, Liu et al. (2016) show that compliance styles among Chinese enterprises can be characterized along four dimensions—formalism, accommodation, referencing, and self-determination. A "formalism" strategy refers to a traditional "go-by-the-book" approach that strictly follows formal rules within a command-and-control regulatory context; an "accommodation" dimension gives priority to dealing with political or bureaucratic demands; a "referencing" dimension embraces a close imitation of peer enterprises' compliance practices and follows professional guidelines recommended by industrial trade associations; and a "self-determination" dimension refers to a discretionary approach that emphasizes intellectual flexibility, self-discretion, and autonomy. Taken together, the multi-dimensional characterization of corporate compliance coping strategies captures the fact that firms have to face demands from various regulations and stakeholders, and firms often have to develop complex arrays of strategies in order to meet their business needs.

The Role of Environmental NGOs in Environmental Regulatory Governance

Emerged in diverse social networks, environmental non-governmental organizations (ENGOs) perform the duty of environmental watch-dogs as extensions of the civil society, which has generated substantial impacts on the traditional regulatory regime, corporate governance practices, and social responsibilities (Doh & Teegen, 2002). NGOs are independent forces capable of bargaining with government on a level playing ground (Simmons, 1998). Especially in more economically developed countries, ENGOs increasingly strategize their monitoring efforts to scrutinize regulatory agents on both international and domestic arenas. In international cooperation, ENGOs can participate to ensure that states comply with a given international treaty by implementing policies and projects according to its formal provisions (Raustiala, 1997). For example, the Convention on International Trade in Endangered Species of Wild Fauna and Flora relies heavily on ENGOs' monitoring to assess state compliance (Pallas & Urpelainen, 2012). Domestically, the Canadian ENGO "Independent Environmental Monitoring Agency" actively monitor the operation of the first diamond mine in Canada and the relevant government regulators to make sure that their operations meet the environmental requirements (Ross, 2003).

The monitoring role of ENGOs has also become visibly stronger in developing countries. Take China as an example, with the enactment of state council ordinance on environmental information disclosure, ENGOs from various provinces created a Pollution Information Transparency Index (PITI) to hold government officials accountable for environmental information disclosure (Johnson, 2011). So far, the PITI has gained remarkable influence nationwide. Drawing from

Mexican experiences, Fox (2001) also points out the importance of effective independent civil society monitoring of public policy processes. With vertically integrated monitoring from policy-making to implementation, the coordinated monitoring of all levels of public decision-making can reveal where the true problems reside and what more targeted strategies are available (Fox, 2001).

On the other hand, regulatory agencies can also leverage ENGOs' expertise and experience to monitor corporate environmental compliance. The ENGOs can pressurize polluting industry to adopt green production by various means from law suits, organized political lobbying to even mobilizing consumer boycotts and popular protests (Aldashev, Limardi, & Verdier, 2015; Spar & La Mure, 2003). Sometimes, when the government is unwilling or unable to impose sufficient regulatory safeguards, ENGOs can adopt nontraditional means to push local firms or even large transnational corporations to hold social and environmental responsibilities (Newell, 2001). ENGOs have also been pressurizing firms to adopt more sustainable practices by setting independent screenings and endorsement, most notably in the EIA (Environmental Impact Assessment) process. From the NGO-firm interaction, new standards and codes emerge, which also reinforces government's regulatory efforts of policy-making (Perez-Aleman & Paterson, 2008). In turn, state agencies are willing to build alliances with NGOs, not necessarily to control them, but to obtain benefits which can meet the organizational needs of the regulatory agencies (Hsu, 2010).

In recent years, social organizations also gained voice in developing countries in the trend of governance decentralization. As environmental deterioration becomes prominent relative to the rapid economic growth, ENGOs are established by both government agents and the general civic society to tackle the urgent environmental issues. Government-organized environmental NGOs (GONGOs) are usually funded and controlled by government agents. The well-connected leadership and rich political access in these NGOs raise environmental awareness in the government circles (Knup, 1997). Under this circumstances, critical environmental issues and the possible means to solve them are more likely to be put on the table for negotiation and discussion. However, in terms of effective monitoring, GONGOs have been criticized for their limited role as being a watch-dog of government policies and regulation (Tang & Zhan, 2008). The close ties with state government make them vulnerable to political influences. As a result, they are widely considered a part of the government's regulatory apparatus of the bureaucratic structure (Shieh, 2009).

There has been a continuous growth in the number of civic ENGOs or generally known as "grassroots" ENGOs. Civic ENGOs are not financially supported by the government. Instead, they heavily rely on international funding (Tang & Zhan, 2008). They have more room to perform the watch-dog duties compared with GONGOs, but usually in informal ways, such as writing letters to government officials, mobilizing media attention to certain environmental issues, and being involved in public hearings (Tang & Zhan, 2008). By utilizing non-political channels, civic ENGOs are able to perform the monitoring duties and pressurize regulatory enforcement. However, in developing economies, the civic ENGOs still need to tiptoe around the red lines since government still holds tight controls over their activities. Tang and Zhan (2008) document a case where the ENGO tries to raise issues about state-owned polluting enterprises, then its relationship with government becomes tense. In this case, the ENGO is very likely to lose government support in the future. As a result, civic ENGOs need to carefully find their niche where they can best strategize their monitoring influence on government and polluting firms. Compared with ENGOs in the West countries, they are still experiencing conflicting political pressures and trying to

construct functional relationships with both government and business corporations.

In sum, environmental NGOs have been playing an increasingly critical role in environmental regulatory governance from domestic to global levels. Their monitoring efforts have generated substantial impacts on both government and corporation policy-making and behavioral changes. Difficult as the progress may be, the influence of NGOs in developing countries is still prominent. Facing the fact that the political complexity tends to hold them back when they try to confront the governmental authority directly, the environmental NGOs are still finding their precise role in the political process.

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Cross-Jurisdiction Analysis: Taking Voluntary Environmental Governance as an Example

Comparative investigations and cross-region analyses is undoubtedly vital to understand environmental regulatory governance. A central question is, do explanations of regulatory compliance differ across contexts? In general, the spilling of regulatory regime over developing and emerging economies have led to the urgent need of regulatory studies in third world nations with the call for adapted or novel theoretical formulations capable to explain regulatory governance there. The literature disperses too widely for us to review all scholarship that focus on distinct bases to explain the effectiveness of regulatory governance. Regarding the most widely used command-and-control approach, our earlier review suggests that ample evidence from both developed and developing regimes indicates that it has both strength and weakness in enhancing compliance (Burby & Paterson, 1993; Dasgupta et al., 2000; Gunningham et al., 2005; Scholz & Pinney, 1995; Liu et al., 2016). In this section, we limit our focus to review cross-contextual analysis of the widespread voluntary environmental governance, a crucial regulatory alternative to the coercive methods and send quick overviews.

Research on voluntary regulatory instruments embraces studies that focus on various domestic programs and international standards implemented in a wide range of countries. Typical examples of the former strand include investigations of the effectiveness of the 33/50 program and the Responsible Care Program in the U.S., and the Accelerated Reduction/Elimination of Toxins (ARET) Program in Canada (Antweiler & Harrison, 2007). The convergence and adaption of voluntary approaches is also observed in developing and emerging economies. Examples abound for research interests in the Clean Industry Program in Mexico (Henriques et al., 2013), the Sustainable Tourism Program in Costa Rica (Rivera, 2004), and the Green Ratings Project in India (Blackman, 2008). Although investigations on various domestic voluntary programs provide rich insights, conclusions from these studies may risk generalizability. Examining the effectiveness of international environmental standards in a wide range of contexts offers additional insights to understand the effectiveness of voluntary approaches. For example, empirical investigations of the mostly examined ISO 14001certified Environmental Management System among industrial enterprises were broadly evidenced in both developed and developing regimes (Boiral, 2007; Fryxell et al., 2004; King et al., 2000; Potoski & Prakash, 2005).

In spite of its growing popularity and diversity, the merits of VEPs has remained controversial. Notably limited in the literature, is large-scale work on the contextual variations. Efforts to bridge context-level analysis of voluntary governance have taken several forms and generated three major insights. Both cross-regime convergence and divergence were identified. First, evidence from comparative investigations highlights divergence in regulatory goals, design, and implementation

means. As Prakash and Potoski (2012) concludes, the emergence of voluntary environmental regulation across countries could be attributed to variations in the existing configurations of policy instruments, political institutions, and political culture. VEPs differ not only in design and requirements but also brand values as perceived by regulated firms. For example, competing government-sponsored and industry-sponsored VEPs could send different signals to firms about how external stakeholders assess the value of certification (Darnall et al., 2010).

Second, institutional distinctions contribute to the global diffusion of voluntary tools and their effectiveness. Since weak institutions hamper the effectiveness of traditional command-and-control tools in developing and emerging regimes, voluntary approaches were increasingly favoured by regulators there. In examining a government-sponsored VEP in China, Liu et al. (2018) found that policy uncertainty has distinct influence on within-industry and within-jurisdiction diffusion of voluntary environmental practices. Cross-country case comparison (two programs in Mexico and one in India) found that voluntary regulatory endeavours in developing regimes could be risky due to longstanding institutional hurdles such as weak regulatory and non-regulatory pressures, possible regulatory capture, and preponderance of small-scale firms (Blackman, 2008). In terms of diffusion of international environmental standards, accumulated evidence also suggest that it varies across regulatory contexts since firms face various types of institutional environments in terms of compliance culture, stakeholder pressure, and degrees of exposure to regulatory oversight.

Third, the efficacy of VEPs also varies across contexts. The weakness of voluntary programs due to lack of effective monitoring and sanction mechanisms is prevalent in both developed and developing regimes. This is evidenced in comparative case studies across nations, quantitative investigations of a wide array of domestic programs in a single country, and cross-country analysis of the aggregate benefits of VEPs. For instance, meta-analysis results indicate the limited effectiveness of the collective VEPs in the U.S. in that participants do not improve performance over nonparticipants (Darnall & Sides, 2008). Similar findings yield from the ISO 14001 certification in Mexico, suggesting a critical role of regulatory fines to attract dirty firms to join the voluntary endeavor and hence potentially to improve performance (Blackman & Guerrero, 2011). A cross-country analysis (a panel of 138 countries) suggests that aggregate ISO 14001 adoption is positively related to reduction in visible type of pollution only (Potoski & Prakash, 2013).

In sum, the over review above highlights the need for more large-scale cross-jurisdiction investigations to reconcile the mixed findings not only in current VEP research but also in the broader environmental regulation and compliance domains. We discuss potential future directions in the concluding part.

Research Methodologies in Environmental Regulatory Governance

Research methodologies adopted in environmental regulatory governance literature have become increasingly sophisticated in order to capture the dynamics of regulatory enforcement, compliance and monitoring in the regulatory process. Our earlier review of the literature falls in three broader methodological groups, namely qualitative, quantitative, and mixed method.

Early works, which were largely exploratory in nature, have widely adopted qualitative research methods, most notably, case studies within the context of a specific nation or a particular industry

sector. For example, Lo and Cheung (1998) discuss sustainable development model and associated challenges with the case of Guangzhou. Delmas and Keller (2005) used the case of the U.S. EPA Water Wise programme to detect the free riding problem in voluntary environmental programmes. Tilt (2007) observed the case from Sichuan rural industrial sector and found heterogeneity of the political ecology behind pollution enforcement in China.

Explorative studies have also been conducted based on interviews with environmental agencies' enforcement officials, industrial enterprises' managers, and eNGO leaders. Interviews allow us to have deeper understanding of organizations' behavior rationales, which are very difficult to capture otherwise. For example, At street level, a series of interviews with street-level environment enforcement officials in Guangzhou, China, had been conducted during 2000-2014 to explore enforcement strategies adopted at local enforcement agencies over time (Lo et al., 2016, 2019). Iraldo et al. (2011) investigated whether an environmental management system implemented within the EU Environmental Management and Auditing Scheme has a positive effect on both firm competitiveness and environmental performance based on 100 interviews with organizations. By conducting semi-structured interviews with green business professional and policy makers, Al-Saleh and Mahroum (2015) were able to uncover the interactions between various policy instruments and emergent green business models. Interviewing environmental activists provides novel insights on how the new environmental information disclosure policy create new roles and spaces for ENGOs to pressure on local governments and polluting enterprises (Johnson, 2011). Additionally, there has been increasing use of interviews with an array of government, enterprises, and ENGOs to explore the complex and dynamic interactions among these entities to enhance regulatory enforcement (Liu et al., 2015).

Another popular qualitative method is content analysis (Krippendorff, 1980). Content analysis is based on organizations' documents, including organizations' websites, annual reports or environmental reports, to count the number of occurrences of key information, or to make structural or linguistic analysis. For example, Albino, Balice, and Dangelico (2009) used content analysis to capture the evaluation of the measurable actions related to environmental strategies and green product development. A more sophisticated practice in this exploratory stage of regulatory governance research was a combination of case studies, interviews and documents content analysis, particularly the case in the context of developing and non-democratic settings where regulatory information was scare and fragmented, in order to provide a more solid inferential empirical basis for theorizing and generalization (e.g. Lo, Yip and Cheung, 2000). Although these qualitative studies have the advantage to penetrate to the underlying mechanisms of regulatory governance, the lack of statistical data hinders the literature to establish casual links (Iraldo, Testa, Melis, & Frey, 2011). The data limit includes not only the inadequate environmental performance data points and the unsatisfying quality of data, but also limit the generalization of the findings.

With the emergence of theory driven research questions in environmental regulatory governance, quantitative research methods have increasingly employed for these deductive inquires. Among them, questionnaire survey was perhaps the most frequently used. The survey methodology allows researchers to obtain a fairly large sample compared with case studies and interviews. Survey information has been collected from different actors in the regulatory community, such as corporations' CEOs and managers (Arimura et al., 2008; I Henriques & Sadorsky, 1999; Tang, Li, Fryxell, & Lo, 2015), environmental protection bureau officials (Tang et al., 2003), and eNGO leaders (Li, Lo & Tang, 2017). Survey studies have also been adopted to explore motivations of firms to seek for participating in environmental programmes (Fryxell, Lo, & Chung, 2004); the

effectiveness of VEPs adoption (Darnall & Kim, 2012); and the changes of institutional contexts and regulation attributes with different time points (Lo, Liu, Li, & Wang, 2016).

In addition to collecting primary survey data, researchers also use secondary archival data to model real world phenomena with more sophisticated econometric methods (Lyon & Maxwell, 2007; McGuire et al., 2018). With advanced data analytic methods and computer-aided techniques, researchers are able to build large datasets with cross-sectional or longitudinal data points. Usually the datasets are created with objective data. Longitudinal observations with large samples allow researchers to conduct more robust estimations. In terms of making estimations of the results, researchers can utilize a variety of statistical packages to identify the underlying patterns of the data. The most popular estimators are perhaps the versatile use of regression and structural equation modeling (SEM). Regression models, such as Linear Regression, LOGIT, ANOVA and MANOVA, are able to analyze of relationship between dependent and independent variables at one single level. In contrast, SEM enables researchers to answer a set of interrelated questions by modeling multiple dependent and independent variables simultaneously (Gefen, Straub, & Boudreau). In order to untangling the inconsistent findings, researchers also rely on the techniques of meta-analysis (Albertini, 2013; Darnall & Sides, 2008). Meta-analysis overcomes several short boards. It concerns with the "size" of the observed effect rather than whether the effect is significant. Second, it corrects for sampling biases. Third, it allows the comparison among studies that evaluate related but not necessarily identical dependent variables.

In recent year, more and more researchers turn to experimental methods to study environmental regulatory compliance. For example, Telle (2013) adopted a natural field experiment design to examine the efficacy of a regulatory program initiated by the Norwegian Environmental Protection Agency to enforce hazardous substances regulations, by randomly assign monitoring and enforcement actions to manufacturing firms. In sum, the regulatory field provides a rich setting to apply field and lab experiment design to explore the effectiveness of various regulatory approaches in modifying regulatees' attitudes, preferences, and subsequent compliance behaviors (Croson & Treich, 2014).

A less-common quantitative method adopted is modelling and simulation studies, which is widely used in environmental economics to examine regulatory topics. In order to compare the costs and effectiveness of different regulatory approaches, Jaffe and Stavins (1995) run a simulation study to compare the diffusion of new technology. La Nauze and Mezzetti (2019) model the regulation of diffuse emissions via regulatory incentives through the combination of tax rebates. Tietenberg (2006) summarizes 14 simulation studies applied to different regions and pollutants, and finds that abatement costs would be 40 to 95 percent lower under emission taxes or tradable allowances than other technology mandates or performance standards (Goulder & Parry, 2008).

In sum, the methodology in environmental regulatory governance literature becomes more sophisticated and diversified over time. The trend moves from cross-sectional single year observation to longitudinal analysis, from using single method to mixed methods, and from qualitative to integrating both qualitative and quantitative ones. The most frequent combination is perhaps to integrate survey and interview data (Kuperan & Sutinen, 1998; Wang & Jin, 2006). For instance, interview could be used as side-proves to complement the survey findings. In Lo and Fryxell (2005), via personal interviews with green associations, they logically argue for the lack of independence of the role green associations play during the policy process, and consequently their neglect of the importance residing in social involvement and support. The strength of mixed

methods also manifests in an array of research designs defined by the priority and sequence of the respective method (Molina-Azorín & López-Gamero, 2014).

Insert Table 5 here

Reflections, Discussions and Conclusions

The growing complexity in environmental regulatory research has taken place, as highlighted in the review above, notably in the search of alternative regulatory approaches in the enforcement pollution control and conservation regulations on the part of the regulatory agencies as the traditional command-and-control approach was proved to be of limited effectiveness; the inquiries into the puzzling compliance behavior on the part of regulated firms in an increasingly stringent regulatory setting and an ever expanding environmental legal regime in their gradual but active integration of corporate environmental management into their business sustainability strategy; the exploration into aggressive monitoring strategies of ENGOs under the growing recognition of them being an ally of regulatory agencies in regulatory governance; the examination of the cross-jurisdiction regulation in the rapid globalization of environmental regulatory governance in front of the urgency of effecting a better integrated environmental regulatory regime in domestic, national, regional and international linkage to combat environmental crisis in a world scale; and the adoption of sophisticated and innovative research methodologies as simplistic research methods being unable to take advantage of world-wide information bloom and data multiplicity in environmental regulation for producing highly credible and reliable analyses and findings for advancing the theoretical frontiers and solving practical environmental regulatory problems. How do these set the future agenda for the future environmental regulatory research?

In general, as shown in our conceptualization of the environmental regulatory community in Figure One, there is a call for an interactive perspective of environmental regulatory governance in the proper integration of these three key actors of enforcement agencies, regulated firms and ENGOs in a single study in terms of theory, methodology and research design for capturing the full picture of environmental regulation. In the review, existing environmental regulatory research has mainly taken up one of them as the core focus in research question formulation, in research design, in analytical framework development, and research methods adoption. Hardly anyone of them has gone beyond this single actor research format. Although theoretically there are already conceptual formulations available for possible reference, like collaborative regulatory governance, the "regulatory triangle" model, and possibly ecological modernization, they are still too loose to provide a sound analytical framework to sort out the theoretical linkage and interactions among them in the regulatory process, not to mention the challenges in research design and methodology selection as well as data collection and data analyses. Added to the complication is the further integration of different levels of regulation ranging from the street-level to the global level. In unpacking the complexity of the enforcement-compliance-monitoring triangle, the starting point may well be the study on the interactions of two actors at a given regulatory level, particularly interesting are the enforcement-compliance linkage on the agencies-firms' approaches-strategies responses, the enforcement-monitoring linkage on the patterns of environmental agencies-ENGO alliance; and the compliance-monitoring linkage on the effect of ENGO regulatory pressures on firms' compliance behaviors. More can be explored.

In the conceptualization of environmental regulatory enforcement style, the doubts on its traditional treatment as a coherent concept has been increasingly raised as there has been a growing trend of differentiating the inspection task from that of the sanctioning one. Frontline enforcement officials have increasingly been restricted from undertaking inspection of polluting firms' performance on their compliance with related pollution control regulations, while office-based enforcement officials will determine the penalties to be given to violators based on inspection information collected by these street-level inspectors. Such a division of regulatory task serves the important purpose of increasing the accountability of the enforcement team as a whole in order to reduce the possible capturing effect from the regulated parties and at the same time prevents possible conflicts of interest for inspectors in the performance of their enforcement duties. Liu van Rooij and Lo advanced this new conceptualization in their latest research on regulatory enforcement of pollution control regulations in China by separating the concept of enforcement into the two aspects of inspection and sanction with solid empirical support (Liu, van Rooij and Lo, 2018). This opens a new line of research to explore the proper linkage between inspection and sanction in environmental regulatory enforcement, both theoretically and empirically. Another stream of research emerges to explore a complementary tool of enforcement campaigns. Different from regular enforcement, campaign-style enforcement is largely driven by strong political sponsorship and massive resource mobilization. In Liu et al (2015), a dual pathway model comprises of resource mobilization and power redistribution was developed to unpack the recoupling mechanisms of campaign-style enforcement.

Firms in a wide range of sectors are regulated by environmental agencies that establish, monitor, and enforce rules on an array of environmental regulatory domains. Our overview of the environmental compliance literature highlights the significance to understand not only that industrial firms differ in their compliance performance but also varies in their compliance strategies towards environmental regulations. The traditional environmental regulation literature has mainly subscribed to regulatory perspectives to examine corporate compliance. Recent research integrates the regulatory and strategy literature to explore the strategic and behavioral pattern formed in the regulatory process. In our earlier work on corporate environmental coping strategies, for example, we shift the study of corporate environmental behavior into a diversity perspective instead of the traditional performance view. This new lens bridges compliance performance and its antecedents by explaining when certain compliance strategy will be adopted and its performance outcome. Future research could build on our frameworks and results to study corporate compliance strategies in a wide range of regulatory domains, and more importantly, how they potentially evolve over time.

As ENGOs have gained their momentous role in environmental regulatory governance in both international and domestic arenas, increasing research attention should be directed to ENGOs' organizations, strategies and effectiveness in achieving their watch-dog functions in the regulatory process. To deepen ENGO research, a multiple-stakeholder perspective can be considered, which may turn to be especially important when we seek to understand how ENGOs' monitoring strategies would change over time, for example, from confrontation to seeking partnership, from single strategy to a mixed strategy, in response to the divergent environmental interests of individual donors and funding bodies as well as taking advantage over the rise internet environmental activism and the growing influence of ESG investment. Finally, in-depth studies of ENGOs' monitoring strategy in developing and non-democratic settings are badly needed where

ENGOs' limited organizational and resources capacity are pronounced and the regulatory contexts are more hostile to their watch-dog role than the Western ones.

To effectively capture the growing complexity of environmental regulatory governance, the research design and methodological issue should be carefully considered. It is strongly desirable to have a long-term plan that starts with a cross-sectional study as the basis for cross-jurisdictional comparative and longitudinal studies. Such a research design would enable us to examine the dynamic for geographical and temporal variations. The challenge here is the difficulty of convincing regulatory agencies to involve their enforcement officials in the study. Methodologically, the mixed-method design collecting both quantitative (through questionnaire surveys and archival data compilations) and qualitative data (through interviews and case studies) has become increasingly popular. If properly integrated, it serves the important purposes of triangulation of findings, deepening the analysis, or broadening the scope of inquiry to enhance the validity and reliability of the study. To go beyond self-reporting bias, it is perfectly appropriate to make a serious attempt to get objective data, particularly on the actual performance and outcome of inspectors' enforcement actions. Recently, there has been a noticeable trend of employing data science methods by assembling a large data set based on available statistics on the regulated domain concerned for model analyses or hypothesis testing, which has been made attractive and feasible with greater disclosure in environmental information and pollution statistics at both domestic and global levels and in both developed and developing countries. To perform data analytics with large datasets of more observations and longer time-frame is extremely desirable. Large datasets allow greater variety in performing the analysis, particularly predictive analysis and machine-learning approach that has rapidly diffused in the field. In addition, based on objective data and advanced analysis techniques, the findings are often statistically more reliable with greater explanatory power. However, large datasets are not always problem-free, particularly in the measurement of constructs, and the treatment of correlation as causal relations in data analysis. However, the most challenging part in employing this method is providing the data-mining endeavour with a strong theoretical underpinning of regulatory enforcement in order to make the study theory- instead of data-driven. In short, the complexity rests with the proper integration of different methodologies in the research design.

Moreover, recent methodological development offers opportunities to advance and test theory of environmental regulation and compliance. In particular, the Big Data movement make data utilization for full-cycle of environmental regulatory studies possible. One obvious extension is to integrate the considerable amount of data from social media, internet search, and NGO monitoring data with the increasingly available government disclosed data. Such data integration offers strengths in data and measurement source to explore the width and depth of interactions within the "regulatory triangle". Such potential has been demonstrated in recent scholarly effort to examine the underlying mechanisms of how non-governmental monitoring increase local governments' compliance with central mandates in environmental information disclosure (Anderson et al., 2019). More rigorous and comprehensive work in this and other directions is needed. It is in our hope that our review of the three broad environmental regulatory topics in a comparative perspective and methodological issues could spark future ideas to advance the field.

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Figures

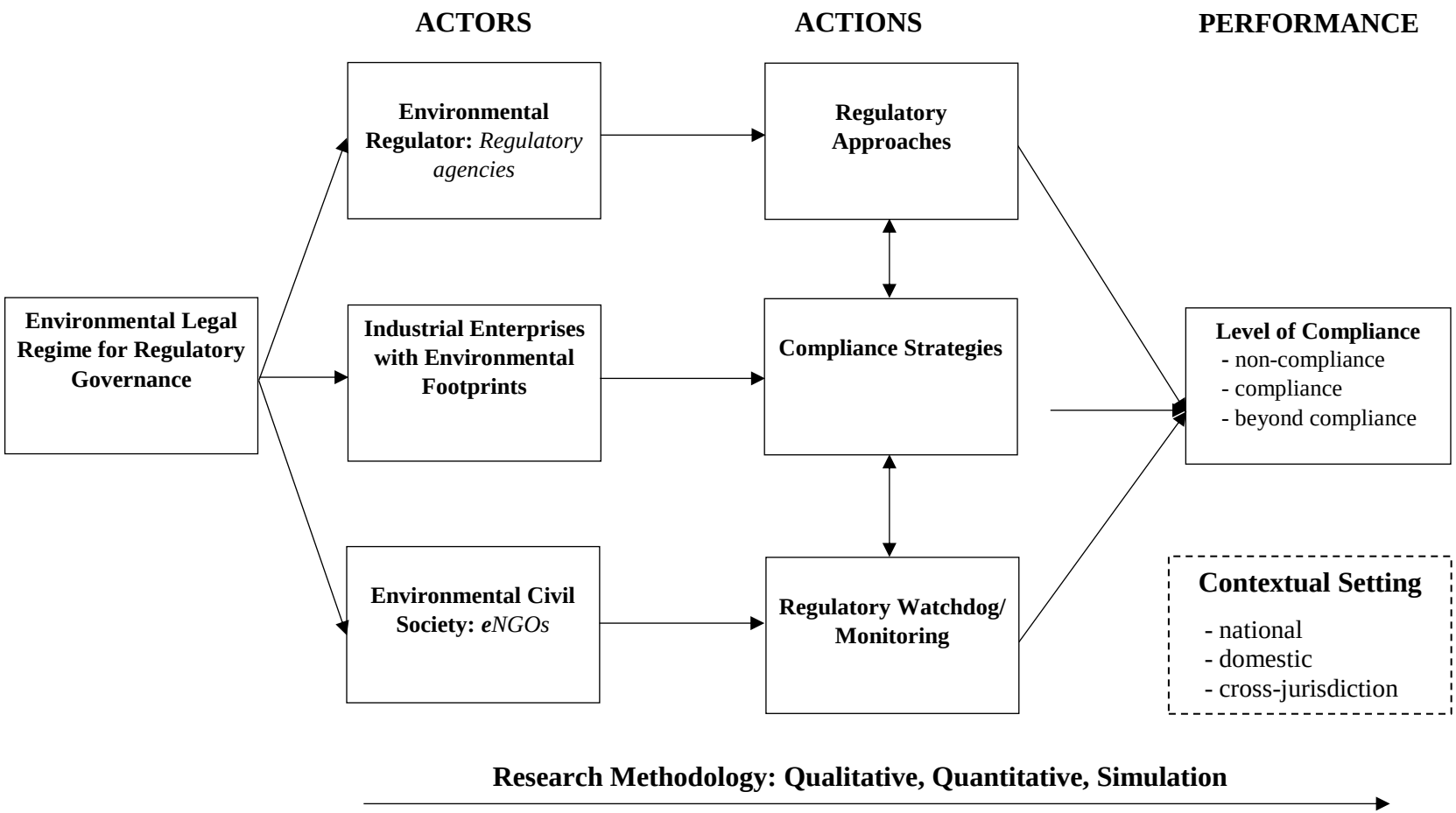

FIGURE 1. Complexity in Environmental Regulatory Governance: Conceptualization

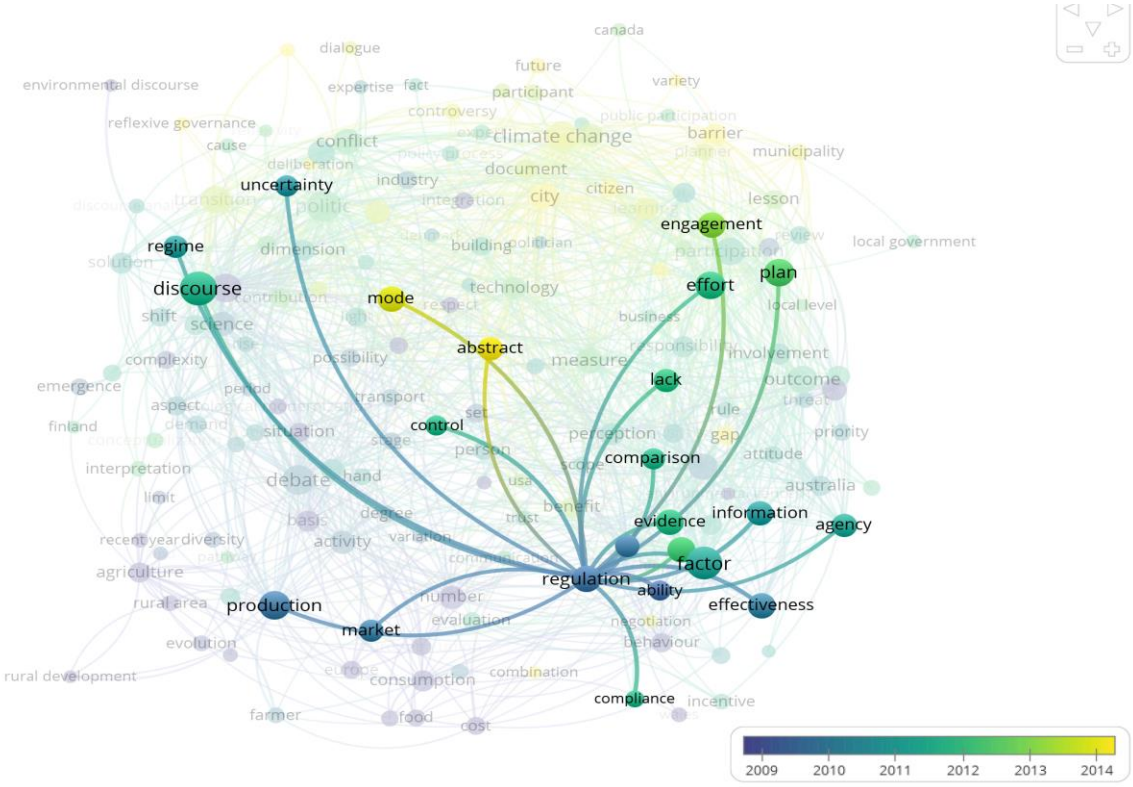

Figure 2. The most relevant terms occurring in the title or abstract of JEPP articles, with data obtained in Scopus database

Tables

Table 1. Regulatory approaches and policy instruments

Regulatory approach	Related instruments	Strengths	Weaknesses
Command-and-control/direct approach	Technology mandates; Performance standards	High effectiveness	Economic inefficiency; high imposing and monitoring costs
Incentive-based/ Market-based approach	Marketable pollution permits and allowances; Effluent taxes; Grants and subsidies	High flexibility; lower imposing costs	Mismatched incentives
Voluntary approach	ISO 14001; 33/50 programme; Green Lights; Leadership in Energy and Environmental Design (LEED)	High flexibility and organizational autonomy	Free-riding and shirking; excess entry

Table 2. Selective Studies on Each Regulatory Approach in Environmental Governance

Author(s)	Summary
Hahn and Stavins (1991)	Policy instruments are divided as "command-and-control" approaches and market-based/incentive-based approaches. The evaluation of policy design is proposed from the aspects of static efficiency and cost effectiveness, dynamic incentives, and the relative distributional equity or fairness. The study calls for a positive theory of instrument choice.
Tietenberg (1990)	Economic theory and empirical evidence support the improved cost-efficiency and flexibility compared with the traditional "command-and-control" approaches, in the policy context of emission trading and emission charges.
Potoski and Prakash (2004)	The study explores the interaction of government regulatory enforcement and firms' compliance with mandatory regulations and voluntary codes. The win-win outcomes can be achieved with both sides cooperating and the credible signals between firms and government are projected.
Gunningham (2009)	The article examines a new collaborative environmental governance approach, which involves the collaboration among diverse stakeholders of government and social actors. The devolving of decision-making from the state to the local level contributes to a greater degree of success, conditioned on three roles the government serves: definitional guidance, participatory incentives, and enforcement capability.
Anton, Deltas, & Khana (2002)	Three sources are found to motivate firms adopt environmental management system (EMS), which are the threat of liabilities and pressures from consumers, investors and the public. Among all, consumer pressures motivate firms to adopt higher quality EMS. EMS is found to significantly reduce firms' emissions.
Marshall (2008)	Policy makers begin to take the challenge of decentralizing environmental governance seriously. The community-based voluntary cooperation is clarified from the perspectives of collective actions and robustness by applying the "nesting principles".
Liu, Lo, Zhan, & Wang (2015)	The article develops and tests a model of recoupling mechanisms of campaign-style enforcement and its effects on environmental regulatory compliance. Regulatory compliance can be effectively improved when the efficiency and legitimacy conflicts are addressed by providing policy incentives and clear hierarchy in political authority.

Table 3 Selective Conceptual Classification of Corporate Approaches/Strategies in Environmental Management and Compliance

Author(s)	Conceptual Classifications
Braithwaite (2003)	Five motivational postures to capture the way regulatees position themselves in relation to regulatory authority, including two positive orientations (commitment and capitulation) and three defiance postures (resistance, disengagement, and game playing).
Roome (1992)	Four business positions on the environment: three reactive (driven by threat, legislation, and communication) and one discretionary (management driven). Five strategic options: noncompliance, compliance, compliance plus, commercial and environmental excellence, leading edge.
Hart (1995)	Three interconnected environmental strategies: pollution prevention, product stewardship, and sustainable development.
Aragón-Correa & Sharma (1998)	Three types of types of corporate approaches to manage the natural environment: information & education, traditional/regulated correction, modern/voluntary prevention.
Henriques & Sadorsky (1999)	Four profiles of corporate environmental practices: reactive, defensive, accommodative, and proactive.
Buysse & Verbeke (2003)	Three dominant environmental management strategies: reactive, pollution prevention, and environmental leadership.
Murillo-Luna, Garces-Ayerbe, & Rivera-Torres (2008)	Four types of environmental response pattern in terms of degree of proactivity: passive, attention to legislation, attention to stakeholders, total environmental quality.
Liu, Tang, Lo, & Zhan (2016)	The article conceptualizes a four-dimensional classification of corporate environmental coping strategies and environmental practices, namely, formalism, accommodation, referencing, and self-determination. Corporations adjust their coping strategies by considering the constraints defined by both internal and external environments. The article demonstrates that referencing and self-determination strategies are associated with stronger environmental protection practices compared with formalism and accommodation strategies.

Table 4. Regulatory Strategies of Environmental NGOs

Authors	ENGO Strategies
Peres-Aleman & Sandilands (2008)	The study discusses how to include and upgrade small-scale suppliers in the global supply chains in order to benchmark them with new social and environmental norms. NGOs may build partnerships with multi-national corporations and drive the defining and implementation of new standards in the industry. The NGO-MNC partnership can support the small-scale suppliers and localize the standards in developing countries.
Spar & Mure (2003)	The study discusses the phenomenon that NGOs (including environmental NGOs) are increasingly focussing their powers of persuasion of firms in forms such as protests and lobbying. Firms in turn have increased their compliance with NGO pressure, especially those who place great value on their brand images.
Johnson (2011)	The study describes how environmental NGOs in China use government-led environmental information disclosure to hold polluting firms accountable through stimulating public participation. The ENGO website display a blacklist of names and violations of any firms who have been sanctioned by local government and media. The ENGO also seek to persuade these firms to improve their environmental performance and provide incentive to be removed from the blacklist.
Yang (2005)	In the study, the author discusses how ENGOs can serve as both sites and agents of democratic social change in China. The author mentions that ENGOs sometimes take legal actions to fight polluting industries and to protect pollution victims. For example, the ENGO in the study perform monitoring duties by operating a telephone hotline to collect environmental legal issues.
Cook, Wright, & Andersson (2017)	In the context of forest governance, the study tries to uncover the relationship between NGO funding and governance responsiveness. With the purpose to fulfil the organization's missions and goals, EGNOs may choose to fund the local government in order to exert political pressures.
Li, Lo, & Tang (2017)	The article has examined a theory of ENGO policy advocacy under authoritarianism. It analyzes how ENGOs would manage their resource dependencies and political risks and shape their advocacy strategy under the influence of government funding, government affiliation, foundation funding and peer collaboration.
Rietig (2016)	The study investigates how government representatives pay attention to the inputs of ENGOs in the international negotiations. Two broad strategies of ENGOs are presented. First is activist strategy, which involves pressurizing government representatives via media to influence public opinions and to raise concerns about an issue that demands government action. Second is lobbyist strategy, by which ENGOs try to influence governmental negotiation positions to reflect the ENGOs' objectives.

Table 5. Research Methodology

Research methodology	**Analysis technique**
Qualitative approach	Case study
	Survey study
	Interview
	Content analysis
Quantitative approach	Econometrics and modelling
	Cross-sectional/Longitudinal/Panel data analysis
	Meta-analysis
	Simulations
Integrated approach	Qualitative and quantitative approach integration