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Co-Ownership and Environmental Performance

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Business
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CO-OWNERSHIP & ENVIRONMENTAL PERFORMANCE
(Thesis format: Integrated Article)

by

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Graduate Program in Business Administration

A thesis submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

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ABSTRACT

Over the past 50 years, scholars have examined the effects of industrial activity on the natural environment and why firms should willingly spend resources to reduce their environmental impacts. While scholars have identified numerous economic benefits that accrue to firms prioritizing environmental performance, firms still vary considerably in the manner and extent to which they address their hazardous waste. Recent studies have placed an emphasis on business context and what differentiates firms' responses to societal concerns. However, we still know very little about how divided corporate ownership influences environmental outcomes. This dissertation examines *whether, when, and why divided corporate ownership affects the emission and mitigation of hazardous waste known to adversely impact human health.*

I first ask whether and when divided ownership influences facilities' emissions and mitigation of hazardous waste and examine if perceived harm (cancerous and non-cancerous hazards) encourages greater precautions. I then take a closer examination of JV ownership coalitions to explore the mechanisms by which divided ownership influences the mitigation, namely the recycling and treatment, of cancerous and non-cancerous hazardous waste. I find robust empirical evidence that co-ownership, ownership dispersion (i.e. the number of partners and their balance of equity), the types of owners collaborating in a JV, coalition heterogeneity, and chemical classifications influence the extent and manner in which JV facilities address their hazardous byproducts.

Overall, this dissertation demonstrates when co-ownership detracts from environmental performance and broadens theoretical accounts of ownership's nuanced social sensitivity to hazardous externalities.

Keywords: Joint Ventures, Environmental Performance, Hazardous Emissions, Pollution Mitigation, Ownership Dispersion, Coalition Heterogeneity

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INTRODUCTION

For over 50 years, business scholars have examined the environmental consequences of industrial activity. While society accepts that some hazardous byproducts are a natural result of production (Coase, 1988), scholars have increasingly studied the reasons why firms should voluntarily spend additional resources to go above and beyond legal requirements to protect the general public from known harm. Normative prescriptions of moral duty have exhibited only limited success in changing organizational behaviour, so emphasis has shifted towards enticing firms to mitigate harm by building the business case for environmental sustainability and identifying how it “pays” (Griffin & Mahon, 2003; Margolis & Walsh, 2001; Roman, Hayibor, & Agle, 1999; Burke & Logsdon, 1996). Moral-duty perspectives remain, but, increasingly, scholars recognize that change will occur more quickly by linking sustainability to traditional organizational objectives (Marcus & Fremeth, 2009).

Many studies in the 1990s and 2000s appealed to the economic self-interest of organizations by establishing the link between environmental and financial performance. For example, scholars have theorized and found evidence that pursuits of environmental performance improve financial performance by creating strategic benefits (Porter & van der Linde, 1995), providing learning opportunities (Larpe, Mukherjee, & Van Wassenhove, 2000), reducing risks (Shrivastava, 1995) and liabilities (Rooney, 1993), lowering the costs of capital (Sharfman & Fernando, 2008), lowering costs of materials usage (Hart, 1995) and hazardous waste disposal fees (Young, 1991), increasing sales (Bagnoli & Watts, 2003), and improving production efficiency (Sprinkle & Maines, 2010; Klassen & Whybark, 1999; Waddock & Graves, 1997).

Meta-analyses concur that pursuits of the common good can pay off or break even without sacrificing profits (Margolis, Elfenbein, & Walsh, 2007; Orlitzky, Schmidt, & Reynes, 2003), but others highlight that firms pursue environmental sustainability *when* it pays not necessarily *because* it pays (Reinhardt & Stavins, 2010; van de Ven & Jeurissen, 2005). In other words, firms evaluate the economic and/or strategic advantages of socially beneficial investments and pursue them when the predicted returns exceed their costs. Despite all the advantages associated with a corporate focus on environmental performance, a wide and persistent variance in environmental outcomes still separates those firms embracing environmental sustainability from those avoiding the topic altogether.

This research is inspired by an interest in understanding why seemingly similar organizations differ in the extent to which they control foreseeable harm arising from their activities. Neither the traditional normative prescriptions for moral duty nor the profit-enticing empirical accounts appear adequately equipped to answer systematic sources of variance in environmental outcomes. A growing consensus of executives recognize the importance of working within society's expectations and avoiding activities that societies deem unacceptable (Gunningham, Kagan, & Thornton, 2004), calling into question a lack of conviction to address stakeholders who increasingly expect firms to reduce their environmental impacts. Further, "two decades of tightening regulatory rules and legal threats have led many businesspeople to assume that any hazards and harms that their enterprise engenders, even if not clearly illegal today, will sooner or later be subject to public censure, government action, and legal liability" (p. 308), calling into question a strategic choice to ignore environmental hazards or an inability to recognize their importance.

More recent extensions within the sustainability literature focus upon firms' differences and their unique sensitivities to the costs and benefits of environmental performance (van de Ven & Jeurissen, 2005). Herein lies the frontier of sustainability research – determining when, why, and how situational context matters to environmental performance. Different types of organizations have differential access to resources that can affect their costs for social investments (Darnall & Edwards, 2006). Different firms have different constituencies exhibiting unique environmental preferences (Sharma, 2000; Branzei *et al*., 2004). Certain types of firms, such as publically traded corporations, find themselves more exposed to public scrutiny than others, leading them to invest more heavily in the common good (Lee, 2009). Owners account for value differently, which can differentiate social investments (Berrone *et al*., 2010; Westhead, Cowling, & Howorth, 2001; Birley, Ng, & Godfrey, 1999; Fletcher, 2000).

While research is beginning to uncover why individual firms, given their unique situational contexts, differ in the extent to which they invest in the common good, we still know very little about how joint-venture (JV) partnerships between firms, each with unique preferences, affect environmental outcomes. Reconciling social investments with financial objectives is difficult enough for individual firms (Margolis *et al*., 2007; van de Ven & Jeurissen, 2005). Reconciling social investments with multiple organizations' unique characteristics, constituencies, preferences, and financial objectives appears to be a formidable challenge.

In August 2011, ConocoPhillips was blamed for an oil spill off of China's coast in the Bohai Sea; in April 2012, the company agreed to pay approximately $297 million in compensation (Rapoza, 2012). ConocoPhillips, the minority operating partner of a 51-49% joint-venture (JV) with the China National Overseas Oil Corporation (CNOOC), immediately notified the Chinese government about the spill, but clean-up operations were delayed for weeks.

ConocoPhillips complained that its joint-venture partner prevented containment of the spill in a timely manner (Watts, 2011). CNOOC had allegedly insisted on contracting with one of its Chinese affiliate companies for environmental emergencies rather than using ConocoPhillips' own service provider, which could respond to environmental emergencies anywhere in the world within 24 hours. These co-ordination challenges for building social value through protecting the environment eventually resulted in an uncontained oil spill the size of London (U.K.), significantly affecting the Chinese fishing and tourism industries (Kuang *et al*., 2012).

This incident, and especially the division of interest and blame between the two partners, provides anecdotal evidence that co-ownership creates difficulties for co-ordinating collective action for environmental objectives. It raises important new questions for sustainability scholars about the role corporate ownership plays in environmental performance – specifically, how and why co-ownership influences JV's ability to reduce environmental impacts.

In this thesis, I take an in-depth examination of co-ownership to explore whether, when, why, and how co-ownership influences two aspects of environmental performance – hazardous emissions and pollution mitigation. I explore not only the additional challenges that JV organizations face in identifying common interests and agreeing upon collective action, but also how the characteristics of a JV's ownership coalition and its members systematically influence cancerous and non-cancerous waste processing. I find strong evidence that co-ownership, the characteristics of JV partners, and the characteristics of the ownership coalition influence the extent to which facilities address hazardous byproducts.

1.1 Joint Ventures and Environmental Performance

Joint-venture (JV) scholars have long recognized the challenges of co-ordinating multiple owners' divergent interests (Alchian, 1965; Demsetz, 1967; Cartwright & Zander, 1968; van de Ven, 1976) at the facility level (Harrigan, 1988; Gill & Butler, 1996), which become increasingly complicated with additional owners (Graicunas, 1937). I argue that divided corporate ownership undermines partners' ability to identify, agree, and act upon common interests for pursuing the common good.

JVs rely heavily upon partitioning and specialization in the components of private property (Alchian, 2008). In forming equity JVs, corporate partners pool their resources to create a separate legal entity that produces some product that the individual firms cannot efficiently produce independently (Das & Teng, 2000). Regardless of the root cause of the inefficiency, each parent firm seeks complementary resources that make the enterprise viable. When JV partners dedicate resources to the enterprise, they increase the risk of expropriation by releasing control over corporate assets to a separate legal entity with multiple property rights holders (Mahoney, 2005).

To manage this additional risk, JV partners negotiate a contract (a.k.a. partnership agreement) that defines each partner's rights to residual claimancy and control (Libecap, 1989), rights of monitoring and governance (Reuer, Ariño, & Mellewigt, 2006; Kumar & Seth, 1998), and roles and responsibilities (Gulati & Singh, 1998). In negotiating the contractual agreement, partner firms attempt to build in protections against value expropriation (Williamson, 1991) while seeking to maximize their private net gains (Libecap, 1989). While these ex-ante guidelines protect individual owners' interests, they also impede efficient decision making (Pearce, 1997) and create structural rigidities (Mahoney, 2005; Barzel, 1997) resistant to change

(Libecap, 1989). Thus, JVs appear to face greater challenges in coordinating collective action for pursuing socially beneficial investments.

JV scholars provide several guideposts that identify how much ownership corresponds to an equity JV where minority partners actively engage in the venture, because very small equity owners may simply invest in the enterprise without actively participating. While anecdotal evidence and previous studies suggest that a minority partners can, at least, partially control a JV (Geringer & Herbert, 1989; Mjöen & Tallman, 1997), scholars propose that the minimum minority ownership for equity joint-ventures ranges between five percent (Killing, 1983) to twenty percent (Dhanaraj & Beamish, 2004). I first adopt Dhanaraj & Beamish's (2004) more conservative twenty percent threshold to examine the differences between equity JVs and independent firms and to ensure coordination challenges are present among JV co-owners. I then adopt the more liberal threshold to examine differences among JVs because I argue that different levels, types, and configurations of ownership influence the manner in which facilities deal with hazardous waste.[1]

In Chapter 2, "*The Environmental Consequences of (un)Divided Ownership,*" I focus on how and why environmental decisions differ for JVs and independent organizations and, subsequently, how these differences affect hazardous emissions and pollution mitigation for substances with known cancerous and non-cancerous properties. Unlike their independent peers, when making equity allocations, JV partners face a trade-off between investment incentives and control-benefits extraction (Hauswald & Hege, 2009). JVs inherently raise owners' concerns about control (Wang & Zhu, 2005; Kumar & Seth, 1998; Inkpen & Beamish, 1997), cost

[1] All of the results in this thesis are robust to examining the population of JVs using a 1% equity threshold. These results are available from the author upon request.

spillovers (Richards & Yang, 2007), and benefit capture (Killing, 1983; Gulati & Singh, 1998) and focus owners' attention on who contributes, who benefits, and how from each investment decision (Mahoney, 2005; Libecap, 1989; Barzel, 1997). Despite these difficulties, JV owners frequently align their interests to collectively pursue additional economic efficiencies (Das & Teng, 2000).

Nonetheless, economic and environmental efficiencies are not always aligned; environmental performance typically requires trade-offs (Husted & Salazar, 2006). These trade-offs are not exogenously determined, as JV partners tend to face the same regulatory constraints and institutional pressures as their independent peers. As regulation increases and society increasingly focuses on industrial byproducts, more convergence in environmental outcomes would be expected across facilities and firms, regardless of ownership.

However, the challenges of aligning multiple owners' interests (Killing, 1983; Parkhe, 1993; Cartwright & Zander, 1968) could undermine investments in the common good when financial returns remain uncertain or incalculable. Divided ownership complicates trade-off decisions, reduces strategic flexibility, and impedes structural adaptability (Mahoney, 2005; Barzel, 1997; Libecap, 1989) because JVs must work within the confines of negotiated terms (Killing, 1983). Environmental performance investments are understood as purchases of a public good (Reinhardt, 1999, 1998) that require an extensive amount of sustained effort (Marcus & Fremeth, 2009; Falck & Heblich, 2007; King & Lennox, 2002; Klassen & Whybark, 1999) for distant and uncertain future benefits (Economist, 2009; Elkington, 1998). If any partner remains unwilling to make such an investment, the other partners must either forgo environmental performance investments or choose to incur a disproportionate cost for improving environmental outcomes.

I argue that co-ordination challenges reduce the odds of achieving consensus for environmental performance initiatives. As a result, I expect that JV facilities produce more hazardous waste, emit more hazardous waste, and address less hazardous waste through pollution mitigation than individually owned facilities. However, I also theorize that social forces, in the form of increased liability and perceived differential harm, will influence the extent to which JV facilities differ from independent facilities in the manner in which they deal with their cancerous and non-cancerous waste. I test these arguments through adopting a quasi-experimental, matched-pair design, a method of causal inference (Dehejia & Wahba, 2002), that contrasts Canadian independent and joint-venture facilities who disclosed their hazardous emissions and abatement efforts to Environment Canada between 2004 and 2009.

While Chapter 2 focuses on differences between JVs and independent firms, Chapter 3, *"JV Ownership Coalitions and Environmental Performance,"* examines how and why JVs differ from one another in pollution mitigation – namely, the recycling and treatment of hazardous waste. Scholars theorize that firms pursue (or refrain from) environmental sustainability for instrumental reasons (Lynch-Wood & Williamson, 2007; Hawkins & Hutter, 1993), ranging on a continuum from moral-duty to profit-maximization (van de Ven & Jeurissen, 2005; Scalise, 2005; Cox & Hazen, 2003). In Chapter 3, I argue that the characteristics of a JV's ownership coalition and the characteristics of the coalition's members shift the extent to which JVs exhibit a moral-duty or profit-maximization tendency.

I argue that ownership dispersion – that is, more owners with more balanced equity stakes – undermines partners' ability to identify, agree, and act upon common interests for pursuing the common good, thus shifting the JV's tendency toward profit maximization. However, I further argue that *who* sits at the table also matters; different types of owners have different costs (Darnall & Edwards, 2006), stakeholders (Darnall, Potoski, & Prakash, 2010; Darnall, Henriquez, & Sadorsky, 2009), and preferences (Berrone *et al*., 2010; Schulze *et al*., 2001) that influence the extent to which managers gravitate toward moral-duty or profit-maximization perspectives. To test these arguments, I examine the effects of JV ownership dispersion, types of partners, and coalition heterogeneity on pollution mitigation for JVs reporting to Environment Canada's National Pollution Release Inventory between 2004 and 2009.

1.2 Intended Contribution

The intended theoretical contribution of this dissertation is explaining why and how the decision to collectively organize for production has consequences for how owners see and negotiate the interface between business and society. I explain and empirically find that co-ownership has predictable environmental consequences. However, JV owners can and do overcome co-ordination challenges to reduce hazardous emissions and improve pollution mitigation for facility byproducts perceived to be the most detrimental to human health.

Chapter 2:
The Environmental Consequences of (un)Divided Ownership

Environmental performance has preoccupied management scholars since the late 1950s. The sustainability literature has evolved through several distinct periods (Marcus & Fremeth, 2009), from humble beginnings creating awareness, to exploring ethical mandates (Levit, 1958) and moral responsibility (Donaldson & Davis, 1991), to building a business case for sustainability (Porter & van der Linde, 1995), to explicitly questioning the financial returns of environmentally responsible business practices and measuring the environmental impact of hazardous waste (King & Lenox, 2002; Russo & Fouts, 1997). While a growing consensus asserts that the benefits of environmental performance outweigh its costs (Reinhardt & Stavins, 2010; Margolis, Elfenbein, & Walsh, 2007; Roman, Hayibor, & Agle, 1999; Russo & Fouts, 1997), organizations still differ considerably in the manner and extent to which they address their hazardous byproducts.

Some scholars ascribe variances in environmental performance to differences in corporate ownership (Darnall & Edwards, 2006; King & Shaver, 2001; Margolis & Walsh, 2001; Sethi, 2003). For instance, some argue that long-term institutional ownership increases investments in the common good because managers depend upon long-term investors who actively monitor firms and have more to gain from social investments (Neubaum & Zahara, 2006; Johnson & Greening, 1999). Berrone *et al*. (2010) aver that family-controlled firms exhibit greater environmental performance because family owners attain additional non-economic value from social investments, such as an enhanced family reputation. Yet, others theorize and find evidence that public firms exhibit greater environmental performance because they are more visible and face greater societal pressures (Lee, 2009).

While these studies highlight how and why different kinds of owners influence firms' environmental outcomes, the question of co-ownership has not received much theoretical or empirical attention. The only study I found on co-ownership and environmental performance examined firms' use of one hazardous chemical. Lee (2009) found that joint ventures emitted more benzene than did public firms, and he attributed this finding to the increased visibility of public firms. Because co-ownership partially shelters corporate owners from public scrutiny, Lee (2009) suggests that JVs are more likely to engage in incidental wrongdoing (Bazerman & Tenbrunsel, 2011; Palmer, 2012).

I extend Lee's study and contribute to prior research on ownership and environmental performance by examining whether, how, when, theoretically why, and to what extent divided corporate ownership influences the emission and mitigation of hazardous byproducts. Divided ownership elucidates decision processes that independent firms take for granted because partners place additional emphasis on who contributes, who benefits, and how from each investment decision (Libecap, 1989). Each owner brings a unique mix of constituents and priorities that influence not only its own environmental strategy (Sharma, 2000) but also its social investments and expected returns from these investments (Berrone *et al*., 2010; Branzei *et al*., 2004). Any investment decisions made by co-owned facilities are more heavily scrutinized by multiple parties on a cost-benefit basis, and the allocation of costs and returns may be disputable. If one or more partners remain unwilling to invest in environmental initiatives, other partners must either opt out all together or choose to incur a disproportionate cost for improving environmental outcomes. As a result, divided corporate ownership increases the difficulty of co-ordination

(Killing, 1983; Parkhe, 1993; Cartwright & Zander, 1968) and reduces the odds of achieving consensus (Kim & Mahoney, 2002).

I examine these arguments in the context of hazardous emissions and pollution mitigation for over 300 hazardous chemicals used by Canadian facilities and reported to the National Pollution Release Inventory (NPRI) between 2004 and 2009. The NPRI provides an ideal setting in which to examine the effects of divided ownership because Environment Canada sets and enforces systematic standards for reporting, reports facility performance publicly, and facilitates comparisons across environmental outcomes and/or industries. I focus specifically on the facility level of analysis because facilities represent the key unit of intervention and accrual for environmental activities (Environment Canada, 2012; U.S. Environmental Protection Agency, 2012a).

I find that divisions of ownership are consequential: co-owned facilities, on average, emit approximately 74% more hazardous byproducts than do their single-owned peers.

2.1 THEORY & HYPOTHESES

I define a joint-venture as a common legal organization where two or more firms pool a portion of their resources (Kogut, 1988) to produce some product or service that collaboration makes more lucrative (Das & Teng, 2000). I adopt Dhanaraj & Beamish's (2004) more conservative definition of an equity JV, namely a JV where at least one minority partner holds a minimum of twenty percent equity, to provide added assurance that at least two partners are actively participating in the venture.

JVs tend to be highly customized (Turowski, 2005), but one characteristic that distinguishes JVs from their independent peers is the transaction costs associated with shared ownership. The JV literature examines transaction costs from two distinct vantage points. The first examines the JV organizational form as a mechanism for corporations to reduce transaction costs by building economies of scale (Dyer, 1997; Hennart, 1988), overcoming knowledge asymmetries (Inkpen, 2000; Chi & McGuire, 1996), gaining entry into new markets (Delios & Beamish, 1999; Makino & Neupert, 2000; Beamish & Banks, 1987), and subjugating opportunism (Crook *et al*., 2013; Williamson, 1991). The second examines the increased transaction costs associated with owners bridging differences and making decisions within the JV organizational form (Pearce, 1997). I extend this second account from economic considerations to environmental outcomes.

I argue that coordinating social investments generally, and environmental investments more specifically, is more challenging for JVs, because each owner has to incur immediate costs for distant and uncertain shared future benefits (Slawinski, 2010; Sarkis & Cordeiro, 2001; Hart & Ahuja, 1996; Elkington, 1988). Investing in projects with immediate costs and ambiguous and uncertain returns could prove especially problematic for co-owners mindful of proportionally allocating costs and benefits (Barzel, 1997; Libecap, 1989; Demsetz, 1967) because of the increased likelihood of cost and benefit spillovers. Even when partners are willing to discuss the allocation itself, their attempt to establish criteria for proportional contributions and gains significantly and often suddenly magnifies coordination costs. Although co-owners can discuss and agree on precautionary or protective measures, they will struggle to track costs over the long-term and/or to protect benefits they cannot readily observe.

2.2 JVs and Hazardous Waste Volume

The sustainability literature recognizes that hazardous byproducts are a combined function of production; pollution prevention, which attempts to remove hazardous byproducts from the production lifecycle; and pollution mitigation,[2] which attempts to safely dispose of hazardous waste once it occurs (King & Shaver, 2001; Klassen & Whybark, 1999). Pollution prevention refers to any proactive measures that integrate environmental concerns into product design and process technologies and that subsequently influence the types of pollutants emitted, the hazardous byproducts generated, and the energy consumed in the production process (Klassen, 2002; Judge & Douglas, 1998). Pollution mitigation, in contrast, refers to the recycling and treatment of hazardous waste prior to disposal.

JVs could produce greater volumes of hazardous waste because they forego pollution prevention measures that eliminate hazardous waste before it occurs (King & Lenox, 2002).[3] The benefits of pollution prevention are oftentimes unobservable (King & Lenox, 2002; Klassen & Whybark, 1999; Hart & Ahuja, 1996) and incalculable (Elkington, 1998). Even when JVs can foresee environmental benefits, attaining them takes time and money: pollution prevention requires a long-term (Arora & Cason, 1995), sustained (Hirschhorn, 1994) commitment of resources, while its positive yet uncertain effects accrue in the distant future (Slawinski, 2010).

Investing in projects with immediate costs and ambiguous and uncertain returns (Sarkis & Cordeiro, 2001; Hart & Ahuja, 1996) appears especially problematic for co-owners mindful of proportionally allocating costs and benefits (Barzel, 1997; Libecap, 1989; Demsetz, 1967) because of the increased likelihood of cost and benefit spillovers. This makes it more likely for

[2] Some sustainability scholars use the term pollution control rather than pollution mitigation to refer to end-of-pipe measures such as the recycling and treatment of hazardous waste. However, the public policy literature uses the term pollution control to refer to legal and regulatory requirements (Lin & Darnall, 2010) for pollution abatement. I use the term pollution mitigation to avoid any misunderstandings surrounding the definition of pollution control.

[3] JVs could also differ in hazardous emissions and pollution mitigation due to larger production volumes, since those facilities that produce more typically create more hazardous byproducts (Harrison & Antweiler, 2003; Antweiler & Harrison, 2003). JV scholars have long-emphasized economies of scale as one of the primary motivations for joint-venturing (Shapiro & Willig, 1990; Kogut, 1988; Hennart, 1988; Contractor & Lorange, 1988).

one or more of the partners to decline or delay needed investments, which unevens the cost-benefit calculations and adds further coordination challenges to all the JV partners. Even when co-owners can discuss and agree on precautionary or protective measures, they will struggle to track costs over the long-term and/or to protect benefits they cannot readily observe.

I therefore predict that joint-venture facilities produce more hazardous byproducts than do their single-owned peers, because divided ownership makes it more difficult (costly and complex) to agree upon and implement pollution prevention measures.

Hypothesis 1: JV facilities produce more hazardous byproducts than do single-owned facilities.

2.3 Environmental Trade-offs

Divided ownership may constitute an influencing factor in the way facilities deal with the hazardous products of their activities. The classic trade-off set-up in the sustainability literature is economic: because emitting is cheaper and mitigation is more expensive, managers that focus upon profit-maximization will opt for more emissions and/or less mitigation. This trade-off may be sharper for JVs for a couple reasons. First, JVs have a clear economic value-creation mandate (Killing, 1983), which increases the saliency of costs and benefits for all owners, directing attention to economic considerations (Barzel, 1997; Libecap, 1989). Second, when facilities have multiple owners, their different calculations of costs and benefits re-activate economic considerations on an ongoing basis (Mahoney, 2005; Libecap, 1989).

But some owners also make environmental trade-offs: they compare the environmental pains and gains of different ways of dealing with hazardous byproducts (Sarkis & Cordeiro, 2001; El-Halwagi, 1997). Emitting comes with serious environmental consequences, which can be costly for owners – but not necessarily equally costly for all owners. When there are multiple owners, these pains may be diluted or diverted to a different partner. Pollution mitigation provides some environmental gains, but these too may be unevenly diffused and distributed among multiple partners. Environmental trade-offs may be less influential for JVs compared to their single-owned peers because divided corporate ownership disassociates pains and gains through delegating operational and executive control, ex-ante guidelines, and/or routines that constrain even the best-intended co-owners from considering environmental concerns (Pearce, 1997).

Across facilities, social scrutiny can also motivate the reduction of emissions and/or greater mitigation. Social scholars suggest that public scrutiny provides incentives for favouring pollution mitigation over emissions (Langpap, 2007; Lynch-Wood & Williamson, 2007). For example, the appearance of doing good builds goodwill that subsequently establishes commitment to a company's stock and products (Margolis *et al*., 2007). On the other hand, firms that violate the public's expectations can bring about swift recourse in the form of reputational damage, decreased sales, and progressively stringent regulation (Gunningham, Kagan, & Thornton, 2004).

I argue that the effectiveness of social scrutiny is diminished when multiple owners are involved, because the effectiveness of social pressures will be diluted when multiple owners are involved. An independent owner has complete control over the operations of a facility and therefore presumably has direct responsibility for its emission and mitigation of hazardous byproducts. Attribution theory suggests that assigning responsibility for good or bad outcomes is relatively easy in cases of single ownership (Teigen & Brun, 2011; Shaver, 1996), but external observers struggle to assign accolades or blame to multiple causal agents (Teigen & Brun, 2011; Sanders & Hamilton, 1997; Shaver, 1996) embedded within complex organizations (Gailey &

Lee, 2005; Sanders & Hamilton, 1997). To hold individual JV owners accountable, observers must disentangle the JV's ownership structure to determine who is responsible, and in what proportion, within the embedded principal-agent relationships of a JV.

I therefore predict that, compared to their independently owned peers, co-owned facilities will emit more and mitigate less hazardous byproducts.

Hypothesis 2A: JV facilities emit more hazardous byproducts than do single-owned facilities.

Hypothesis 2B: JV facilities mitigate less hazardous byproducts than do single-owned facilities.

2.4 Legal Considerations

Facility owners are not always free to choose the way they deal with hazardous byproducts, even if they bypass public scrutiny when considering environmental trade-offs. Laws and regulations constrain corporate behaviour by setting limits on emissions; they create and enforce expectations by providing legal demands to work within these constraints and legal recourse against firms who ignore them.

However, laws and regulations are not always effective at influencing pollution abatement. Many claim that existing laws and regulations fail to provide enough incentive to encourage environmentally responsible behaviour (Gunningham *et al*., 2004). Some argue that the costs of compliance exceed the costs of non-compliance (Lanoie, Laplante, & Roy, 1997; Russell, 1990), and environmental agencies oftentimes lack the resources for effective enforcement (Russell, 1990). I argue that divided ownership will influence the effectiveness of specific laws and regulations on the emissions and mitigation of hazardous byproducts. I explore this argument using the legal liability regimes which predetermine the allocation of environmental pains, or legal liability, when multiple partners are involved.

Legal liability regimes that govern business within a political jurisdiction define firms' potential liability in cases of environmental harm. In cases of divided ownership, the liability of the partners does not necessarily reflect their ownership shares (Wright, 1988). Typically, plaintiffs hold the joint-venture liable for its own actions, and penalties are allocated proportionally to corporate owners. However, in cases of insolvency, undercapitalization, or negligence, different jurisdictions specify how strictly property rights assignments are externally enforced (Grady, 1990). Some Canadian provinces restrict potential liabilities on a basis of proportional responsibility, while others disconnect ex-ante responsibilities from ex-post penalties for wrongdoing.

Joint-and-several liability regimes treat defendant firms more harshly (Kornhauser & Revesz, 2009; Kornhauser & Revesz, 1994) and provide victims with certain added protections against wrongdoing (Dopuch, Ingberman & King, 1997); plaintiffs can hold any solvent partner fully liable for damages incurred (Kornhauser & Revesz, 2009; Vandall, 2000; Wright, 1988). Businesses frequently complain, however, that joint-and-several liability encourages unmeritorious lawsuits (Palmrose, 1994-1995: 54). These regimes likely encourage additional preventative care because JV partners increasingly seek to find shared priorities, and, as enforcement increases, to act on these priorities so they can anticipate and mitigate penalties disproportionate to the bundles they own (Grady, 1990).

Proportional liability regimes, in contrast, appear to provide fewer incentives for addressing hazardous externalities in cases of divided ownership. Proportional liability provides

JV partners with added protections by limiting their liability to the proportion of their responsibility for wrongdoings (Kornhauser & Revesz, 2009; AAMDC, 2010). In these regimes, plaintiffs must individually sue each potentially culpable party to recover full damages, thus increasing plaintiffs' costs, discouraging lawsuits, and preventing disproportional penalties.

Co-owners in stricter liability regimes share a common interest in mitigating potential disproportionate liabilities. I therefore expect that JV facilities in stricter liability regimes will emit less and mitigate more hazardous waste than will all other facilities.

Hypothesis 3A: JV facilities in joint-and-several liability regimes emit less hazardous byproducts than do all other facilities.

Hypothesis 3B: JV facilities in joint-and-several liability regimes mitigate more hazardous byproducts than do all other facilities.

2.5 Categories of Harm

People agree that corporate actions should not harm bystanders (van de Ven & Jeurissen, 2005; Gunningham *et al*., 2004), and Donaldson & Dunfee (2000) point to a significant and growing global consensus around the moral authority of such transcultural norms. Consistent with the precepts of major religions and philosophies, global industry and professional standards, and the laws of multiple countries (Dunfee, 2006), these "hyper-norms," which emphasize the avoidance of harm, drive managerial behaviour and sometimes substitute for the absence or ineffectiveness of laws and regulations (Donaldson & Dunfee, 1994: 265). Thus, perceptions of harm should influence the relationship between divided ownership and the choices facilities make to address their hazardous byproducts.

Classifications of harm represent one characteristic of hazardous byproducts that influences these perceptions. Federal and non-profit organizations classify chemicals according to the numerous dimensions that capture their hazardous impacts on humans and the natural environment. Cancerous and non-cancerous human health impact classifications are fairly common across scales (Toffel & Marshall, 2004; Bare *et al*., 2003; McKone & Hertwich, 2001). Classifying chemicals in this manner shapes the way people think about hazardous emissions (Slovic, 1996). Such classifications not only stigmatize unambiguous harm (Berman & Wandersman, 1990; Stahly, 1989) but can also mislead some to believe that ambiguous harm is less problematic. For example, some may consider the impacts of ‘non-cancerous’ chemicals as somehow more manageable and/or less undesirable than those of ‘cancerous’ chemicals, although exposure to non-cancerous emissions has deleterious effects, such as high rates of chronic and acute respiratory illnesses, increased morbidity, and decreased life expectancy (Bare *et al*., 2003).

The perceived undesirability of harm influences the likelihood that social observers will blame and sanction organizations for wrongdoing (Lang & Washburn, 2012). The more severe the perceived undesirability, the more likely such questionable behaviour will trigger feelings of suffering, unfairness, and violations of in-group and out-group boundaries (Appiah, 2009). Because all owners should see and agree that cancerous emissions are harmful, they have similar inherent and external incentives to avoid such unambiguous harm. Thus, I do not expect that co-ownership contributes to differences in the emission or mitigation of cancerous chemicals.

Hypothesis 4: For cancerous byproducts, there is no difference between JV and single owned facilities in a) emissions and b) mitigation.

Conversely, I hypothesize that ambiguous categories such as “non-cancerous” chemicals leave room for interpretation, both among stakeholders and among owners. In such cases, JVs may downplay environmental considerations and prioritize the economic trade-offs discussed above, emitting more and mitigating less of their non-cancerous hazardous byproducts than their independently owned peers.

Hypothesis 5: For non-cancerous hazardous byproducts, JV facilities a) emit more and b) mitigate less than single-owned facilities.

2.6 METHODS

2.6.1 Data and Sample

I examine the relationship between divided ownership, hazardous emissions, and pollution mitigation by examining Canada's legislated inventory of pollutant releases, named the National Pollution Release Inventory (NPRI). Under the Canadian Environmental Protection Act (CEPA 1999), Environment Canada is charged with collecting, compiling, and insuring the accuracy of self-reported pollution data for over 8800 facilities exceeding chemical release thresholds for at least one of over 300 tracked substances (Environment Canada, 2013a). Environment Canada randomly conducts on-site visits to verify reported data, and if these audits identify any inaccuracies, firms are legally obliged to correct their reports (Environment Canada, 2013b).

Reporting to the NPRI is mandatory under Canadian law, however, the NPRI does not track all hazardous substances, and some facility sectors remain exempt from reporting requirements. Federal law also provides exemptions for all facilities utilizing fewer than 20,000 annual man hours, the equivalent of 10 full-time employees, which prevents examining data for the smallest Canadian facilities. A sector by sector analysis indicates that the percentage of reporting facilities varies for the highest polluting industries (from 36 to 97%), due to these exemptions, but NPRI coverage and compliance has increased substantially over time

(Environment Canada, 2013c). I focus solely on industry sectors that contain JVs that reported to the NPRI.[4]

Environment Canada periodically adds new chemicals to the reporting requirements,[5] updates reporting and auditing procedures, and changes chemical report thresholds (Environment Canada, 2013d, 2012). I included the last five years of publicly available data at the initiation of the study (2004–2009), since changes to the NPRI reporting program and estimation procedures make it difficult to clearly compare more recent data to earlier periods. [6] I verified the continuity of reports across the five years,[7] and the data appeared robust to potential reporting errors of omission and commission, which affected less than one percent of the sample over the five-year period. I corrected four obvious data-entry errors for facility size[8] but made no further alterations to the original data.

2.6.2 Empirical approach

I leveraged a quasi-experimental propensity score matched-pair design to empirically test how divided ownership influences facility-level environmental performance. JV and independent facilities differ on many characteristics, and any of these differences may introduce bias into estimates. Randomizing facilities into treatment and control groups would overcome this

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[4] A list of industries included in this analysis is provided in Appendix B.

[5] This study only observes chemicals that were tracked by Environment Canada as of 2004. A complete list of chemicals observed in this study is provided in Appendix A.

[6] 2009 represented the last year of publically available data at the initiation of this study.

[7] I reviewed entries year by year to flag and document any potential inconsistencies or disparities. I flagged observations 1) where a facility consistently filed reports for four contiguous years and failed to provide a report in one of the years in my sampling frame, 2) where a facility failed to report a chemical one year while consistently reporting the chemical in previous and future years, 3) when a facility report on a specified chemical exceeded a 500% annual difference without being part of an apparent upward or downward trend for the facility's use of that chemical, and 4) where someone obviously made a data-entry error on the fields observed in this study.

[8] None of the corrected records was chosen as a match by the propensity score matching algorithm used in this study.

challenge, but randomization is practically infeasible with observational data. Propensity score matching (PSM) provides a feasible alternative to empirically singling out the effect of ownership by maximizing comparability between treatment and control groups (Villalonga, 2004). PSM allows causal inference (Rosenbaum & Ruben, 1983) and yields unbiased estimates in the absence of experimentation (Dehejia & Wahba, 2002) by pairing each co-owned facility with an independently owned peer that is closely aligned on observable internal and external characteristics.

Specifically, PSM uses a vector of the observable relevant differences to maximize the comparability between two facilities in all respects except the predictor of interest. By comparing facilities that closely resemble each other on all other observables, PSM effectively deals with sample-selection bias on the predictor variable (Heckman, Ichimura, & Todd, 1998). In other words, this approach ensures comparability of facilities that differ in ownership. This aspect is important in general because ownership is a choice that occurs early in the life of the firm and changes infrequently over time. Therefore, the same facility's environmental performance cannot typically be observed before and after a switch in ownership structure. The PSM approach requires the inclusion of all relevant characteristics and assumes that any remaining unobserved differences occur due to random chance, leaving open the possibility of selection bias on non-observed characteristics.

I defined an equity JV as any co-owned facility where the second largest corporate parent holds at least 20% ownership (Dhanaraj & Beamish, 2004), which provided a sample of 85 JV facilities[9] that had filed 303 hazardous waste processing reports to the NPRI between 2004 and 2009. Table 1 provides a detailed description of the ownership configurations within these JVs using Blodgett's (1992) topology of JV ownership. I then used a PSM algorithm (Leuven & Sianesi, 2003) to identify the nearest-neighbour independently owned facility for each co-owned facility. I used matching with replacement to maximize comparability between treatment and control observations, minimize selection biases for observable characteristics (Dehejia & Wahba, 2002), and avoid additional bias stemming from the order in which treatment units were matched (Rosenbaum, 1995). Although matching with replacement can reduce the precision of estimates, it is preferable in cases when there are few observable differences and when the number of close matches remains questionable (Dehejia & Wahba, 2002).

Table 1: JV facility-year observations under different configurations of ownership

		Number of Partners			
		2	3	4	5-6
Ownership Category	Majority-Minority (32)	49	23	1	16
	Slightly Unequal (14)	53	3	0	0
	Dual Ownership (28)	103	0	0	0
	Minority-Minority (11)	0	17	9	18

* The number of JV facilities per ownership category is provided in parentheses

Scholars emphasize that including variables that are weakly related to treatment assignment typically reduces bias more than it increases variance, and, therefore, most believe that all available controls should be included in matching algorithms (Rubin & Thomas, 1996; Heckman *et al*., 1998), especially when the number of control observations vastly exceeds the number of treatment observations (Ho *et al*., 2007), as in my data. Based on theoretical rationale explained in greater detail below, I used all available, relevant, and observable characteristics for

[9] I excluded one military joint venture (Canadian/U.S. SIC code 811/971), all independently owned military facilities, and 3 equity JVs not meeting the ownership threshold defined by Dhanaraj & Beamish (2004) for equity JVs. Including these facilities produced similar findings.

the matching algorithm:[10] the legal jurisdiction into which each facility falls (the province where they are located), the three-digit Standard Industry Classification (SIC) code, size (the number of employees per facility), scale (the number of peer facilities sharing the same federal business number), and impact (the number of chemicals processed by each facility).[11] This approach resulted in a final sample of 606 facility-year observations, including 249 facilities in 37 industries.[12]

2.6.3 Dependent variables

I used two operationalizations for the dependent variables. I first analyzed hazardous emissions and pollution mitigation by weighting chemicals according to their cumulative impacts on human health using the Chronic Human Health Indicator (CHHI). The CHHI constitutes a chemical toxicity-weighting mechanism within the U.S. Environmental Protection Agency's Risk-Screening Environmental Indicators (RSEI) model (U.S. Environmental Protection Agency, 2012b) that provides different weights to chemicals based upon human exposure pathways, because the same chemical can have a differential impact depending upon whether it is inhaled or absorbed through contact or consumption (Toffel & Marshall, 2004). I then used a finer-grained operationalization that weights chemicals with the Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI). TRACI is a newer EPA-sponsored measure that acknowledges differences for each exposure pathway depending upon

[10] Many of the demographic fields in the NPRI are optional, and Environment Canada does not vet optional information. Propensity score algorithms cannot consider records with missing data, so I included all observable, mandatory, vetted, and relevant fields in the analysis.

[11] Production volume and financial indicators represent two unobservable factors that could introduce bias into estimates if JVs and independent firms systematically differ on these criteria. Prior studies on hazardous emissions typically used the number of employees as a rough proxy for production (Antweiler & Harrison, 2003), and JVs are not required to provide financial information to the public.

[12] The mean propensity score difference between the 303 JV facility year observations and their matches was .0020 with a standard deviation of .0078.

whether a given chemical has cancerous or non-cancerous human health impacts. The measure utilizes disability-adjusted life years to consider decreased life expectancy and the years lived with disability standardized by discount weights to capture unfavourable health conditions (Bare *et al*., 2003).

I calculated hazardous byproducts with the equation

$$ln \sum(\varphi_{\mathrm{cetf}}\omega_{\mathrm{sce}} + \delta_{\mathrm{cetf}}\omega_{\mathrm{sce}} + \Psi_{\mathrm{cetf}}\omega_{\mathrm{sce}}) \, , \qquad (1)$$

hazardous emissions with the equation

$$ln \sum(\Psi_{\mathrm{cetf}}\omega_{\mathrm{sce}}) \, , \qquad (2)$$

and pollution mitigation with the equation

$$ln \sum(\varphi_{\mathrm{cetf}}\omega_{\mathrm{sce}} + \tau_{\mathrm{cetf}}\omega_{\mathrm{sce}}) \, , \qquad (3)$$

where φ represents the total tonnage of chemical c recycled that would typically affect humans through exposure pathway *e* in year *t* for facility *f*, and *ω* equals the hazardous weight provided by scale s (CHHI vs. Traci) for chemical *c* for exposure pathway *e.* δ represents disposals (with and without treatment), Ψ represents emissions, and τ represents the total hazardous byproducts disposed of after treatment. I take the log transformations of these measures to correct for skewness and kurtosis.

2.6.4 Independent variables

I operationalized the JV indicator (*JV*) as 1 for joint ventures and as 0 for independent facilities, which allowed me to examine the effect of co-ownership on hazardous emissions and pollution mitigation. I operationalized the joint-and-several indicator (*J&S*) as 1 for joint-and-several political jurisdictions and as 0 otherwise, because more legal stringency in the form of potentially disproportionate liability may influence co-owned facilities corporate response to hazardous waste. The empirical setting (Canada) contains three distinct legal liability regimes that vary in stringency. Most Canadian firms operate under the most stringent joint-and-several legal liability regime. However, Saskatchewan firms operate under a pure proportional liability regime, while British Columbian firms operate under a hybrid joint-and-several/proportional liability regime. I coded both Saskatchewan and British Columbian facilities as 0, since there were not enough Saskatchewan observations to allow a separate analysis of that province's less-stringent legal liability regimes.[13]

2.6.5 Control variables

Since my population of interest (i.e., co-owned facilities) was stratified within the numerous dimensions used to match co-owned facilities with similar independently owned facilities, I used each matching criterion as a control within the regression equations (Ho et al., 2007; Villalonga, 2004; Friedlander & Robins, 1995). Following prior NPRI (Harrison & Antweiler, 2003; Antweiler & Harrison, 2003) and TRI studies, (Berchicci *et al.*, 2012; King & Lenox, 2001; King & Shaver, 2001), I used facility size (*FacilitySize*), operationalized by the number of facility employees, as a crude measure of production, because I expected larger facilities to pollute more. I also controlled for the number of chemicals (*NumberofChemicals)* and the volume, or raw tonnage, of hazardous waste (*HazardousByproducts)* reported by each facility because I expected facilities emitting a larger number and volume of chemicals to differentially anticipate (Hart, 1995), monitor (Russo & Fouts, 1997), report (Sharma & Vrendenburg, 1998; Shrivastava, 1995), and abate (Diestre & Rajagopalan, 2011) their emissions.

[13] Excluding Saskatchewan facilities altogether does not alter the findings in the analysis.

I also controlled for three additional aspects of ownership that can influence environmental outcomes. First, approximately 23% of the facilities had at least one foreign owner. I controlled for the percentage of foreign ownership (*ForeignOwnership*) because prior studies argue that foreign-owned firms pollute more (King & Shaver, 2001) and may be judged more harshly for doing so (Lange & Washburn, 2012). Second, I controlled for the percentage of ownership represented by firms listed on the S&P 500 and S&P TSX Composite Index (*S&P*) in case additional visibility and/or equity market scrutiny influences environmental performance[14] (Lee, 2009; Villalonga, 2004). Finally, firms with multiple facilities may face stronger pressures for shared responsibility and/or take advantage of peer-to-peer learning in pollution prevention and abatement. I therefore controlled for the number of Canadian-based, NPRI-reporting peer facilities owned and operated by the same parent(s) (*PeerFacilities*).

2.6.6 Analysis

I used standard OLS pooled regression and clustered the error terms by facility to account for potential correlation in the error term attributable to the same facility reporting across time (Rodgers, 1993). I included year fixed-effects (*Year*) to account for annual trends in pollution abatement technologies, industry fixed-effects at the three-digit SIC level (*Industry*) to control for idiosyncratic differences that vary across industries, and provincial fixed-effects (*Province*) to account for any cultural and regulatory differences attributable to regional jurisdictions. My baseline regression equation was:

[14] The percentage of foreign ownership and the percentage of ownership listed on S&P indexes were excluded from the matching algorithm because independently owned facilities would either be 100% or 0% in both of these indicators.

$$\ln(Emissions\ or\ Mitigation) = \beta_0 + \beta_1(JV) + \beta_2(J\&S) + \beta_3 \ln(FacilitySize) + \beta_4\ln(PeerFacilities) + \beta_5 \ln(ForeignOwnership) + \beta_6 \ln(S\&P) + \beta_7 ln(NoChemicals) + \beta_8\ln(HazardousByproducts) + \beta_{9-16}(Province) + \beta_{17-53}(Industry) + \beta_{54-58}(Year) + \varepsilon$$

Overall, the baseline model accounted for a significant proportion of the variance in the data, ranging from 40 to 63 percent depending upon the dependent variable observed. The independent variables accounted for up to 3.1% of the statistical significance in the model depending upon the dependent variable examined.[15] As expected, context (industry and province) and scale (facility size, number of chemicals reported, and hazardous waste volume) accounted for the vast majority of variance in the data. While the models' statistical significance attributable to the independent variables appears small, the more important question is whether the substantive significance of the findings is meaningful (Miller, 2008; Weisberg. 2004). The results below demonstrate that co-ownership, overall, significantly and substantially influences hazardous emissions and pollution mitigation for substances known to detrimentally impact human health.

Correlations between the independent variables were moderate, but multicollinearity did not appear to affect the results. The largest variance inflation factor (VIF) for the JV predictor was 1.49, and the largest VIF for remaining variables was J&S at 5.66, well below the threshold value of 10 (Kennedy, 1997; Neter *et al*., 1996), indicating that multicollinearity did not affect the results. While all coefficients' corresponding p-values were significant at an alpha level of

[15] The independent variables independent accounting for variance in the data was examined by running the models without control variables.

0.05 in the main analysis, I indicate a more liberal level of significance at an alpha of 0.1 since a type II error, that is the failure to reject the false null hypothesis, would fail to identify outcomes that potentially impact human health. Table 2 provides the descriptive statistics of the matched-pair sample along with pair-wise correlations among variables in the analysis.

2.7 RESULTS

Tables 3 and 4 present the results of the analysis. Hypothesis 1 predicted that, ceteris paribus, JV facilities would produce more hazardous byproducts because they struggle to align their collective interests to agree upon and implement pollution prevention measures that require long-term investments with uncertain and hard-to-allocate returns. As shown in column 1 of Table 3, the coefficient for the JV predictor was negative and statistically non-significant, indicating that co-owned facilities do not produce more hazardous byproducts than the matched control of single-owned facilities. I further verified that this matched control sample was representative of the larger population of single-owned facilities using ANOVA.[16] The f-statistic of 1.84 (p=0.175) confirmed that the control subsample did not significantly differ from the population of independently owned facilities. Thus, H1 was rejected: JV facilities do not automatically produce more byproducts than do comparable single-owned facilities.

Hypothesis 2A predicted that JV facilities would emit more hazardous waste compared to their independently owned peers, because JVs favour economic trade-offs and are less likely to take environmental trade-offs into consideration when deciding how to deal with their hazardous byproducts. The results indicated that, compared to their independent cohorts, co-owned

[16] Not displayed for parsimony. I used frequency weights to account for the same independent facility observation serving as a match for multiple JV facility observations, and I restricted the ANOVA to those industries included in the match-pair sample.

Table 2: Descriptive statistics and pairwise correlations

		Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9
1	Volume Haz. Byproducts	1,182,578	7,726,940	0	158,000,000	1								
2	Hazardous emissions	367,867	1,255,587	0	24,100,000	0.2207	1							
3	Mitigation	95,429	432,635	0	5,337,714	0.0664	0.0877	1						
4	Non-Cancerous Emissions	159,398	706,154	0	6,968,236	0.0980	0.2328	0.0442	1					
5	Cancerous Emissions	53.80	461	0	9,440	0.0229	0.0181	0.1673	0.0489	1				
6	Non- Cancerous Mitigation	13,587	111,301	0	1,934,868	0.0823	0.0292	0.0359	-0.0154	0.0129	1			
7	Cancerous Mitigation	42.54	420	0	4,791	0.0108	-0.0060	0.1365	0.0307	0.6370	-0.0116	1		
8	JV	0.50	0.50	0	1	0.0452	-0.0533	-0.1802	0.1086	-0.0920	-0.0009	-0.1011	1	
9	J&S	0.86	0.34	0	1	0.0054	-0.0774	0.0771	-0.2799	0.0370	0.0174	0.0401	0.0000	1
10	Facility size	888	2,142	2	11,252	0.0731	0.1724	0.1898	-0.0180	0.2392	0.0615	0.1976	-0.2014	0.1155
11	Peer facilities	5.39	16.43	0	121	-0.0307	-0.0131	-0.0484	-0.0340	-0.0298	-0.0274	-0.0177	-0.0382	-0.0822
12	Foreign ownership	15.60	32.20	0	100	-0.0615	-0.0873	-0.0730	-0.0581	-0.0508	-0.0506	-0.0491	0.2319	0.0944
13	S&P Constituency	16.29	30.96	0	100	0.0236	-0.0296	-0.0952	-0.0315	-0.0339	0.1168	-0.0532	0.2767	-0.0341
14	Number of Chemicals	13.98	11.72	1	58	0.1759	0.2460	0.1852	0.2242	0.3318	0.1815	0.3642	-0.0833	-0.1210

		9	10	11	12	13	14
9	J&S	1					
10	Facility size	0.1118	1				
11	Peer facilities	-0.0636	-0.0909	1			
12	Foreign ownership	0.0609	-0.0830	0.0091	1		
13	S&P Constituency	-0.0154	-0.1066	-0.0931	-0.0421	1	
14	Number of Chemicals	-0.1106	0.2235	0.0518	-0.1972	-0.0120	1

Note: n = 606. The minimum reported total toxic emissions exceeds zero, but rounds to zero. Correlations (absolute value) greater than 0.0796 (0.1045) are significant at the 5% (1%) level.

Table 3: The relationship between co-ownership and pollutants weighted by their general human health impacts

	Hypotheses 1			Hypothesis 2A		Hypothesis 2B	Hypothesis 3A	Hypothesis 3B
	Hazardous Byproducts	Hazardous Byproducts	Emissions	Emissions	Mitigation	Mitigation	Emissions	Mitigation
JV		- 1.2291		0.5544 ***		- 0.9240	-0.6014	- 3.5532
		(4.6471)		(0.2901)		(1.7547)	(1.0286)	(3.7094)
JV*J&S							1.4007	- 3.0438
							(1.0920)	(7.2197)
J&S	3.2241	3.1718	1.9481 **	1.9713 ***	- 1.5904	- 1.6291	1.3494	3.1862
	(11.2731)	(11.3192)	(1.1570)	(1.1108)	(7.1841)	(7.1133)	(1.1844)	(4.0871)
Ln(Facility Size)	7.1286 ****	7.1060 ****	0.5805 ****	0.4875 ****	2.2617 ***	2.2460 ***	0.5952 ****	2.2581 ***
	(1.8921)	(1.9129)	(0.1039)	(0.1627)	(0.9014)	(0.8849)	(0.0965)	(0.8911)
Ln(Peer Facilities)	2.1536	2.0613	0.4461 ***	0.4875 ***	0.1019	0.0329	0.5087 ***	0.0810
	(2.3725)	(2.3351)	(0.1725)	(0.1627)	(1.1262)	(1.1243)	(0.1680)	(1.0737)
Ln(Foreign Ownership)	0.1564	0.1752	0.0041	- 0.0044	0.0923	0.1065	-0.0078	0.0986
	(0.2662)	(0.2812)	(0.0162)	(0.0163)	(0.0854)	(0.0854)	(0.0160)	(0.0877)
Ln(S&P Constituent)	- 0.0315	- 0.0256	0.0054	0.0027	- 0.0220	- 0.0175	0.0014	- 0.0204
	(0.1060)	(0.1041)	(0.0049)	(0.0048)	(0.0307)	(0.0295)	(0.0048)	(0.0294)
Ln(No. Chemicals)	17.9299 ****	17.8468 ****	1.7357 ****	1.7711 ****	3.2728 ***	3.2138 ***	1.7547 ****	3.1765 ***
	(4.8048)	(4.7838)	(0.2702)	(0.2592)	(1.3789)	(1.3945)	(0.2603)	(1.3953)
Ln(Haz. Byproducts)			0.0214 ****	0.0215 ***	0.0058	0.0056	0.0211 ****	0.0046
			(0.0044)	(0.0043)	(0.0220)	(0.0220)	(0.0043)	(0.0223)
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.5111	0.5103	0.7319	0.7347	0.4898	0.4896	0.7369	0.4896
ΔR^2		0.0008		0.0028		0.0002	0.0050	0.0002
Facilities	249	249	249	249	249	249	249	249
n	606	606	606	606	606	606	606	606

p<.001 = ****; p<.01 = ***; p<.05 = **; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parenthesis
Chemicals in hypotheses 1 to 3 are weighted using the Chronic Human Health Indicator

facilities emit approximately 74% more hazardous emissions,[17] lending support for hypothesis 2A. Net of the volume of hazardous waste resulting from each facility's production process (H1),co-ownership was shown to have significant and substantial effects on facilities' emissions.

Counter to Hypothesis 2B, I found no evidence that JVs and independently owned facilities differ in hazardous byproducts mitigation. While the coefficient for JV facilities is large and negative, it is statistically non-significant. This result was somewhat surprising in light of JVs' hazardous emissions. I considered the possibility that JVs mitigate similar amounts of hazardous waste because recycling and treatment technologies may not exist for some chemical byproducts, since King & Shaver (2001) suggest that foreign-owned facilities may produce unique and unfamiliar chemical compounds that prevent mitigation. Unlike King & Shaver, however, I found no evidence of a relationship between foreignness and hazardous waste processing,[18] and every chemical reported by facilities in the sample had been recycled or treated by firms prior to 2003. Thus, all emitted chemicals in the sample could have been treated or recycled, but facilities chose to emit nonetheless.

One potential explanation for this non-finding is that most facilities – JVs and independent alike – appeared to do little in terms of pollution mitigation. Over the six-year sample, facilities treated or recycled only 12.64% of all hazardous waste that could have been treated or recycled.[19] Perhaps facilities minimize pollution mitigation to the bare minimum allowed by laws or regulation. An alternative explanation is that all facilities employ at least

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[17] The percentage difference for JV facilities is determined by examining the exponentiated coefficient of the JV indicator variable: $\exp(\beta_1) - 1 =$ exp(0.5544) – 1 = 1.74

[18] King & Shaver (2001) did not examine JV facilities in their study, and they weighted chemical hazards by an older method that is no longer utilized (i.e. the inverse of reportable quantity threshold), providing two potential explanations for the different findings.

[19] Based upon hazardous waste reported to the NPRI by all facilities, prior to weighting the level of hazard.

some half-hearted pollution mitigation measures, perhaps to signal a requisite degree of concern for environmental externalities.

In hypotheses 3A and 3B, I predicted that, compared to all other facilities, co-owned facilities in pure joint-and-several regimes would emit less and mitigate more hazardous waste since stricter liability regimes increase the enforceability of social expectations through potentially disproportionate penalties. Counter to my predictions, I found no evidence that JV facilities in stricter liability regimes differ from other facilities in hazardous emissions or pollution mitigation; I therefore reject hypotheses 3A and 3B.

One potential explanation for these results might be that they stem from unobservable cultural differences within political jurisdictions in the sample. Eighty-seven percent of my observations for non-joint-and-several regimes derived from British Columbia, where environmental landscapes represent a great source of pride and concern for the region's population (Willems-Braun, 1997). This heightened awareness of environmental issues could influence decision-makers embedded within the regional culture and provide additional incentives for facilities to address environmental externalities, thus eliminating the legal liability influence that would typically be observed.

Another potential explanation is that disproportionate liability manifests only in cases of undercapitalization, insolvency, or negligence (Grady, 1990). It is possible that co-owners of struggling or undercapitalized JVs in stricter regimes pay closer attention to environmental externalities or that co-ownership reduces the likelihood of negligent emissions. However, the data cannot differentiate facilities along these dimensions. The self-reported (and sometimes audited) and publicly available government information simply speaks to more typical decisions and behaviours[20] that may not activate the legal liability regime.

As shown in Table 4, I next examined the extent to which co-owners attend to cancerous byproducts (H4A and H4B) and neglect non-cancerous byproducts (H5A and H5B). Supporting null-hypotheses 4A and 4B, I found no difference between JV and independent firms in their emissions and mitigation of cancerous byproducts. JV and independently owned facilities emit (H4A) and mitigate (H4B) similar amounts of cancerous waste. A power analysis, including a sample size of 606, a minimum observed R^2 of 0.3979, 58 predictors, and a type-one error rate of .001, revealed that hypotheses 4A and 4B provided a statistical power equal to one, indicating that there was more than sufficient statistical power to support these null hypotheses. In support of hypothesis 5A, I found that co-owned facilities emitted approximately 158% more non-cancerous hazardous waste. However, I found no evidence that they mitigate less non-cancerous waste, which led me to reject hypothesis 5B.

While I expected co-owned facilities to emit more non-cancerous byproducts, I was surprised to discover how much more co-owned facilities emit. I therefore ran a robustness check to ensure that the statistical significance and magnitude of the results remained robust to the weighting mechanism used to capture cancerous and non- cancerous externalities. I replaced TRACI's weighting mechanism with the Environmental Defense Funds Toxicity Equivalent Potential Scorecard (TEPS), Environment Canada's preferred hazardous weighting mechanism.

[20] I assume that a large majority of emissions in the data fell within acceptable thresholds established by existing laws and regulations since firms provide self-reported emissions data to the government and general public.

Table 4: The relationship between co-ownership and pollutants weighted by their cancerous and non-cancerous human health impacts

	Hypothesis 4A		Hypothesis 4B		Hypothesis 5A		Hypothesis 5B	
	Cancerous Emissions	Cancerous Emissions	Cancerous Pollution Mitigation	Cancerous Pollution Mitigation	Non-Cancerous Emissions	Non-Cancerous Emissions	Non-Cancerous Pollution Mitigation	Non-Cancerous Pollution Mitigation
JV		- 0.1780		- 0.8702		0.9497 ***		- 0.1714
		(0.2157)		(0.8987)		(0.4640)		(1.4775)
J&S	0.6597	0.6536	- 3.7137 *	- 3.7435 *	- 1.2695	- 1.2286	- 1.6794	- 1.6868
	(0.7753)	(0.7925)	(2.6475)	(2.5629)	(1.2772)	(1.2676)	(6.6239)	(6.6191)
Ln(Facility Size)	0.3799 ****	0.3770 ****	1.4719 ***	1.4574 ***	0.0925	0.1107	1.7082 ***	1.7049 ***
	(0.0850)	(0.0834)	(0.5105)	(0.4919)	(0.2532)	(0.2522)	(0.6771)	(0.6742)
Ln(Peer Facilities)	- 0.0855	- 0.0983	0.6942	0.6314	0.4225 *	0.4939 ***	- 0.0492	0.0364
	(0.1232)	(0.1321)	(0.7196)	(0.6992)	(0.2704)	(0.2637)	(0.8710)	(0.8814)
Ln(Foreign Ownership)	- 0.0132 *	- 0.0104	- 0.0369	- 0.0235	0.0155 *	0.0011	0.0829 **	0.0855
	(0.0084)	(0.0086)	(0.0486)	(0.0497)	(0.0187)	(0.0209)	(0.0685)	(0.0718)
S&P Constituent	0.0014	0.0022	- 0.0325 **	- 0.0283 ***	0.0084	0.0037	- 0.0139	- 0.0131
	(0.0030)	(0.0031)	(0.0145)	(0.0144)	(0.0100)	(0.0090)	(0.0273)	(0.0252)
Ln(No. Chemicals)	0.6119 ****	0.5996 ****	1.3457 *	1.2856 *	2.8842 ****	2.9510 ****	4.3769 ****	4.3648 ****
	(0.1684)	(0.1709)	(0.8470)	(0.8601)	(0.3873)	(0.3775)	(1.1344)	(1.1532)
ln(Cancerous Byproducts)	0.0188 ****	0.0186 ***	0.0245	0.0234				
	(0.0058)	(0.0058)	(0.0267)	(0.0265)				
ln(Non-cancerous Byproducts)					0.0470	0.0465 ****	0.0190	0.0191
					(0.0109)	(0.2637)	(0.0312)	(0.0309)
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.5583	0.5595	0.3979	0.3993	0.5978	0.6045	0.4800	0.4791
ΔR^2		0.0012		0.0014		0.0067		0.0009
Facilities	249	249	249	249	249	249	249	249
n	606	606	606	606	606	606	606	606

p<.001 = ****; p<.01 = ***; p<.05 = **; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parenthesis
Chemicals in hypotheses 4 and 5 are weighted using the Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI)

The TEPS, like TRACI, provides hazardous weights for chemicals based upon lifecycles assessments and exposure pathways and provides separate weights for cancerous and non-cancerous impacts.[21] Using the TEPS weights provided by Environment Canada, I reweighted chemical hazards and reran the regressions for hypotheses 4 and 5. The TEPS weighted sample and robustness regressions in Table 5 replicate the main findings and indicate that JV facilities emit approximately 134% more non-cancerous substances (H5A), emit similar amounts of cancerous byproducts (H4A), and mitigate a similar amount of their cancerous (H4B) and non-cancerous (H5B) byproducts.

In summary, the results of the analysis showed that divided ownership contributes to negative externalities that have an impact on human health. A summary of hypothesized effects along with the analysis findings is provided in Table 6. The results reinforce the assertion that we are not merely witnessing a difference between two sets of facilities but rather a systematic way in which co-owned facilities emit more. Clearly, multiple owners can agree and act jointly just as effectively as single owners do to mitigate the unambiguous harm attributable to cancerous chemicals. At the same time, co-ownership systematically desensitizes facilities to legal liability regimes, environmental trade-offs, and ambiguous environmental categories such as non-cancerous chemicals. Differentiating between cancerous and non-cancerous impacts allowed me to uncover variance between JV and independent facilities that could not have otherwise been explained. This differentiation also allowed me to distinguish among different mechanisms through which co-ownership may systematically hinder environmental performance.

[21] While TEPs and TRACI examine a similar number of chemicals (356 vs. 345), TEPs examines 19 chemicals not listed in TRACI and TRACI examines 30 chemicals not listed in TEPs, providing an overlap of 86.9%.

Table 5: Robustness checks examining co-ownership and cancerous and non-cancerous human health impacts

	Hypothesis 4A		Hypothesis 4B		Hypothesis 5A		Hypothesis 5B	
	Cancerous Emissions	Cancerous Emissions	Cancerous Pollution Mitigation	Cancerous Pollution Mitigation	Non-Cancerous Emissions	Non-Cancerous Emissions	Non-Cancerous Pollution Mitigation	Non-Cancerous Pollution Mitigation
JV		- 0.1780		- 0.8702		0.9497 ***		- 0.1714
		(0.2157)		(0.8987)		(0.4640)		(1.4775)
J&S	0.6597	0.6536	- 3.7137 *	- 3.7435 *	- 1.2695	- 1.2286	- 1.6794	- 1.6868
	(0.7753)	(0.7925)	(2.6475)	(2.5629)	(1.2772)	(1.2676)	(6.6239)	(6.6191)
Ln(Facility Size)	0.3799 ****	0.3770 ****	1.4719 ***	1.4574 ***	0.0925	0.1107	1.7082 ***	1.7049 ***
	(0.0850)	(0.0834)	(0.5105)	(0.4919)	(0.2532)	(0.2522)	(0.6771)	(0.6742)
Ln(Peer Facilities)	- 0.0855	- 0.0983	0.6942	0.6314	0.4225 *	0.4939 ***	- 0.0492	0.0364
	(0.1232)	(0.1321)	(0.7196)	(0.6992)	(0.2704)	(0.2637)	(0.8710)	(0.8814)
Ln(Foreign Ownership)	- 0.0132 *	- 0.0104	- 0.0369	- 0.0235	0.0155 *	0.0011	0.0829 **	0.0855
	(0.0084)	(0.0086)	(0.0486)	(0.0497)	(0.0187)	(0.0209)	(0.0685)	(0.0718)
S&P Constituent	0.0014	0.0022	- 0.0325 **	- 0.0283 ***	0.0084	0.0037	- 0.0139	- 0.0131
	(0.0030)	(0.0031)	(0.0145)	(0.0144)	(0.0100)	(0.0090)	(0.0273)	(0.0252)
Ln(No. Chemicals)	0.6119 ****	0.5996 ****	1.3457 *	1.2856 *	2.8842 ****	2.9510 ****	4.3769 ****	4.3648 ****
	(0.1684)	(0.1709)	(0.8470)	(0.8601)	(0.3873)	(0.3775)	(1.1344)	(1.1532)
ln(Cancerous Byproducts)	0.0188 ****	0.0186 ***	0.0245	0.0234				
	(0.0058)	(0.0058)	(0.0267)	(0.0265)				
ln(Non-cancerous Byproducts)					0.0470	0.0465 ****	0.0190	0.0191
					(0.0109)	(0.2637)	(0.0312)	(0.0309)
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.5583	0.5595	0.3979	0.3993	0.5978	0.6045	0.4800	0.4791
ΔR^2		0.0012		0.0014		0.0067		0.0009
Facilities	249	249	249	249	249	249	249	249
n	606	606	606	606	606	606	606	606

p<.001 = ****; p<.01 = ***; p<.05 = **; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parenthesis
Chemicals in the robustness checks are weighted using the Toxicity Equivalent Potential Scorecard (TEPS)

Table 6: Summary of hypothesized effects and analysis findings

Hypothesis	Finding
H1: JV facilities produce more hazardous byproducts than do single-owned facilities.	Not supported
H2A: JV facilities emit more hazardous byproducts than do single-owned facilities.	Supported
H2B: JV facilities mitigate less hazardous byproducts than do single-owned facilities.	Not supported
H3A: JV facilities in joint-and-several liability regimes emit less hazardous byproducts than do all other facilities.	Not supported
H3B: JV facilities in joint-and-several regimes mitigate more hazardous byproducts than do all other facilities.	Not supported
H4A: There is no difference between JV and single owned facilities in the emission of cancerous byproducts.	Supported
H4B: There is no difference between JV and single owned facilities in the mitigation of cancerous byproducts	Supported
H5A: JV facilities emit more noncancerous hazardous byproducts than do single owned facilities.	Supported
H5B: JV facilities mitigate less noncancerous hazardous byproducts than do single-owned facilities	Not supported

2.8 DISCUSSION

This study highlights the previously under-theorized role of divided ownership in whether and how facilities address hazardous byproducts. I argued and showed that co-owners can be as sensitive as single owners to consensual issues, such as preventing exposure to cancerous byproducts. However, in the face of ambiguous categories of harm (i.e. non-cancerous hazards), co-owners were shown to be predictably and systematically less responsible than single owners. Simply put, co-owners predictably fail to address issues of social relevance because it takes more effort to reconcile multiple corporate interests (Mahoney, 2005; Beamish & Inkpen, 1995; Killing, 1983) in pursuits of the common good.

Theoretically, this study suggests that divisions in ownership can influence how co-owned facilities see and negotiate the interface between business and society. Co-owners can overcome differences in goals and co-ordination challenges to move towards the greater good, but they predictably and rationally choose not to. These arguments resonate with environmental psychology arguments and advance a multiplicity trap. Specifically, I argued and showed that the mere presence of multiple owners can fundamentally alter whether and how facilities address pressing environmental issues.

The sustainability literature has grown beyond organizational studies that have examined operations and technologies. There has been sustained interest across disciplines in efforts to control, abate, and/or divert hazardous byproducts before they have adverse effects on human health (Wilson, Chia, & Ehlers, 2006; Fullerton, 2006; Burby & Strong, 1997; Johnson, 1997; Landrigan & Carlson, 1995; Baker & Markoff, 1986; Arbuckle *et al*., 1976). My findings are complementary to prior evidence that emphasizes the necessity and validity of internal drivers, even in the absence or the divergence of external inducements (Branzei *et al.*, 2004). By including ownership as an important internal driver, and by showing how resilient it can be to environmental trade-offs and constraints (but not categories), I add new momentum to the question of what else differentiates firms' environmental performance.

2.8.1 Limitations and future research opportunities

There are several limitations to the study that provide opportunities for future researchers to build upon my findings. First, I examined only two aspects of facility level environmental performance – emissions and pollution mitigation. JVs can leverage the best practices of multiple firms, which could lead to improvements in energy consumption, product cradle-to-grave impacts, or natural resource utilization. Further, JVs create the opportunity for knowledge and technology transfers (Spender & Grant, 1996; Kogut, 1988) that could improve parent firms' environmental performance in ways not observed in this study. Thus, the relationship between divided ownership and other dimensions of environmental performance deserves future analysis.

Second, the data in my study did not allow controlling for production directly, as in other studies examining hazardous byproducts (Berchicci *et al*., 2012; Berrone *et al*., 2010; Antweiler & Harrison, 2003; King & Lenox, 2001; King & Shaver, 2001). While I controlled for the volume of hazardous waste created in the production life-cycle, it remains possible that JV facilities produce differently. For example, JV partners may take extra precautions, introduce different technologies, or pool and transfer capabilities across different partners. Some of the mechanisms by which co-ownership anticipates harm could not be tested in this study, but they are worthy of future queries. Co-ownership can be a force for good, and new literature is currently addressing whether and when divisions are generative and may even tackle intractable environmental challenges (Branzei & Le Ber, 2013).

Third, JV scholars indicate that different divisions of equity among JV partners influence the balance of power between corporate owners, the extent to which partners accommodate one another in decision making (Blodgett, 1992; Beamish & Banks, 1987), and the stability of the JV itself (Reuer, Zollo, & Singh, 2002; Lee & Beamish, 1995; Beamish 1993, 1985). In JVs with unequal ownership, the majority parent may have more leverage to influence decisions than minority partners. In dual ownership JVs (50-50 equity sharing), however, extensive conversations and/or negotiations are often required to reach a decision (Park & Ungson, 1997). Thus, different configurations of JV equity ownership could influence co-owners ability to agree upon and implement collective action for addressing hazardous externalities within their facilities.

More research is also required to determine the exact mechanisms by which divided ownership influences environmental outcomes. An important premise of my theoretical framework is that the greater difficulty of co-ordinating multiple economic interests gets in the way of environmental interests. Aligning divergent interests should become increasingly difficult with more heterogeneous partners and more balanced equity shares. JVs with a strong majority owner may behave more like independent firms than like other JVs with equal, or nearly equal, owners.

My inferences relied on publicly accessible data, and I presumed that owners had access to such data. This presumption was particularly strong when I discussed environmental categories such as cancerous versus non-cancerous chemicals. Owners and other publics may lack accurate and actionable intelligence regarding the dangers of emitted toxins. Environment Canada and the U.S. Environmental Protection Agency provide invaluable information on hazardous waste processing and disposal, but I would argue that this information remains uninterpretable for the common citizen. The average person can easily ascribe meaning to "cancer" and "non-cancer" but cannot easily differentiate the relative hazard between nitrosodiphenylamine, cancerous yet relatively benign, and phenyl mercaptan, non-cancerous yet highly toxic. Providing tools that allow the average person to ascribe accurate meaning to publicly available data could prove very effective in encouraging firms to address more hazardous externalities. Such tools may also improve owners' ability to understand – and therefore their willingness to heed – warning signals.

Finally, this study was set in a single industrialized country with a strong legal system that protects social interests. I suspect that the results generalize to other industrialized countries with similar characteristics, but exploring the influence of divided ownership on environmental outcomes in the absence of these institutions or in the presence of different institutions deserves future study. I also encourage replications of my analysis in additional countries containing joint-and-several and proportional liability political jurisdictions to determine the extent to which the results generalize to different contexts. It is possible that future scholars could find relationships between legal liability stringency and environmental outcomes where I could not.

2.8.2 Practical implications

The results of the analysis provide some interesting practical implications for policy-makers and environmental agencies. First and foremost, they show how co-ownership substantially increases the hazardous chemicals produced and systematically causes JV facilities to emit more than their single-owned peers. While these effects may be disheartening to some, an important silver lining emerges: alerting co-owned facilities to the differences found may inspire greater attention to the co-ordination challenges discussed here. Going one step further, implementing differential audits, or even systems of incentives and regulations that provide more stringent scrutiny to co-owned facilities, may achieve important environmental improvements. Because co-owners can and do effectively mitigate unambiguous harm, even simple communication strategies that emphasize the harmful effects of specific chemicals can direct attention and motivate action that benefits, rather than hurts, society.

Further, policy-makers and environmental agencies should place additional emphasis on regulating hazardous non-cancerous substances, an act that would decrease ambiguity and leave less room for debate or delay among co-owners. Tightening regulation around less-common or less-understood, non-cancerous hazards would complement the motivational power of informal societal pressures towards cancerous substances, thus reducing overall environmental hazards.

2.9 CONCLUSION

The key conceptual and empirical contribution of this study lies in showing how and explaining why divided ownership shapes the way facilities deal with hazardous byproducts. I find that single and multiple owners can and do address environmental externalities when environmental categories are unambiguous (i.e., cancerous chemicals). However, co-ownership significantly and substantially downplays environmental trade-offs when categories are ambiguous (i.e., non-cancerous chemicals). Thus, divided ownership contextualizes hazardous waste processing decisions and can hinder organizations' willingness and/or ability to take environmental concerns into account.

Chapter 3:
JV Ownership Coalitions & Environmental Performance

Rachel Carson's *Silent Spring* (1962) created widespread awareness of the detrimental consequences of industrial waste, not only to the natural environment but also to human health. The last 50 years have seen marked improvements in legislation and regulation to protect the public from hazardous industrial byproducts, and, increasingly, firms have worked to reduce industrial pollution (Glicksman & Earnhart, 2007; Laplante & Rilstone, 1996; Magat & Viscusi, 1990) through advancements in technology (Jaffe, Newell, & Stavins, 2005; Shrivastava, 1995), processes (Porter & van der Linde, 1995), and capabilities (Diestre & Rajagopalan, 2011; Russo & Fouts, 1997). Despite these advancements, however, firms continue to release harmful byproducts that have serious health consequences, and seemingly similar organizations still exhibit a wide and persistent variance in environmental performance.

More recently, scholars have increasingly ascribed differences in environmental performance to the systematic characteristics and preferences of different types of owners. These studies suggest that certain types of firms are more or less likely than others to address hazardous externalities due to their distinctive resources (Darnall & Edwards, 2006), inherent capabilities (King & Shaver, 2001), influential stakeholders (Darnall, Henriguez, & Sadorsky, 2010; Lee, 2009), and valuation of environmental performance (Berrone *et al*., 2010; Sethi, 2003). While these studies highlight when, why, and how different types of owners pursue environmental sustainability, relatively little is known about how co-owners, each with a unique set of organizational objectives, influence environmental performance within their joint venture (JV) subsidiaries. In this study, I ask "*Does a JV's ownership coalition affect its environmental performance, and if so, how, when, and why?*"

JV scholars hold two competing hypotheses concerning the effect of multiple owners on traditional performance constructs. Some theorize and find an inverse relationship between the number of partners associated with a venture and financial performance, arguing that additional partners increase complexity and costs (van de Ven, 1976), create opportunities for free-riding (Parkhe, 1993), intensify management problems (Beamish & Schaan, 1988) and increase the likelihood of conflict from divergent interests (Parkhe, 1993; Cartwright & Zander, 1968). Even good JV owners "can and will disagree on just about anything" (Beamish & Inkpen, 1995: 27), but many tackle even the toughest co-ordination challenges when they set out to build additional economic value (Das & Teng, 2000). Others claim and show that additional owners provide JVs access to more resources that can increase performance (Hu & Chen, 1996) and survival (Park & Russo, 1996). In some cases, the costs and benefits associated with additional owners effectively offset one another (Beamish & Kachra, 2004).

Much less is known about the effect of multiple owners on social and/or environmental performance. Both positive and negative effects are possible because co-ordination difficulties can create additional opportunities for social value creation (Le Ber & Branzei, 2010; Ostrum, 2000; Ostrum, 1990), and successes can open up unprecedented opportunities to innovate and grow more than competitors, especially when firms face challenging issues that require multiple stakeholders and partners (Branzei & Le Ber, 2013). However, creating social value becomes complicated by the economic costs incurred ex-ante, with unpredictable economic gains accruing in the distant future (Slawinski, 2010; Sarkis & Cordeiro, 2001). Thus, when it comes to voluntary social or environmental investments (i.e., where costs are certain and incurred upfront while economic benefits remain questionable and/or unclear), co-owners may be less inclined to spend resources to overcome co-ordination challenges (Bazerman & Tenbrunsel, 2011; King & Lenox, 2002; Klassen & Whybark, 1999; Elkington, 1998; Arora & Cason, 1995; Hart & Ahuja, 1996; Hirschhorn, 1994).

Individual firms' characteristics and internal and external constituencies (Branzei *et al*., 2004; Sharma, 2000) may further increase disparities among partners, with some bearing disproportionately higher costs for social investments (Darnall & Edwards, 2006) and others ascribing or reaping higher returns for social and/or environmentally minded activities (Margolis, Elfenbein, & Walsh, 2007). When we add the perceptual and attributional differences among partners (Berrone *et al*., 2010; Lange & Washburn, 2012; Darnall *et al*., 2010; Henriguez & Sadorsky, 1999) to the real differences in the economic costs and benefits associated with steps taken by each partner, the shared search and struggle for finding overlapping interests for socially beneficial investments is not only less likely to happen but also harder to complete or sustain.

My premise is that co-ownership influences JVs' environmental performance through three distinct mechanisms. First, I hypothesize that greater numbers of owners exacerbate the co-ordination problems stemming from real and perceptual costs and benefits, and therefore negatively affect environmental performance. Second, I explain that heterogeneous partners can surface and balance heterogeneous preferences that include specific environmental issues, and may therefore unilaterally or disproportionately improve common environmental performance for these specific issues. Third, I explain that when categories of partners – that is, partners representing different types of ownership – (de)emphasize specific environmental issues, the environmental performance of a co-owned facility adjusts accordingly.

3.1 THEORY & HYPOTHESES

Several theoretical accounts explain why firms undertake voluntary social investments, and these proclivities lie upon a continuum polarized by profit-seeking and moral duty (van de Ven & Jeurissen, 2005; Scalise, 2005; Cox & Hazen, 2003). While profit seeking and moral duty are not necessarily mutually exclusive motivations, normative accounts suggest that managers pursue social investments because it is the moral thing to do (Marcus & Fremeth, 2009) and economic accounts suggest that managers pursue social investments when they pay off financially (Reinhardt & Stavins, 2010; van de Ven & Jeurissen, 2005). Several meta-analyses demonstrate that firms do consider the financial implications of environmental initiatives and are more likely to undertake them when they "pay" (Orlitzky, Schmidt, & Reynes, 2003) or at least quickly break even (Reinhardt & Stavins, 2010; Margolis *et al*., 2007). However, whether or not an environmental investment pays depends upon how firms frame environmental issues and account for value.

Margolis *et al*. (2007) highlight two distinct mechanisms linking social performance to financial performance. The first mechanism views environmental initiatives as investments in a distinctive resource that directly affects costs and/or complements other resources to help build more value internally. For instance, studies suggest that environmental initiatives increase resource efficiency (Porter & van der Linde, 1995), reduce risks (Flanigan, 2002; Shrivastava, 1995), eliminate hidden costs (King & Lenox, 2002), and strengthen manufacturing performance (Klassen & Whybark, 1999). Scholars in this theoretical domain typically suggest that firms pursue environmental initiatives that predictably increase firms' profitability (Earnhardt & Lizal, 2006; van de Ven & Jeurissen, 2005).

The second mechanism views environmental initiatives as tools for building value indirectly through managing relationships with external stakeholders. In other words, morally responsible actions can serve a firm's self-interest, and firms can do better by doing good (Margolis *et al*., 2007). These studies suggest that environmental performance generates additional demand for a company's products (Sprinkle & Maines, 2010; McWilliams, Siegel, & Wright, 2006), builds goodwill (Margolis *et al*., 2007) and lowers the costs of capital (Sharfman & Fernando, 2008; Aintablian, McGraw, & Roberts, 2007; Thompson & Cowton, 2004).

While profit-seeking theoretical accounts focus on the financial implications of socially beneficial investments, they intentionally overlook firms that account for value accruing outside the firm. Family owners, for instance, are known to derive non-economic utility from their firms' moral actions (Barrone *et al*., 2010; Corbetta & Salvato, 2004; Tagiuri & Davis, 2004; Schulze *et al*., 2001; Dane *et al*., 1999), while government owners provide financial capital with the intent that value will accrue to society (Darnell & Edwards, 2006; Downs & Larkey, 1986). Firms with family and/or government owners also pursue profits, but, whereas profit-maximizing firms may restrict investments to those that will ultimately provide calculable financial returns, family-controlled firms (Schulze *et al*., 2001) and government agencies (Downs & Larkey, 1986) also consider social investments with ambiguous financial returns that provide societal value.

When examining social investments, JV partners must not only manage different logics (Thornton & Ocasio, 1999) but also different objectives (Killing, 1983) for social value creation that could undermine their ability to collectively agree upon an appropriate course of action. Chapter 2 demonstrates that co-ownership systematically influences environmental performance, and prior research explains that going beyond one owner necessarily increases conflict and complexity (Mahoney, 2005; Parkhe, 1993; Libecap, 1989; Barzel, 1989; Beamish & Schaan, 1988; van de Ven, 1976; Cartwright & Zander, 1968), even in partnerships designed purposefully and collaboratively (Branzei & Le Ber, 2013; Grudinschi *et al*., 2011). Different owners serve distinct internal and external stakeholders (Darnall, Potoski, & Prakash, 2010; Darnall, Soel, & Sarkis, 2009; Branzei *et al*., 2004; Sharma, 2000) and differ in their environmental expectations, in their readiness to undertake initiatives, and in their ex-ante sensitivity to environmental costs and benefits (Earnhardt & Lizal, 2006). Further, they follow different methods to evaluate and monetize any penalties or gains that accrue from environmental initiatives (Margolis *et al*., 2003). Getting to "maybe" is hard work (Westley, Zimmerman, & Patton, 2006), and common ground is never a foregone conclusion (Killing, 1983; Mahoney, 2005; Barzel, 1997; Beamish & Inkpen, 1995; Libecap, 1989).

Scholars also suggest that some environmental initiatives provide more internal value than others. I focus on JVs' pollution mitigation of hazardous byproducts – namely, recycling and treatment prior to disposal – for two primary reasons. First, unlike pollution prevention measures that eliminate byproducts before they occur, pollution mitigation measures typically increase costs without providing additional strategic or financial advantage (King & Lenox, 2002; Sarkis & Cordeiro, 2001; Porter & van der Linde, 1995). Thus, increased pollution mitigation should more closely align with a moral-duty tendencies, while refraining from pollution mitigation should align with a profit-maximization tendencies. In contrast, the motivations for pursuing or not pursuing pollution prevention, which affects emissions, remain unclear and could easily align with both perspectives. Second, scholars suggest that larger firms may inherently emit more as a result of higher production levels (Antweiler & Harrison, 2003; Harrison & Antweiler, 2003) and thus may have less control over emissions. However, through pollution mitigation, all firms that produce hazardous waste can choose the extent to which they address their environmental impacts.[22]

I examine specific distributional characteristics of co-ownership to argue that *who* works together predictably shapes JVs' pollution mitigation. I theorize that JV co-ownership, in general, exposes the often-hidden tension between profit-maximizing and moral-duty tendencies, and I theorize and test how the balance between these tendencies shifts, depending upon 1) ownership dispersion – the number of JV partners and their respective balance of ownership within the coalition, 2) the type of firms participating in the coalition, and 3) coalition heterogeneity – the balance in equity between the different types of owners in the coalition.

3.2 OWNERSHIP DISPERSION

Ownership dispersion represents a key distributional characteristic of ownership, specifically, how finely the equity invested in a specific facility is spread across multiple partners. Co-owned facilities range from low dispersion (few partners with uneven equity stakes) to high dispersion (many partners with even equity shares).[23] The mechanism by which ownership dispersion influences JVs is its moderation of complexity (van de Ven, 1976) and co-ordination difficulties (Parkhe, 1993; Cartwright & Zander, 1968), which can manifest as conflict, decision delays, or increased costs (Barzel, 1997; Libecap, 1989; Demsetz, 1967). Whatever the issue, partners who differ in their priorities naturally struggle to align multiple, and oftentimes conflicting, goals (Killing, 1983). These coordination difficulties are likely to be

[22] Every chemical reported by JV facilities in my sampling frame has been reported as treated or recycled at some point between 1994 and 2003, thus eliminating concerns that technology may not exist to abate certain chemical hazards.

[23] Drawing upon Killing's (1983) definition of equity joint ventures for this study, , the lowest dispersion represents a JV with an equity distribution of 95/5, and the highest dispersion arises from an eight-partner JV with an equity distribution of 32/25/12/9/7/5/5/5.

magnified for environmental issues, which are deeply controversial (Zietsma & Lawrence, 2010) and elicit different time perspectives (Slawinsky, 2010), different perceptual and analytical scales (Wood, 2012), and different organizational routines and capabilities (McKnight, 2012).

Environmental issues are difficult to negotiate, even when partners want to move forward and initiate responsible collective action. Whereas many other organizational actions are internally focused and self-reliant, environmental issues often call for consultation and have implications for many more external constituencies (Hart & Sharma, 2004). Each owner's decisions and actions potentially require consideration of their own multiple stakeholders (Berrone *et al*., 2010; Branzei *et al*., 2004), further magnifying complexity and co-ordination difficulties (Graicunas, 1937). Sometimes the interests of partners frequently change (Inkpen & Beamish, 1997), and the identification of, let alone mutual commitment to, a shared interest becomes hard to attain and sustain (Dhanaraj & Parkhe, 2006; Dhanaraj, Branzei, & Subramanian, 2013). Even when such commitments are fortuitously reached (Zietsma, 2002; MacDonald, 2010), they may be unstable and therefore require consistent support or renewed commitments (Hoffman, 2011).

Ownership dispersion can create internal frictions, even when partners agree on the issues, understand how to address them, and express willingness to bear the costs needed to improve their environmental performance. The paramount concerns of who contributes, who benefits, and how (Mahoney, 2005; Libecap, 1989; Barzel, 1997) from each environmental investment decision amplify the challenges in aligning the partners' objectives. One partner's equity share may polarize commitment, with lower equity owners more prone to bystander effects (Admati, 1994) and higher equity owners withstanding the lion's share of societal pressure and bearing the brunt of irresponsibility attributions should anything go wrong (Lange & Washburn, 2012).

While these arguments suggest that ownership dispersion should be inversely related to environmental performance, some evidence exists to show that this effect is particularly pronounced for ambiguous issues (Zietsma, 2002) that leave room for debate and/or contestation over the appropriate course of action (MacDonald, 2010). As issues become clearer and more legitimate, partners face fewer challenges and more incentives, often in the form of societal pressures, to address their negative externalities (Gunningham, Kagen, & Thornton, 2004).

Many hazardous byproducts are harmful but to different extents. The effects of even widely known harmful chemicals like DDT or asbestos are contested, and it can take decades to reach consensus or unambiguously classify a substance (McGuire *et al*., 2013; McGuire & Hardy, 2009). As long as ambiguity regarding a chemical's harmfulness remains, debate and disagreements among multiple owners will make it more complex, difficult, and costly to reach consensus for abatement. Once hazardous chemicals receive a cancerous classification, however, harm becomes less contestable (Berman & Wandersman, 1990; Stahly, 1989), and partners should face fewer challenges in agreeing upon pollution mitigation.

In addition to clear legal penalties, market mechanisms can shift incentives by reallocating supply and demand (Mackey, Mackey, & Barney, 2007). What society deems unacceptable will further tighten the range of actions by holding up to public scrutiny those who fail to do the right thing right away (Lange & Washburn, 2012). Partners may be differentially sensitive to these external constraints, but the multiplicity of cues will guide them on a narrower and clearer path, making it more likely that they will agree to take joint action to mitigate their cancerous externalities.

I therefore predict that JV facilities will remain equally mindful of addressing their cancerous byproducts, regardless of ownership dispersion, because these substances are perceived to be the most detrimental for society (Berman & Wandersman, 1990; Stahly, 1989). Thus, co-owners should face fewer challenges in identifying and agreeing upon pollution mitigation for these substances because of the moral duty to protect the general public from harm. However, JV organizations will increasingly struggle to address non-cancerous externalities as ownership dispersion increases, because ownership dispersion dials up the intractability of issues, the multiplicity of stakeholders and dynamics that ensue, the cost associated with negotiating a common course, and the inner polarization of incentives and punishments.

Hypothesis 1A: There is no relationship between ownership dispersion and pollution mitigation for cancerous substances.

Hypothesis 1B: As ownership dispersion increases, co-owned facilities' mitigation of non-cancerous pollutants decreases.

3.3 TYPES OF PARTNERS

Over the past 10 years, several scholars have theorized that firms characterized by different types of ownership perceive environmental costs and benefits differently. Therefore, different types of partners may be more or less likely to advocate or act in environmentally responsible ways (Berrone *et al*., 2010; Darnall & Edwards, 2006; Sethi, 2003). Put differently, some partners find it easier than others to align their self-interest with their moral duty.

3.3.1 Government Effect

Typically in western societies, the intent of government participation in industry involves facilitating the production and provision of goods and services that markets cannot reliably provide independently (Downs & Larkey, 1986). Darnall and Edwards (2006) highlighted that governments finance endeavours with the intent that benefits will accrue to society rather than solely to the enterprise. Thus, a government financier should thoughtfully consider investments that balance self-interest and moral duty. More importantly, having a government co-owner can heighten the importance of pollution mitigation by overtly or implicitly encouraging the other co-owners to more thoughtfully consider hazardous byproducts and their impact on society.

Notably, some studies have argued that the effects of government ownership are contingent on efficiency. Since government firms are typically less efficient and less productive than non-government firms (Brown, Earle, & Telegdy, 2006; Megginson & Netter, 2001; Mascarenhas, 1989), and productive firms typically pollute less (Cui, Lapan, & Moschini, 2012; Holladay, 2010), governmental ownership can be associated with poorer environmental outcomes, especially in underdeveloped economies (Meyer & Pac, 2013; Wang & Jin, 2007). However, government-backed firms are more likely to internalize environmental externalities (Cato, 2008; Baumol & Oates, 1988), while non-government owners tend to overlook them (Beladi & Chao, 2006). Further, some studies suggest that government ownership typically improves environmental performance once industry-effects are accounted for, even in developing economies (Earnhart & Lizal, 2006).

Sharing equity with a government co-owner, who is not only a participant or financier but also an enforcer of laws, regulations, and societal expectations, is fairly common, especially in highly polluting industries (Earnhart & Lizal, 2006). While governmental co-ownership may be over-represented among environmentally under-performing industries, firms partnering with government can signal transparency (they attract attention), accountability (they reassure critics), and willingness to invest in improved performance (or risk being made an example of) (Lin & Darnall, 2010).[24] I therefore predict a positive correlation between the percentage of government ownership in a JV facility and pollution mitigation for cancerous and non-cancerous hazardous byproducts.

Hypothesis 2: A higher percentage of government ownership in co-owned facilities will increase pollution mitigation for a) cancerous and b) non-cancerous byproducts.

3.3.2 Private-firm Effect

I rely on Environment Canada's definition of private firms as those firms owned by the private sector yet not publicly traded, excluding sole-proprietorships, crown corporations, and corporate partnerships.[25] Relatively few studies directly examine the relationship between private ownership, as defined, and environmental performance, but some evidence suggests that private firms will underperform non-private firms. Compared with their publically traded counterparts, private firms tend to be undercapitalized and typically have fewer slack resources (George, 2005; Baker, Pricer, & Ninde, 2000; Holtz-Eakin, Joulfaian, & Rosen, 1994a, 1994b) that provide firms greater freedom to pursue social objectives (Waddock & Graves, 1997). Private firms also place less emphasis on developing environmental performance measurement indicators than

[24] Potential partners with government will likely envisage, ex ante, the added responsibilities and scrutiny that accompany a government partner. Heavy polluters that already struggle to comply with environmental regulations may refrain from partnering with the enforcer of environmental regulations, and government may refrain from partnering with heavy polluters to prevent granting legitimacy to corporate partners who skirt societal expectations.

[25] Private ownership has numerous meanings within different literatures (Perry & Rainey, 1988). Many sustainability scholars use the term *private ownership* to characterize all non-public sector (i.e., non-government) and non-communal (Wang & Jin, 2007) owners, but this definition of private ownership comprises multiple categories of firms, including JVs, family firms, sole proprietorships, and firms that are privately held yet not publicly traded. Each category of private firms likely exhibits unique characteristics that could systematically influence environmental outcomes.

public firms (Henri & Journeault, 2008). Lee (2009) found that private firms emit more Benzine than non-private firms[26] and attributes this finding to greater managerial autonomy and shelter from public scrutiny.

However, shelter from outside pressures could provide private firms more flexibility to pursue socially beneficial initiatives. Agency theory scholars argue that equity markets (Schulze *et al*., 2001; Bosch, Eckerd, & Lee, 1998; Gersick *et al*., 1997), in general, and specifically the threat of hostile takeover (Walsh & Seward, 1990) prioritize profit maximization (Fama & Jensen, 1983a, 1983b). Refraining from equity markets, and thus the market for corporate control, may grant private firms more freedom to prioritize moral duty within their JV subsidiaries.

Some agency scholars further suggest that private ownership affords owner-managers too much freedom and thus creates its own unique agency costs. Schulze .*et al.* (2001), for instance, highlight that private firm owner-managers oftentimes lack self-control and make excessively altruistic decisions. In a study of family control over public firms, Berrone *et al.* (2004) argue that family owners pursue non-economic utilities that build socio-emotional wealth, such as perpetuating a positive family image and reputation (Sharma & Manikutty, 2005), building personal prestige in the community (Corbetta & Salvato, 2004; Dane *et al*., 1999; Tagiuri & Davis, 2004), and accumulating social capital (Arregle *et al*., 2007).[27] In other words, families' social identities can become intertwined with the social performance and actions of firms in which they hold substantial ownership (Westhead, Cowling, & Howorth, 2001; Birley, Ng, & Godfrey, 1999; Fletcher, 2000).

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[26] It remains unclear whether Lee includes sole-proprietorships within his definition of private firms.

[27] Berrone et al. (2010) define family ownership as five percent equity ownership in a publically traded firm.

If private owners remain more sensitive to environmental externalities and experience greater utility from environmental performance, then a higher percentage of private ownership should translate into better environmental outcomes (in my case, more pollution mitigation). As with all other types of owners, private firms may be more sensitive to cancerous than non-cancerous byproducts due to the known and unambiguous harm the former can cause (Berman & Wandersman, 1990; Stahly, 1989). If private owners' unconstrained reign allows them to take more decisive action, as prior studies seem to suggest (Schulze et al., 2001), I also expect stronger and more substantive effects for the mitigation of cancerous emissions.

Hypothesis 3: A higher percentage of private-firm ownership in co-owned facilities will increase pollution mitigation for a) cancerous and b) non-cancerous byproducts.

3.3.3 Russian-Doll Effect

In contrast to government owners who increase transparency and private owners who leverage transparency when following their pro-social values, facilities can also opt for equity contributions by other joint ventures. In such cases, a new and different configuration of second-order partners non-additively increases the costs of agreeing upon socially beneficial environmental investments while simultaneously sheltering those indirect co-owners from some of the friction and frustration of working out a common course and from blame if such a course is never found. This configuration simultaneously overplays self-interest and downplays moral-duty, making it more likely to act as a spanner in the works, dampening down collective efforts and/or collective efficiency at mitigating hazardous emissions.

Effectively, such second-order JV ownership overtaxes even the best-intended decision-makers (Mallard, 2012) and makes it more challenging to find meaningful links between the issues firms confront and the courses they choose (Weiner, 1995) – in this case, firms' efforts and/or efficiency at mitigating hazardous waste. Fösterling (1988) explained that this cognitive link becomes less likely when more steps in the logical chain of events separate the evaluated cause and effect, when more intertwined influences contribute to the outcome (Teigen & Brun, 2011), and when organizations have less control over the activities that led to the outcome (Struthers *et al*., 2004). Because a JV parent creates more distance between the parent's corporate owners and the effect of the subsidiary JV's environmental performance, a JV parent not only significantly thickens the ranks of influential parties working on any given issue[28] but also dampens everyone's ability to recognize and agree upon the appropriate course of action.

So it is neither added self-interest nor the ability to hide lower moral responsibility that gets in the way but, rather, a default to profit-maximization that disconnects moral-duty within subsidiary operations from decision-making within the JV parent. This condition creates a Russian-doll effect whereby each additional layer of ownership further reduces a JV subsidiary's ability to address hazardous externalities. This effect may be even stronger for cancerous chemicals, where the first-order owners may be more willing and likely to mitigate emissions in the first place, but they remain unable to convince a parent JV owners-in-hiding, which impose their own financial interests.

Hypothesis 4: A higher percentage of joint-venture ownership in co-owned facilities will decrease pollution mitigation for a) cancerous and b) non-cancerous byproducts.

[28] The number of relationships surrounding a JV is represented by the equation $\frac{N+1}{2}(N)$, where N equals the number of parties affiliated with the joint-venture. The number of relationships parent JV managers must consider is surrounding a parent equation $\frac{P+1}{2}(P) + \frac{N+1}{2}(N)$, where P equals the number of parties affiliated with the parent JV and N equals the number of parties affiliated with the subsidiary joint-venture.

3.4 COALITION HETEROGENEITY

In the previous section, I theorize that three types of owners (government, private firms and joint-venture equity holders) drive co-owned facilities in different directions. While government, private, and JV owners constitute large and often heterogeneous categories, theory and evidence suggest that each group may share a recognizable cognitive frame[29] (Polleta & Jasper, 2001; Brickson, 2000; Thornton & Ocasio, 1999; Tyler, 1999), especially when it comes to the ways they might go about addressing environmental externalities (Berrone *et al*., 2010; Darnall & Edwards, 2006). For example, one would expect that government owners would generally push for moral-duty (i.e., more mitigation and less harm) and JV owners would subscribe to self-interested gains. But being pulled in different direction leaves unanswered the logically next question: Which direction might prevail, and when?

Owners sharing the same frame may be quick to work through issues and converge on agreeable solutions (Thomas & Ely, 2009; Grey, 1989; Lax & Sebenius, 1986), but the greater the number of different frames, the longer and more non-linear the journey (Hoffman, 2011a, 2011b; Zietsma & Lawrence, 2010). In the last decade, a large and growing literature on cross-sector solutions to environmental issues has suggested that different frames can be bent and fused to unearth often unprecedented value and/or resolve intractable issues (Branzei & Le Ber, 2013; Le Ber & Branzei, 2010; Lin & Darnall, 2010). Indeed, while frame-bending and fusion has its own costs, the benefits are often worthwhile. Even warring parties can overcome their prior biases and break substantively different new grounds (Zietsma *et al*., 2002; MacDonald,

[29] Institutional logics embody socially derived formal and informal rules that influence how managers from different types of organizations construe meaning from their environment, evaluate problems, and ascribe value (Vurro, Dacin & Perrini, 2010; Friedland & Alford, 1991; Boltanski & Thevenot, 1991). They provide context for social influence in decision-making (Thornton & Ocasio, 1999) and guide and constrain organizational behaviour by signaling what constitutes rational and appropriate action (Thornton, 2004; March & Olsen, 1989) in and across situations.

2010). The greater the heterogeneity in the types of partners co-owning a facility, the greater the chance that the significantly higher effort invested in working together will pay off (Thomas & Ely, 2009; Lax & Sebenius, 1986) in the form of improved environmental performance.

Greater heterogeneity may prove particularly helpful in mitigating cancerous emissions because of the recognized and agreed-upon harm attributable to these chemicals. Non-cancerous chemicals, however, may garner less attention since they are generally perceived to be less detrimental to human health (Berman & Wandersman, 1990; Stahly, 1989) and their harm remains contestable. In other words, greater heterogeneity may undermine or deemphasize mitigating non-cancerous chemicals. I therefore predict a positive relationship between coalition heterogeneity and pollution mitigation for cancerous byproducts and an inverse relationship between coalition heterogeneity and pollution mitigation for non-cancerous hazardous byproducts.

Hypothesis 5: Co-owned facilities with more coalition heterogeneity will a) emit more cancerous byproducts and b) mitigate less non-cancerous byproducts.

3.5 METHODS

3.5.1 Data and Sample

To examine the influence of ownership composition on JV's pollution mitigation, I used the National Pollution Release Inventory (NPRI), Canada's federally legislated inventory of industrial hazardous substances. The NPRI is similar to the U.S.-based Toxic Release Inventory (TRI), which scholars commonly use to research environmental performance (Berchicci *et al.*, 2012; King & Lenox, 2001, 2002; King & Shaver, 2001; Klassen & Whybark, 1999). Along with detailed information on each facility's emissions and abatement efforts, the NPRI provides additional facility-level information on the allocation of ownership that remains unavailable within the TRI. Specifically, it identifies not only whether a facility is independently or jointly owned but also the composition of ownership within JVs.

Federal law requires annual reports from over 8,800 facilities exceeding 20,000 annual man-hours and exceeding chemical-use thresholds for any one of over 300 hazardous chemicals (Environment Canada, 2013a). Environment Canada is responsible for ensuring the integrity of the self-reported data and randomly conducts on site visits to verify reports. If Environment Canada identifies any inaccuracies, firms are legally obliged to correct their reports.

To eliminate bias attributable to new chemicals being added to reporting requirements over time (Environment Canada, 2013d), I examined only those chemicals within the NPRI that required reports as of 2004.[30] An analysis of the data for inconsistencies or disparities suggested that less than one percent of the reports appeared questionable to errors of omission and commission,[31] and thus the original publically available data was not altered. I examined the population of non-military JV facilities between 2004 and 2009, providing a final sample of 315 JV facility-year observations for 86 JVs in 37 industries.[32]

3.5.2 Dependent Variable

I measured JVs' environmental performance by examining their facilities' pollution mitigation – specifically, the amount of recycling and treatment of hazardous waste prior to

[30] A list of chemicals examined in this analysis is provided in Appendix A.

[31] An error of omission or commission was assumed when 1) a facility consistently filed reports for four contiguous years and failed to provide a report in one of the years in the sampling frame, 2) a facility failed to report a chemical one year while consistently reporting the chemical in previous and future years, 3) a facility report on a specified chemical exceeded a 500% annual difference without being part of an apparent upward or downward trend for the facility's use of that chemical, and 4) where someone obviously made a data-entry error on the fields observed in this study. No obvious data-entry errors occurred in the reports examined in this study.

[32] A list of industries examined in this analysis is provided in Appendix B.

disposal. This amount was not dependent upon nor predetermined by the levels of production; it reflected voluntary action[33] and was directly comparable across facilities.

I differentiated between cancerous and non-cancerous human health hazards by using the Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI) (Bare *et al*., 2003; Toffel & Marshall, 2004). TRACI provides weights for chemical hazards based upon their cancerous and non-cancerous properties as well as their human exposure pathways, that is, whether a chemical is inhaled or absorbed through ingestion or contact.[34] I calculated pollution mitigation measures with the equation:

$$ln\sum(\varphi_{\mathrm{cetf}}\omega_{\mathrm{ce}} + \tau_{\mathrm{cetf}}\omega_{\mathrm{ce}})$$

where φ represents the total tonnage of chemical c recycled, typically affecting humans through exposure pathway *e*, in year *t* for facility *f*, and ω equals the hazardous weight provided by TRACI for chemical *c* for exposure pathway *e*. τ represents the total tonnage of chemical c treated prior to disposal. I performed a log transformation on the dependent variable to correct for skewness and kurtosis.

3.5.3 Independent variables

JV scholars provide several thresholds, ranging from five percent (Killing, 1983) to twenty percent (Dhanaraj & Beamish, 2004) equity ownership, that indicate when minority partners actively participate in a JV. Since I examine the extent to which levels of ownership

[33] While laws and regulations may limit certain releases of hazardous byproducts, facilities have multiple options for disposing of hazardous waste without recycling or treatment prior to disposal.

[34] Since, by definition, a treated or recycled chemical never leads to exposure, some assumptions are required to weight chemical hazards for pollution mitigation. I used TRACI's inhalation weights for treatment by incineration and TRACI's absorption weights for physical, chemical, biological, and municipal sewage treatment. For recycling, I used TRACI's inhalation weights for energy recovery and TRACI's absorption weights for solvents, organic substances, metals and metal compounds, inorganic materials, acids and bases, catalysts, abatement residue, and used oil.

influence environmental performance, I examined all equity joint ventures where the second largest partner holds a minimum of five percent equity. I operationalized ownership dispersion by using a Herfendahl-like measure that simultaneously accounted for the number of owners and their respective shares:

$$Ownership\ Dispersion = -1 * (\sum \zeta_{\mathrm{nj}}^2)$$

where n represents the number of each partner owning a portion of joint-venture j, and ζ represents the percentage ownership for partner n. The measure approached -1 for single owners with high stakes (low dispersion) and zero for multiple owners with small stakes (high dispersion).

I operationalized the influence of each type of partner by computing the percentage of total ownership held by public firms, private firms, JV firms, and government agencies within each JV.[35] To avoid perfect multi-collinearity, I did not include public firms as a control; thus the effects of private, JV, and government ownership were in relation to public ownership.

Coalition heterogeneity captures the spread of influence among four categories of owners known to differ systematically in their preference for and attention to environmental issues – government, private firms, public firms, and other (second-order) joint ventures.[36] I used the same Herfendahl-like formula used to calculate ownership dispersion, but aggregate the percentage of ownership for each type of partner to capture coalition heterogeneity:

$$Coalition\ Heterogeneity = -1 * (\sum \varsigma_g^2)$$

[35] I considered crown corporations as government ownership.

[36] Because ownership dispersion by partner and ownership dispersion by partner type are distinct constructs, I theorized and tested their effects separately; empirically the two measures were not significantly correlated and the reported results were robust to their simultaneous inclusion.

where g represents the category of ownership and ς equals the sum of ownership stakes by firms in category g. This measure theoretically ranges between -1 and -0.25, equals -1 when all firms belong to the same category, and equals -0.25 when all four categories of ownership are equally represented.

I further probed the influence of dominant ownership by constructing two additional measures. *FiftyPlus* captured majority ownership by any partner and was set to one if any partner owned greater than 50% and zero otherwise. I controlled for the differential difficulty of attaining agreement on any given issue by controlling for the number of partners in each joint venture (*NumberOfPartners)*. Since these additional measures were highly correlated with both ownership dispersion and coalition heterogeneity, I included them in tests of partner-type influence only.

3.5.4 Control Variables

Within the analysis, I also controlled for alternative explanations of environmental performance. I included facility size (*FacilitySize*) and the number of peer facilities owned by the same joint-venture (*PeerFacilities*) to capture any scale or scope economies in pollution mitigation and/or learning effects across facilities. As in former pollution studies (Berchicci, Dowell, & King, 2012; Harrison & Antweiler, 2003; King & Lenox, 2001, 2002; King & Shaver, 2001), as a crude measure of production, I operationalized *FacilitySize* by the number of facility employees since larger facilities may achieve scale or scope economies for mitigating hazardous waste and since larger firms adopt more proactive environmental policies (Darnall, Henriques, & Sadorsky, 2010).

I included the number of chemicals (*NumberofChemicals)* released by each facility since prior research suggests that the number of chemicals processed by a facility may affect hazardous waste processing, in part by creating opportunities for accelerating the development of requisite capabilities (Diestre & Rajagopalan, 2011; S. Hart, 1995; Russo & Fouts, 1997). I included the percentage of foreign ownership (*ForeignOwnership)* since King and Shaver (2001) suggested that foreign-owned establishments may produce more unique waste that could hinder their pollution abatement efforts. I also included the percentage of ownership represented by firms on the S&P 500 index and the S&P TSX 60 index (*S&P Constituent)* to capture the influence of additional market scrutiny on environmental performance (Lee, 2009; Villalonga, 2004). Finally, I included the volume of hazardous waste (*Byproducts)* produced by each facility, cancerous (*CanByproducts)* and non-cancerous (*NoncanByproducts*), respectively, in case hazardous waste volume influences pollution mitigation.

3.5.6 Analysis

I used standard OLS pooled regression analysis, clustering errors by facility to capture correlation in the error term arising from the same JV facilities reporting in multiple years (Rodgers, 1993). Province, year, and industry (3-digit SIC) fixed effects accounted for differences arising from cultural and legal differences, annual trends, and industry specific factors. The following two equations present the baseline regressions for the analysis:

$$\begin{aligned}\ln(PollutionControl) = \beta_0 + \beta_1 \ln(Dispersion\ or\ Coalition\ Heterogeneity) \\ + \beta_2 \ln(FacilitySize) + \beta_3 \ln(PeerFacilities) + \beta_4 \ln(ForiegnOwnership) \\ + \beta_5 \ln(S\&P\ Constituent) + \beta_6 \ln(NumberOfChemicals) \\ + \beta_7 \ln(Byproducts) + \beta_{8-15}(Province) + \beta_{16-52}(Industry) \\ + \beta_{53-57}(Year) + \varepsilon\end{aligned}$$

$$
\begin{aligned}
\ln(PollutonControl) = {} & \beta_0 + \beta_1 \ln(PercentGovernment) + \beta_2 \ln(PercentPrivate) \\
& + \beta_3 \ln(PercentPartnership) + \\
& + \beta_4 \ln(FacilitySize) + \beta_5 \ln(PeerFacilities) + \beta_6 \ln(ForiegnOwnership) \\
& + \beta_7 \ln(S\&P\ Constituent) + \beta_8 \ln(NumberOfChemicals) \\
& + \beta_9 \ln(NumberOfPartners) + \beta_{10} FiftyPlus + \beta_{11} \ln(Byproducts) \\
& + \beta_{12-19}(Province) + \beta_{20-56}(Industry) + \beta_{57-61}(Year) + \varepsilon
\end{aligned}
$$

The baseline model captured 43.8% of the variance in the data for cancerous pollution mitigation and 72.7% of the variance for non-cancerous pollution mitigation. The independent variables contributed to an additional 0.1% to 15.2% statistical significance in the model. However, more importantly (Miller, 2008; Weisberg, 2004), the independent variables demonstrated substantive significance in explaining variance in pollution mitigation for substances known to cause human harm.

Table 7 presents descriptive statistics and pair-wise correlations for the data used in the analysis. Correlations among predictors and control variables were modest to moderate, and the largest variance inflation factor among independent variables was 4.01, alleviating concerns about multi-collinearity (Kennedy, 1997; Neter *et al*., 1996). As expected, JV facilities produced far more non-cancerous than cancerous byproducts, and perhaps because of this disparity, JV facilities addressed approximately 5.18% of their non-cancerous waste through pollution mitigation but only 0.28% of their cancerous waste. This finding could result from different technologies, capabilities, or control efficiencies.

Table 8 reports the unhypothesized effects of the predictors on hazardous waste volume. While the patterns of hazardous waste volume may foreshadow some of the predictions, they cannot fully explain why ownership will elicit different patterns of pollution mitigation.

Table 7: Descriptive statistics and pairwise correlations

		Mean	SD	Min	Max	1	2	3	4	5	6	7	8
1	Non-cancerous volume	251,240	943,619	0	6,968,242	1							
2	Cancerous volume	28.28	276	0	4,859	0.0508	1						
3	Non-cancerous mitigation	13,001	94,179	0	905,034	0.0884	0.3557	1					
4	Cancerous mitigation	0.08	0.57	0	6.00	-0.0364	-0.0078	-0.0173	1				
5	Ownership dispersion	-0.47	0.10	-0.91	-0.20	-0.0302	0.2060	0.3588	0.1776	1			
6	Percent government ownership	0.02	0.10	0	0.51	-0.0508	-0.0188	-0.0296	-0.0288	-0.0387	1		
7	Percent private ownership	0.18	0.28	0	1	-0.1267	-0.0336	-0.0618	-0.0857	-0.0755	0.0111	1	
8	Percent partnership ownership	0.05	0.15	0	0.95	-0.0501	-0.0163	-0.0433	-0.0428	-0.3027	0.3408	0.0172	1
9	Coalition heterogeneity	-0.84	0.21	-1	-0.43	-0.1444	-0.0096	-0.0450	0.0433	0.0854	0.3378	0.5107	0.3565
10	Facility size	457	747	2	4,600	0.0891	0.3125	0.5946	-0.0671	0.2518	-0.0886	-0.1695	-0.0959
11	Peer facilities	4.62	16.31	0	121	-0.0409	-0.0187	-0.0241	-0.0056	-0.0684	-0.0498	0.0050	0.0800
12	Foreign ownership	24.17	35.64	0	100	-0.1428	-0.0541	-0.0758	-0.0936	-0.1438	-0.0038	0.0428	0.1750
13	S&P constituency	23.89	32.41	0	100	-0.0647	0.1230	0.2188	0.0535	0.2464	-0.1566	-0.2377	-0.2156
14	Number of chemicals	13.11	11.67	1	57	0.2654	0.2683	0.4251	0.1274	0.1102	-0.0476	-0.1909	0.0359
15	Number of partners	2.75	1.41	2	8	-0.0489	0.2761	0.5042	0.0142	0.7752	-0.0571	-0.1640	-0.0868
16	Fifty plus	0.48	0.50	0	1	-0.1728	-0.0771	-0.1318	-0.1310	-0.3687	-0.0040	0.1163	0.1501

		9	10	11	12	13	14	15	16
9	Coalition heterogeneity	1							
10	Facility size	-0.1479	1						
11	Peer facilities	-0.0313	-0.0960	1					
12	Foreign ownership	0.0106	0.0434	0.0078	1				
13	S&P constituency	-0.3166	0.0438	-0.1114	-0.2021	1			
14	Number of chemicals	-0.1176	0.3910	0.0752	-0.2826	-0.0585	1		
15	Number of partners	-0.0220	0.3516	-0.0816	-0.1047	0.3671	0.1903	1	
16	Fifty plus	0.0210	-0.1603	0.1632	0.2463	-0.0308	-0.2232	-0.1269	1

Note: n = 315. The minimum reported total toxic emissions exceeds zero, but rounds to zero. Correlations (absolute value) greater than 0.1105 (0.1449) are significant at the 5% (1%) level.

Table 8: Predictors on un-hypothesized hazardous waste volume

	Cancerous Byproducts	Cancerous Byproducts	Non-cancerous Hazardous Byproducts	Non-cancerous Hazardous Byproducts	Cancerous Byproducts	Non-cancerous Hazardous Byproducts	Cancerous Byproducts	Non-cancerous Hazardous Byproducts
Dispersion		- 3.1673		76.6790				
		(17.4702)		(63.2282)				
Perc. Govt.					- 14.1234	- 43.3708 **		
					(13.1030)	(20.6027)		
Perc. Private					7.3896 **	- 4.8592		
					(3.8166)	(6.3846)		
Perc. Partnership					- 11.8154	- 15.8416		
					(7.2648)	(14.2749)		
Own-type Dispersion							0.8616	22.3336 *
							(4.5818)	(15.6261)
Ln(Facility Size)	- 0.4117	- 0.3848	0.0665	- 0.6107	0.3092	- 4.2112	- 0.3739	1.0472
	(1.6853)	(1.6148)	(4.1644)	(3.9954)	(1.2730)	(4.5439)	(1.7102)	(3.8832)
Ln(Peer Facilities)	- 3.8426 *	- 3.8646 *	- 0.3112	0.2433	- 3.6013 *	- 2.6696	- 3.8259 *	0.1212
	(2.5261)	(2.5410)	(2.8993)	(2.9454)	(2.3189)	(3.4473)	(2.5547)	(2.9234)
Ln(Foreign Ownership)	0.2696 ***	0.2748 ***	0.1970	0.0658	0.4296 ***	- 0.0298	0.2666 ***	0.1190
	(0.1038)	(0.1137)	(0.2443)	(0.1866)	(0.1600)	(0.1788)	(0.1015)	(0.2337)
Ln(S&P Constituent)	- 0.1833	- 0.1844 *	- 0.2695	- 0.2415	- 0.2411 *	- 0.1058	- 0.1770	- 0.1071
	(0.1528)	(0.1525)	(0.2247)	(0.2436)	(0.1540)	(0.2232)	(0.1661)	(0.2628)
Ln(No. Chemicals)	2.9747	2.9555	14.0777 **	14.5604 ***	4.8575 *	16.0132 ***	2.9991	14.7099 **
	(3.0102)	(2.9872)	(6.4697)	(6.0302)	(3.0886)	(5.6746)	(3.0368)	(6.5890)
Ln(No. Partners)					- 10.0506	50.1059 *		
					(8.2780)	(28.3765)		
Fifty_plus					4.4646 **	8.8703 ***		
					(1.9001)	(3.3696)		
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.4608	0.4588	0.2838	0.3363	0.4799	0.4348	0.4588	0.2989
ΔR^2		0.0020		0.0525	0.0211	0.1510	0.0020	0.0151
Facilities	86	86	86	86	86	86	86	86
n	315	315	315	315	315	315	315	315

p<.001 = ***; p<.01 = **; p<.05 = *; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parentheses
Percent government, private, and partnership ownership in relation to ownership by publically traded firms

2.6 RESULTS

Table 9 provides the results of the main analysis. Hypothesis 1A predicted that, ceteris paribus, JV facilities will mitigate a similar amount of cancerous byproducts because the cancerous classification removes doubt as to the hazard and the appropriateness of addressing these substances. Consistent with the hypothesis 1A, Table 9 shows that greater ownership dispersion does not influence the mitigation of cancerous emissions – dispersed and concentrated owners mitigate cancerous emissions to a similar extent. A power analysis of the null hypothesis for a sample size of 325, a minimum R^2 of 0.5352, 58 predictors, a sample size of 315, and a type-1 error rate of .001 indicated the statistical power for the regression is 1, confirming there was sufficient statistical power to support the null hypothesis.

Hypothesis 1B explained that facilities will mitigate less non-cancerous waste as ownership dispersion increases because, as the number of owners increases and as their equity shares become more balanced, they will increasingly struggle to align divergent interests and their likelihood of accolades or blame for environmental performance declines. Counter to the hypothesis, the results indicated a strong and significant positive relationship between ownership dispersion and pollution mitigation for non-cancerous byproducts; thus, I reject hypothesis 1B. While JVs with more owners face additional challenges in aligning interests and agreeing (Parkhe, 1993; van de Ven, 1976; Cartwright & Zander, 1968; Demsetz, 1967), more represented interests and opinions in the ownership coalition appears to lead to better outcomes, perhaps by bringing together a broader range of capabilities (Diestre & Rajagopalan, 2011; Sharma & Vrendenburg, 1998; Russo & Fouts, 1997; Shrivastava, 1995) and/or co-creating economies of scale and scope.

Table 9: JV ownership coalition characteristics and pollution mitigation for cancerous and non-cancerous byproducts

	Hypothesis 1A			Hypothesis 1B	Hypotheses 2A, 3A, 4A	Hypotheses 2B , 3B, 4B	Hypothesis 5A	Hypotheses 5B
	Pollution Mitigation Cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-cancer	Pollution Mitigation Non-cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-cancer
Dispersion		- 2.6527		11.5365 *				
		(5.0833)		(7.8747)				
Perc. Govt.					18.7431 ***	12.0307 *		
					(5.8753)	(8.4815)		
Perc. Private					0.4775	- 4.3197		
					(1.1065)	(4.6963)		
Perc. Partnership					- 1.9558	0.7700		
					(2.6298)	(5.1007)		
Own Type Dispersion							3.6831 *	- 6.7689 **
							(2.6240)	(4.0556)
Ln(Facility Size)	- 2.4149 **	- 2.3925 *	- 0.6908	- 0.7881	- 1.8622 *	- 0.6105	- 2.2533 **	- 0.9886
	(1.3644)	(1.3636)	(1.2900)	(1.2658)	(1.0526)	(1.0690)	(1.2894)	(1.2583)
Ln(Peer Facilities)	- 1.0542 **	- 1.0736 *	- 1.9484 *	- 1.8716	- 0.8716	- 1.4955	- 0.9843	- 2.0771 *
	(0.6306)	(0.6292)	(1.4521)	(1.4655)	(0.5275)	(1.3069)	(0.6023)	(1.3951)
Ln(Foreign Ownership)	0.0286	0.0330	0.0257	0.0089	- 0.0118	- 0.0030	0.0158	0.0478
	(0.0686)	(0.0697)	(0.0945)	(0.0931)	(0.0407)	(0.0937)	(0.0642)	(0.0955)
Ln(S&P Constituent)	- 0.0049	- 0.0059	- 0.1332	- 0.1321	- 0.0026	- 0.1319	0.0218	- 0.1804
	(0.0367)	(0.0370)	(0.1374)	(0.1323)	(0.0268)	(0.1193)	(0.0429)	(0.1413)
Ln(No. Chemicals)	4.0560 ***	4.0406 ***	8.0478 ****	8.2744 ****	3.3881 ***	6.3351 ***	4.1613 ***	7.7501 ****
	(1.4271)	(1.4299)	(1.8864)	(1.8805)	(1.2905)	(2.1105)	(1.4334)	(2.0192)
Ln(No. Partners)					- 4.2257	- 2.2194		
					(4.7710)	(4.9171)		
Fifty_plus					0.4648	- 5.1682 **		
					(0.7416)	(2.3106)		
Ln(Can Byproducts)	0.0344	0.0342			0.0337		0.0341	
	(0.0295)	(0.0299)			(0.0314)		(0.0296)	
Ln(Noncan Byproducts)			0.1027 ****	0.0916 ****		0.1316 ****		0.1102 ****
			(0.0260)	(0.0267)		(0.0262)		(0.0276)
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.4375	0.4365	0.7266	0.7292	0.5890	0.7543	0.4471	0.7320
ΔR^2		0.0010		0.0026	0.1515	0.0281	0.0096	0.0054
Facilities	86	86	86	86	86	86	86	86
n	315	315	315	315	315	315	315	315

p<.001 = ***; p<.01 = **; p<.05 = *; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parentheses
Percent government, private, and partnership ownership in relation to ownership by publically traded firms

Hypotheses 2, 3, and 4 suggested that different types of owners would drive environmental outcomes in different directions. Hypothesis 2 explained that the additional scrutiny that accompanies government ownership will encourage co-owned facilities to address more hazardous externalities; that is, co-owners will be more likely to internalize and more stringently mitigate their hazardous waste. Table 9 columns 5 and 6 show supportive evidence for hypotheses 2A & 2B which state that government ownership improves pollution mitigation for both cancerous and non-cancerous hazardous waste. The effects are practically important: for each percent increase in government ownership, the results indicated an approximate 20.6% increase in cancerous pollution mitigation[37] and an approximate 12.8% increase in non-cancerous pollution mitigation.[38]

Hypothesis 3 drew attention to the non-economic utility that private owners derive from corporate social responsibility, predicting that a higher percentage of private ownership may elicit greater mitigation for both types of chemicals. Neither was significant in my sample, so there was no support for the hypothesized private-firm effect. Dialing up or down the percentage of private ownership did not influence the level of mitigation for hazardous byproducts, and thus hypotheses 3A and 3B are rejected. While non-significant, this finding should be interpreted with caution. We know from prior literature that private firms are more likely to heed their own values, but if an equal number subscribe to moral duty and profit-maximization perspectives, the effects will effectively cancel each other out.

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[37] The percentage difference for JV facilities is determined by examining the exponentiated coefficient of the JV indicator variable such that a one unit increase in β corresponds to the change in the dependent variable. Since the variable is a percentage: $\exp(\beta_1 * 0.01) - 1 =$ exp(18.7431*0.01) – 1 = 0.2061

[38] Using an indicator variable for government ownership in place of the percentage of government ownership indicated that government ownership significantly and substantially increased cancerous pollution mitigation, but non-cancerous pollution mitigation was non-significant.

Hypothesis 4 predicted a Russian doll effect whereby the more equity other joint-ventures hold in a co-owned facility, the harder it gets for the partners at the table to identify and agree upon appropriate action. The hypothesized effects were, again, non-significant, so hypotheses 4A and 4B are rejected. This result suggests that even abnormal complications, such as adding high percentages of nested JV ownership, do not set facilities back, despite the cognitive limits of managers and their inability to address such complex and conflicting environmental issues. Future studies may provide additional insights into the sensitivity of co-owned facilities to multiple layers of equity ownership and other forms of control, asking whether it is the indirectness of this type of holding or its hidden nature that keeps JV-owned facilities in this study comparable to their peers.

The last hypothesis stated that greater coalition heterogeneity will improve the ability of co-owned facilities to mitigate cancerous byproducts and undermine their ability to mitigate non-cancerous byproducts. Theoretically, H5 mirrors H1 with one difference. Precisely because of the added complexity and co-ordination challenges associated with finding and fusing different frames, I argued and found that co-owned facilities try harder and succeed at ratcheting up mitigation for cancerous waste. Consistent with hypothesis 5B, I also found that greater partner-type heterogeneity was associated with lesser effort and/or effectiveness at mitigating non-cancerous emissions. A summary of hypothesized effects along with the analysis findings is provided in Table 10.

Table 10: Summary of hypothesized effects and analysis findings

Hypothesis	Finding
H1A: There is no relationship between ownership dispersion and pollution mitigation for cancerous substances	Supported
H1B: As ownership dispersion increases, co-owned facilities' pollution mitigation for non-cancerous hazardous substances decreases.	Not supported
H2A: A higher percentage of government ownership increases pollution mitigation for cancerous byproducts	Supported
H2B: A higher percentage of government ownership increases pollution mitigation for non-cancerous byproducts.	Supported
H3A: A higher percentage of private-firm ownership increases pollution mitigation for cancerous substances.	Not supported
H3B: A higher percentage of private-firm ownership increases pollution mitigation for non-cancerous substances.	Not supported
H4A: A higher percentage of joint-venture ownership decreases pollution mitigation for cancerous substances.	Not supported
H4A: A higher percentage of joint-venture ownership decreases pollution mitigation for non-cancerous substances.	Not supported
H5A: Co-owned facilities with more coalition heterogeneity mitigate more cancerous byproducts	Supported
H5B: Co-owned facilities with more coalition heterogeneity mitigate less non-cancerous byproducts	Supported

3.6.1 Robustness Checks

Studies of environmental performance remain highly susceptible to measurement error, especially for studies of hazardous byproducts. Toffel and Marshal (2004) highlighted that whether or not significant findings arise partially depends upon the weighting mechanisms scholars use to capture the hazard associated with each chemical. To provide a stronger test of the hypothesized relationships, I reweighted chemical hazards using the Environmental Defense Fund's Toxicity Equivalent Potential Scorecard (TEPS) and reran analysis for the hypothesized relationships in this study. TEPS is similar to TRACI in that it provides cancerous and non-cancerous weights for chemicals based upon their human exposure pathways. However, TEPS examines fewer chemicals than TRACI, which could account for differences between the robustness checks and main analysis. The results of these robustness checks are provided in Table 11.

The robustness checks replicated all the findings in the main analysis, with two exceptions. First, the robustness check of the relationship between government ownership and improved pollution mitigation failed to find evidence that government ownership improves the ability of co-owned facilities to mitigate non-cancerous byproducts. Notably, the robustness check did reconfirm increased mitigation of cancerous byproducts. Second, the robustness check of the relationship between private ownership and non-cancerous pollution mitigation was significant, although counter to the direction hypothesized. This result was somewhat surprising, given that prior studies of family control over public firms examined cases of co-ownership among widely dispersed principles (Berrone *et al*., 2010). However, we might expect that the influence of family ownership creates a broad range of responses because private firms can take greater liberty to do a lot more, or a lot less, depending on what they value.

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Table 11: Robustness checks examining JV ownership coalition characteristics and pollution mitigation for cancerous and non-cancerous substances.

	Robustness 1A			Robustness 1B	Robustness 2A, 3A, 4A	Robustness 2B, 3B, 4B	Robustness 5A	Robustness 5B
	Pollution Mitigation Cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-Cancer	Pollution Mitigation Non-Cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-Cancer	Pollution Mitigation Cancer	Pollution Mitigation Non-Cancer
Dispersion		- 2.7191		12.7187 *				
		(5.0703)		(8.3332)				
Perc. Govt.					18.6058 ***	7.2817		
					(5.8503)	(7.7485)		
Perc. Private					0.4732	- 7.6149 **		
					(1.0965)	(4.1498)		
Perc. Partnership					- 2.0594	3.7422		
					(2.6100)	(5.4209)		
Own Type Dispersion							3.6268 *	- 7.2931 *
							(2.6059)	(4.3609)
Ln(Facility Size)	- 2.3959 **	- 2.3729 **	- 0.6731	- 0.7980	- 1.8464 *	- 0.8635	- 2.2372 *	- 0.9837
	(1.3550)	(1.3538)	(1.3573)	(1.3264)	(1.0465)	(1.2758)	(1.2813)	(1.3536)
Ln(Peer Facilities)	- 1.0581 **	- 1.0773 *	- 2.2634 **	- 2.1754	- 0.8791 *	- 2.2159 **	- 0.9906 *	- 2.4043 *
	(0.6240)	(0.6223)	(1.3411)	(1.3566)	(0.5207)	(1.2758)	(0.5962)	(1.3016)
Ln(Foreign Ownership)	0.0271	0.0316	0.0158	0.0079	- 0.0126	- 0.0409	0.0147	0.0380
	(0.0687)	(0.0697)	(0.0869)	(0.0869)	(0.0405)	(0.0841)	(0.0643)	(0.0893)
Ln(S&P Constituent)	- 0.0048	- 0.0058	- 0.0250	- 0.0236	- 0.0028	- 0.0194	0.0214	- 0.0763
	(0.0365)	(0.0367)	(0.1013)	(0.0976)	(0.0264)	(0.0868)	(0.0426)	(0.1088)
Ln(No. Chemicals)	4.0426 ***	4.0263 **	8.6951 ****	8.8823 ****	3.3864 ***	7.0839 ***	4.1474	8.4250 ****
	(1.4196)	(1.4225)	(1.9386)	(1.9573)	(1.2838)	(2.3219)	(1.4267)	(2.0801)
Ln(No. Partners)					- 4.2045	1.9134		
					(4.7430)	(6.0104)		
Fifty_plus					0.5259	- 3.9606 **		
					(0.7081)	(1.9320)		
Ln(Can Byproducts)	0.0352	0.0352			0.0343		0.0345	
	(0.0291)	(0.0294)			(0.0302)		(0.0291)	
Ln(Noncan Byproducts)			0.0738 *	0.0605		0.0869 *		0.0815 *
			(0.0474)	(0.0471)		(0.0515)		(0.0464)
Province Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.4379	0.4371	0.7249	0.7287	0.4942	0.7561	0.4452	0.7309
ΔR^2		0.0008		0.0038	0.0563	0.0312	0.0073	0.0060
Facilities	86	86	86	86	86	86	86	86
n	315	315	315	315	315	315	315	315

p<.001 = ***; p<.01 = **; p<.05 = *; p<.1 = *, one-tailed
Robust standard errors clustered by facility in parentheses
Percent government, private, and partnership ownership in relation to ownership by publically traded firms

3.7 DISCUSSION

This study provides new insights into the relationship between ownership and environmental outcomes by theorizing and testing how multiple and different types of owners shape one critical aspect of JVs' environmental performance – namely, pollution mitigation. By examining the characteristics of ownership coalitions within JV organizations, I uncovered why some JV facilities address their hazardous externalities more than others. Specifically, the characteristics of the coalition and the characteristics of its members systematically influence the extent to which JV facilities exhibit a moral duty or profit maximization tendencies when considering pollution mitigation. The tendency hinges upon the characteristics of the coalition and the characteristics of its members.

Relatively equal partners shift the tendency toward moral duty, while majority-ownership shifts the tendency toward profit-maximization, although to a lesser extent. More owners with more balanced equity stakes raise the bar for mitigating non-cancerous hazardous byproducts, even though these coalitions face greater difficulties aligning interests and coming to agreement (Parkhe, 1993; van de Ven, 1976; Cartwright & Zander, 1968). While my data could not identify why this shift occurs, two explanations seem likely. Similar co-owners with relatively equal shares may be more likely to actively discuss operational decisions and their environmental impacts, thus elucidating potential harm and facilitating discussions of moral duty. Alternatively, JV managers representing similar yet dispersed owners may have more discretion or direction in making socially beneficial operational decisions.

In contrast to ownership dispersion, coalition heterogeneity exhibits a nuanced relationship with pollution mitigation. When different types of owners participate in the JV coalition, and when the categories of ownership are symmetric, facilities' pollution mitigation for non-cancerous byproducts suffers and pollution mitigation for cancerous byproduct improves. Similarity improves partners' co-operation (Brickson, 2000; Tyler, 1999) and thus facilitates agreement upon the necessity, appropriateness, and manner of mitigating harm, but different perspectives among coalition members can undermine the remission of ambiguous and/or contestable harm. When different viewpoints regarding the appropriateness of mitigating hazardous waste ensue, the JV shifts towards a profit-maximization tendency that indisputably contributes to economic interests of owners. Notably, the contestation of harm places the locus of tendency upon chemicals' socially designated and accepted hazards; the cancer/non-cancer classification appears to polarize JVs' response to moral duty. In cases of known harm (cancer), more heterogeneous JV coalitions go above and beyond to address hazardous externalities, thus shifting to a moral-duty tendency.

Government ownership appears to tip the scale in favour of moral duty. Again, the data in this study could not determine the exact mechanism by which this shift occurs, but the effects of government ownership were significant and substantial for pollution mitigation of cancerous and non-cancerous substances. It is possible that government imposes its will in favour of moral duty – namely, more pollution mitigation – ex ante as condition of its financial backing of a venture. It is equally likely that the very presence of government within the ownership coalition naturally shifts the perspective towards moral duty as owners consider the enforcer of social expectations within their midst.

3.7.1 Limitations

As in any empirical undertaking, this study has a number of limitations. First, this study examines only one dimension of environmental performance, pollution mitigation. I chose to examine pollution mitigation deliberately because it is comparable across facilities, firms, and industries and bears immediate and notable consequences for human health. However, the relationship between JV facilities' ownership composition and pollution prevention may differ because of the substantial resource commitments (Arora & Cason, 1995; Hirschhorn, 1994), ambiguity of returns (King & Lenox, 2002; Klassen & Whybark, 1999; Elkington, 1998; Hart & Ahuja, 1996), and delayed returns (Slawinski, 2010; Sarkis & Cordeiro, 2001) surrounding these initiatives. This potential difference gives rise to future opportunities to explore additional relationships between these and other characteristics of ownership and other aspects of environmental performance.

Second, while I theorized that co-owners engage with one another and co-determine the level of mitiation over hazardous emissions, the data did not allow me to verify whether or how fully such engagement actually occurs. Some JV facilities represent collaboratively managed operations while, in others, one owner is assigned operational authority and other partners represent investors in the enterprise (Killing, 1983). It is possible that JVs with one operational authority behave more like independent firms or majority-owned JVs than like collaboratively managed ventures. However, anecdotal evidence suggests that co-owners without operational authority still influence environmental performance. ConocoPhillips, for instance, recently complained that a JV partner, China National Overseas Oil Corporation, prevented them from prudently preparing for environmental containment in the event of an oil spill, even though ConocoPhillips had operational authority over the co-owned facility (Rapoza, 2012; Watts, 2011).

While this example demonstrates that non-operating partners can influence environmental performance, the extent to which JVs with one operational authority differ should receive more theoretical and empirical attention. If variance does exist in the nature and/or levels of engagement, then the findings in this study constitute conservative estimates. Furthermore, my findings are orientative rather than definitive. By showing how different characteristics of ownership can be used as levers to systematically increase mitigation for cancerous and non-cancerous emissions, I neither mean to imply that these predictors will always be effective nor equally effective across facilities. I merely suggest that *ownership matters* and that it may offer willing parties a wide range of tools to help them more deliberately balance self-interest and moral duty.

Third, while the empirical context provides wide variance in coalition heterogeneity, certain configurations of ownership are conspicuously missing. For example, none of the JVs in the data contained a coalition of all JV owners or a coalition of government, JV owners, and private owners without public ownership. Further, some of the existing configurations are more highly represented in certain industries than others, and each type of owner does not necessarily participate in each industry. It remains possible that certain types of industries share characteristics that could partially explain variations in pollution mitigation or that different types of owners behave differently in different industries.

3.7.2 Implications for Theory and Practice

While the findings are provocative, this study is merely a first step towards uncovering how ownership coalitions shape environmental outcomes. The results may not fully generalize to less regulated contexts or to other aspects of environmental performance dissociated with human health. This study simply highlights that ownership coalitions matter, and it opens exciting new opportunities for future studies to identify which configurations matter most, when, where, why, and to what extent.

On average, co-owned facilities address a much larger percentage of their non-cancerous externalities through pollution mitigation compared to cancerous externalities. On the surface, this appears to suggest that, overall, co-owned facilities do not put a lot of effort into reducing cancerous externalities. However, the empirical context of this study does not indicate the level of effort required to mitigate harm. Many cancerous substances, such as hexachlorodibenzofuran, are highly toxic and do not require substantial exposure to produce acute effects. It remains possible that organizations must work harder and/or must spend more resources to address cancerous substances while, as a percentage of total hazards, the gains appear small. More research at the individual chemical level of analysis would help to determine the effort required for and the benefit gained from addressing each hazard.

Additional research at lower levels of analysis is also required to determine the exact mechanisms by which ownership dispersion and coalition heterogeneity influence the moral-duty/profit maximization tendency and whether, how, when, and why observed tendencies change over time. While it is easy enough to examine organizational behaviour, archival data alone cannot definitively determine why this behaviour occurs. Identifying the source of the tendency, how it reifies, and how it manifests will provide valuable information into how it can be changed for the common good.

This study clearly shows that co-owners can both help and hinder the mitigation of hazardous externalities, and it helps to elucidate the theoretical premise and the practical significance of choosing specific ownership configurations within JVs. Aside from the influence of government ownership, potential JV participants likely remain unaware of the environmental consequences of their organizing decisions. Building awareness of the environmental implications of organizing could go a long way towards mitigating harm. Firms should not only ask “How do we organize to build economic value?” but also “How do we organize in the face of perceivable harm?”

3.8 CONCLUSION

This study contributes to former studies of ownership and environmental performance by showing how and theorizing why ownership coalitions influence pollution mitigation. I demonstrate how the number of partners within a coalition, their equity stakes, and their similarities and differences influence the extent to which organizations exhibit moral duty or profit maximization tendencies. I find that ownership dispersion contributes to the mitigation of non-cancerous hazards, thus contributing to a moral-duty tendency. However, coalition heterogeneity polarizes pollution mitigation based upon contestable harm, undermining pollution mitigation for non-cancerous yet hazardous byproducts and encouraging pollution mitigation for cancerous substances. Overall, this study provides strong evidence that the characteristics of a JV’s ownership coalition and the characteristics of the coalition’s members influence the extent to which JV facilities protect society from definitive and contestable harm.

Chapter 4:
CONCLUSION

This thesis brings to the fore the important but so far overlooked role co-ownership plays in environmental performance. Public concerns over environmental degradation have increasingly pressured firms and governments to address the imbalance between industry and the natural environment, but firms significantly and substantially differ in how well they respond to such public concerns and government policy.

Scholars have established that firms exhibit unique sensitivities to the costs and incentives of environmental performance (Berrone *et al*., 2010; Darnall & Edwards, 2006; Margolis, Elfenbein, & Walsh, 2007), but very little is known about if and how firms' individual preferences manifest in their co-owned subsidiary operations. My preliminary thesis posits that joint-venture (JV) organizations struggle to pursue environmental performance because co-ownership confounds the alignment of social initiatives with each owner's objectives, given co-owners' unique stakeholders (Darnall, Potoski, & Prakash, 2010; Darnall, Henriquez, & Sadorsky, 2009), preferences (Berrone *et al*., 2010; Schulze *et al*., 2001), and expected returns from these activities (Margolis *et al*., 2007; Branzei *et al*., 2004). I further argue that ambiguous societal expectations and harm exacerbate these alignment difficulties.

The primary contribution of this dissertation is demonstrating that JVs, in general, and specific aspects of co-ownership, more specifically, carry systematic yet predictable biases that influence environmental performance. In Chapter 2, I argue that co-ownership creates a multiplicity of goals and tools that make environmental issues harder to handle and costlier to manage. I find that co-ownership systematically increases hazardous emissions of non-cancerous substances and that societal pressure in the form of more stringent legal liability appears ineffective in regulating this bias. However, social consensus around the accepted harm of cancerous substances (Berman & Wandersman, 1990; Stahly, 1989) appears to encourage JV facilities to be equally mindful in reducing cancerous emissions.

By focusing on why the simplest aspect of co-ownership (i.e., multiple versus single owners) matters, I contribute to the sustainability literature by highlighting how added complexity creeps in to confound already-challenging decisions. Co-owned facilities face a myriad of decision points that must be negotiated, including how to invest, where to invest, and how much to invest in environmental gains. When environmental outcomes hinge on multiple partners' ability to identify the intersection of everyone's strategic interests and to develop a path forward for environmental performance attainment, prioritizing socially-beneficial, yet economically ambiguous, investments is much harder than in situations where one corporation can unilaterally make decisions. I find robust evidence that environmental outcomes in JV facilities are sub-optimal due to predictable challenges in aligning the various mix of incentives for environmental performance into a unified strategy that is acceptable for and actionable by all parties involved.

This chapter also isolates some conditions that aggravate the JV bias. For example, ambiguous environmental categories make it much harder to agree, while unambiguous categories smooth the path toward identifying common ground to address hazardous byproducts. It also shows that neither social expectations nor regulations constitute effective antidotes for the co-ownership bias. Disproportionate liability regimes do not constrain JV facilities' emissions.

However, a silver lining emerges when we delve more deeply into the differences between JVs; the problems arising from co-ownership can also be addressed through co-ownership.

In Chapter 3, I explore multiple aspects of co-ownership and show how the characteristics of the ownership coalition influence the actions facilities take to mitigate harm. I argue that three specific characteristics shift the extent to which JVs exhibit moral duty or profit maximization tendencies that polarize the accounts of when, why, and to what extent firms mitigate hazardous externalities (Margolis *et al*., 2007; van de Ven & Jeurissen, 2005; Scalise, 2005; Cox & Hazen, 2003). First, I find robust evidence that JVs with more ownership dispersion (i.e., more owners with more balanced equity shares) gravitate toward moral duty tendency. JVs employ more pollution mitigation (i.e., recycling and treatment of hazardous byproducts prior to disposal) as ownership dispersion increases, and they remain equally mindful of mitigating cancerous byproducts regardless of ownership dispersion. Second, I find evidence that who participates in the coalition matters. Government ownership pushes JVs toward a moral duty tendency; facilities increasingly mitigate cancerous and non-cancerous byproducts as government ownership increases. Finally, I find robust evidence that heterogeneity within the coalition undermines pollution mitigation for non-cancerous substances and encourages pollution mitigation for cancerous substances.

Chapter 3 identifies coordination difficulties as the mechanism by which the JV coalition's characteristics influence environmental outcomes. Broader and balanced configurations build momentum towards working together to mitigate harm, but such enthusiasm must be tempered by arguments that co-ordinating understanding and action across complex issues is neither easy nor automatic. Greater diversity among partners creates challenges for pulling everyone in the right direction and increases the odds of slipping by, cutting corners, or doing less when appropriate action and perceived harm remains contestable. When faced with ambiguity and conflicting opinions, JVs gravitate toward profit-maximization, which at least supports the financial interests of JV partners. However, in cases of less contestable harm, JVs go above and beyond to safely address cancerous byproducts.

Overall, the empirical results in this thesis paint a picture of predictable, yet preventable, harm from hazardous byproducts. Co-ownership can be a great force for good, and there is increasing evidence that many parties can pool different resources and capabilities and overcome previously intractable problems (Branzei & Le Ber, 2013). Facilities consistently can and do behave similarly when it comes to cancerous byproducts, but they take considerable license when harm is ambiguous and/or contestable. Notably, the results suggest that awareness and agency inform organizational action. This finding resonates with a moral licensing argument in which firms do right sometimes only to do wrong at other times (Merritt, Effron, & Monin, 2010; Zhong, Liljenquist, & Cain, 2009), but the current studies do not directly address this angle. Longitudinal trajectories and repeated adjustments would be necessary before such presumptions could be extended from organizations to decision-makers.

4.1 Contributions

This thesis contributes to theory by drawing attention to the levers and mechanisms that confound organizations' ability to address their hazardous byproducts. There has been increased attention to the subjects of corporate wrongdoing, (Palmer, 2012; Bazerman & Tenbrunsel, 2011; Frooman, 1997), why decision-makers fall short (i.e. strategic choice) (Merritt, Effron, & Monin, 2010; Zhong, Liljenquist, & Cain, 2009), and why stakeholders often fail to encourage actions that matter (Kock, Santaló, & Diestre, 2012; Darnall, Henriquez, & Sadorsky, 2009; Kassinis & Vafeas, 2006; Alge, Mitchell, & Sonnenfeld, 1999). I provide a socio-structural account of why some firms outperform others in addressing their hazardous byproducts. It is simply harder to collectively organize the divergent interests of multiple partners, and heterogeneous coalitions aggravate interest-alignment difficulties. Working with multiple co-owners provides more opportunities for doing harm but also for apt correction.

Strategy scholars have spent considerable effort in attempting to entice firms into action by theorizing and testing how environmental performance "pays." Co-ownership provides a new vantage point for incentives. Rather than taking incentives for granted, strategists must remember that different firms have different incentives for pursuing environmental performance (van de Ven & Jeurissen, 2005). One size does not fit all. What appeals to one, does not necessarily appeal to another. In cases of co-ownership, it is important to look at the mix of incentives brought to bear within the joint-venture and ask not only "When does it pay?" and "How does it pay?" but also "To whom does it pay?" and "Why does it payoff for some more than others?"

This thesis also reveals that decision-makers recognize a moral duty to address their hazardous byproducts; co-owned facilities can and do protect the public from harm when it perceivably counts the most (i.e., cancerous byproducts). Attentiveness to the recycling and treatment of non-cancerous byproducts substantially improves with increasingly dispersed owners, who are less likely to face public censure for poor environmental outcomes (Teigen & Brun, 2011; Gailey & Lee, 2005; Sanders & Hamilton, 1997; Shaver, 1996; Fösterling, 1988). In cases of indisputable or less contestable hazard, heterogeneous coalitions, who face greater challenges in aligning their interests (Hoffman, 2011a, 2011b; Zietsma & Lawrence, 2010; Thornton & Ocasio, 1999), encourage far more recycling and treatment of cancerous waste.

These findings highlight that addressing hazardous byproducts is not simply a matter of corporate right-doing and wrongdoing but, rather, a series of decisions embedded within a socio-structural context (Hardy & Maguire, 2010; Maguire & Hardy, 2009) that really matters. Categories of harm and perceptions of harm influence the extent to which decision-makers overcome alignment difficulties to protect from harm. Making categories more relevant or requiring facilities to report emissions in human terms, such as disability life-adjusted years, could motivate more owners to act as one. Perhaps the simplest intervention lies in communicating with decision-makers that *how* partners organize and *with whom* partners organize has unintended societal consequences. Many facilities may be unaware that co-ownership holds them back, and appreciating the dangers and possibilities that stem from co-ownership may motivate some decision-makers to extend their mindfulness from cancerous chemicals to more ambiguous hazards.

In conclusion, this thesis answers three important questions – whether, how, and to what extent co-ownership influences one aspect of environmental performance. However, the most important contribution derives from opening a conversation that links ownership to foreseeable harm. While many lawyers may fear such connections, the patterns raise important warning signs about how facilities deal with hazardous byproducts. Firms can and do mitigate such harm, but co-ownership creates additional challenges and opportunities for addressing hazardous byproducts. This dissertation identifies some of the mechanisms hindering joint-ventures' efforts in the hopes that successful prescriptions can be developed to assist co-owners reduce disproportionate harm.

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Appendix A:

List of Chemicals Examined in the Analysis

Chemical	CAS Number
4,6-Dinitro-2-sec-butylphenol	88-85-7
Abamectin	71751-41-2
Acenaphthene - PAH	83-32-9
Acetaldehyde	75-07-0
Acetamide	60-35-5
Acetic acid (2,4-dichlorophenoxy):2,4-D-	94-75-7
Acetonitrile	75-05-8
Acetophenone	98-86-2
Acrolein	107-02-8
Acrylamide	79-06-1
Acrylic acid (and its salts)	79-10-7
Acrylonitrile	107-13-1
Aldicarb	116-06-3
Aldrin	309-00-2
Allyl alcohol	107-18-6
Allyl chloride	107-05-1
Aluminum (fume or dust)	7429-90-5
Aminobiphenyl:4-	92-67-1
Ammonia z	7664-41-7
Anilazine	101-05-3
Aniline (and its salts)	62-53-3
Anisidine:o-	90-04-0
Anthracene	120-12-7
Antimony	7440-36-0
Aroclor 1016, 1X5ML, Transformer Oil 50M G/KG	12674-11-2
Aroclor 1254, 1X1ML, ISO, 1000UG/ML	11097-69-1
Arsenic	7440-38-2
Atrazine	1912-24-9
Azinphos-Methyl	86-50-0
Barium	7440-39-3
Benomyl	17804-35-2
Bentazone	25057-89-0
Benzene	71-43-2
Benzene, 1-methyl-2-nitro-	88-72-2
Benzidine	92-87-5
Benzo(a)anthracene - PAH	56-55-3

Chemical	CAS Number
Benzo(a)phenanthrene - PAH	218-01-9
Benzo(a)pyrene - PAH	50-32-8
Benzo(b)fluoranthene - PAH	205-99-2
Benzo(k)fluoranthene - PAH	207-08-9
Benzoic acid	65-85-0
Benzotrichloride	98-07-7
Benzyl chloride	100-44-7
Beryllium (and its compounds)	7440-41-7
Beta-HCH	319-85-7
Bifenthrin	82657-04-3
Biphenyl	92-52-4
Bis (2-chloroethyl) ether	111-44-4
Bis(2-ethylhexyl) phthalate	117-81-7
Bis(tributyltin) oxide	56-35-9
Bisphenol A	80-05-7
Bladex	21725-46-2
Bromoform	75-25-2
Bromomethane	74-83-9
Bromoxynil	1689-84-5
Butadiene:1,3-	106-99-0
Butyl alcohol:i-	78-83-1
Butyl alcohol:n-	71-36-3
Butyl alcohol:sec-	78-92-2
Butyl alcohol:tert-	75-65-0
Butyl benzyl phthalate	85-68-7
Cadmium	7440-43-9
Captan	133-06-2
Carbaryl	63-25-2
Carbazole	86-74-8
Carbendazim	10605-21-7
Carbofuran	1563-66-2
Carbon disulphide	75-15-0
Carbon tetrachloride	56-23-5
Catechol	120-80-9
CFC-11	75-69-4
CFC -113 Trichlorotrifluoroethane	76-13-1
CFC-12	75-71-8
Chlordane	57-74-9

Chemical	CAS Number
Chlorfenvinfos	470-90-6
Chloro-4-nitrobenzene:1-	100-00-5
Chloroacetic acid (and its salts)	79-11-8
Chloroaniline:4	106-47-8
Chlorobenzene	108-90-7
Chlorobutadine:2-1,3	126-99-8
Chlorobutane:1	109-69-3
Chlorodibromomethane	124-48-1
Chloroethane	75-00-3
Chloroform	67-66-3
Chloromethane	74-87-3
Chloromethyl methyl ether	107-30-2
Chlorophenol:2-	95-57-8
Chlorophos	52-68-6
Chloropropane:2-	75-29-6
Chlorothalonil	1897-45-6
Chlorotriphenyltin	639-58-7
Chlorpropham	101-21-3
Chlorpyrifos	2921-88-2
Chromium	7440-47-3
CIS-Heptachlorepoxide EXO-, Isomer B	1024-57-3
Cobalt	7440-48-4
Copper	7440-50-8
Coumaphos	56-72-4
Cresol (and its salts):m-	108-39-4
Cresol (and its salts):o-	95-48-7
Cresol (and its salts):p-	106-44-5
Crotonaldehyde	4170-30-3
Cumene	98-82-8
Cyclohexane	110-82-7
Cyclohexanone	108-94-1
Cyclohexen-1-one, 3,5,5-trimethyl-:2-	78-59-1
Cymperator	52315-07-8
Cyromazine	66215-27-8
DDD:P,P'	72-54-8
DDE:4,4'	72-55-9
DDT:4,4'	50-29-3
Deltamethrin	52918-63-5
Demeton	8065-48-3
Demeton-S-Methyl Sulfoxide	301-12-2
Diaminotoluene (and its salts):2,4-	95-80-7

Chemical	CAS Number
Diazinon	333-41-5
Dibenzo(a,h)anthracene - PAH	53-70-3
Dibromoethane:1,2-	106-93-4
Dibromomethane	74-95-3
Dibutyl phthalate	84-74-2
Dicamba	1918-00-9
Dichlorobenzene Mixture	25321-22-6
Dichlorobenzene:1,3	541-73-1
Dichlorobenzene:o-	95-50-1
Dichlorobenzene:p-	106-46-7
Dichlorobenzidine:3,3-	91-94-1
Dichlorobromomethane	75-27-4
Dichloroethane:1,2-	107-06-2
Dichloroethylene:1,2-	540-59-0
Dichloroethylene-cis:1,2-	156-59-2
Dichloroethylene-trans:1,2-	156-60-5
Dichloromethane	75-09-2
Dichlorophenol (and its salts):2,4-	120-83-2
Dichlorophenoxybutyric acid:2,4	94-82-6
Dichloropropane:1,2-	78-87-5
Dichloropropene:1,3-	10061-01-5
Dichloropropene:1,3-	542-75-6
Dichloropropene:trans 1,3-	10061-02-6
Dichlorprop	120-36-5
Dichlorvos	62-73-7
Dicofol	115-32-2
Dieldrin	60-57-1
Diethanolamine (and its salts)	111-42-2
Diethyl phthalate	84-66-2
Diethyl sulphate	64-67-5
Dimethoate	60-51-5
Dimethyl phthalate	131-11-3
Dimethyl sulphate	77-78-1
Dimethylamine	124-40-3
Dimethylaniline (and its salts):N,N-	121-69-7
Dimethylhydrazine:1,2-	57-14-7
Dimethylphenol:1,6-	576-26-1
Dimethylphenol:2,4	105-67-9
Dinitrobenzene:1,2-	528-29-0
Dinitrobenzene:1,3-	99-65-0
Dinitrobenzene:1,4	100-25-4
Dinitro-o-cresol (and its salts):4,6-	534-52-1

Chemical	CAS Number
Dinitrophenol:2,4-	51-28-5
Dinitropropane:1,3-	6-1-25
Dinitrotoluene:2,4-	121-14-2
Dinitrotoluene:2,6-	606-20-2
Di-n-octyl phthalate	117-84-0
Dioxane:1,4-	123-91-1
Diphenylamine	122-39-4
Diphenylhydrazine (Hydrazobenzene):1,2-	122-66-7
Disulfoton	298-04-4
Endrin	72-20-8
Epichlorohydrin	106-89-8
Eradicane	759-94-4
Ethoprophos	13194-48-4
Ethoxyethanol:2-	110-80-5
Ethyl acrylate	140-88-5
Ethyl ether	60-29-7
Ethyl methacrylate	97-63-2
Ethylbenzene	100-41-4
Ethylene glycol	107-21-1
Ethylene oxide	75-21-8
Ethylene thiourea	96-45-7
Ethyleneimine	151-56-4
Fenitrothion	122-14-5
Fenthion	55-38-9
Fentin acetate	900-95-8
Fluoranthene - PAH	206-44-0
Fluorene - PAH	86-73-7
Folpet	133-07-3
Formaldehyde	50-00-0
Formic acid	64-18-6
Furan	110-00-9
Glyphosate	1071-83-6
HCFC-142b	75-68-3
HCFC-22	75-45-6
Heptachlor	76-44-8
Heptachlorodibenzofuran:1,2,3,4,6,7,8-	67562-39-4
Hexachlorobenzene	118-74-1
Hexachlorocyclohexane	319-84-6
Hexachlorocyclohexane (Lindane):gamma-	58-89-9
Hexachlorocyclopentadiene	77-47-4
Hexachlorodibenzofuran:1,2,3,4,7,8-	70648-26-9

Chemical	CAS Number
Hexachloroethane	67-72-1
Hexane:n-	110-54-3
Hydrazine (and its salts)	302-01-2
Hydrochloric acid	7647-01-0
Hydrogen cyanide	74-90-8
Hydrogen sulphide	7783-06-4
Hydroquinone (and its salts)	123-31-9
Indeno(1,2,3-c,d)pyrene - PAH	193-39-5
Iprodione	36734-19-7
Isopropyl alcohol	67-63-0
Lead	7439-92-1
Linuron	330-55-2
Malathion	121-75-5
Maleic anhydride	108-31-6
Manganese	7439-96-5
Mecoprop	7085-19-0
Mercury	7439-97-6
Methacrylonitrile	126-98-7
Methanol	67-56-1
Methomyl	16752-77-5
Methoxychlor	72-43-5
Methoxyethanol:2-	109-86-4
Methyl acetate	79-20-9
Methyl acrylate	96-33-3
Methyl ethyl ketone	78-93-3
Methyl iodide	74-88-4
Methyl isobutyl ketone	108-10-1
Methyl mercury	22967-92-6
Methyl methacrylate	80-62-6
Methyl tert-butyl ether	1634-04-4
Methylchlorophenoxyacetic acid:2 -4-	94-74-6
Methylenedianiline:p,p'-	101-77-9
Methylhydrazine	60-34-4
Metolachlor	51218-45-2
Metribuzin	21087-64-9
Mevinphos	7786-34-7
Molybdenum	7439-98-7
Naphthalene	91-20-3
Naphthylamine-beta	91-59-8
Nickel	7440-02-0
Nitroaniline:2	88-74-4
Nitrobenzene	98-95-3

Chemical	CAS Number
Nitrogen Dioxide	10102-44-0
Nitroglycerin	55-63-0
Nitrophenol (and its salts):p-	100-02-7
Nitropropane:2-	79-46-9
Nitrosodiphenylamine:N-	86-30-6
Nitrotoluene:3	99-08-1
Orthene	30560-19-1
Oxamyl	23135-22-0
Oxybis(1-chloropropane):2-	108-60-1
Parathion	56-38-2
Parathion-methyl	298-00-0
Pentachlorobenzene	608-93-5
Pentachlorodibenzofuran:2,3,4,7,8-	57117-31-4
Pentachloronitrobenzene	82-68-8
Pentachlorophenol (PCP)	87-86-5
Permethrin	52645-53-1
Phenol (and its salts)	108-95-2
Phenylenediamine (and its salts):p-	106-50-3
Phenylenediamine:m-	108-45-2
Phenylphenol (and its salts):o-	90-43-7
Phosgene	75-44-5
Phoxim	14816-18-3
Phthalic anhydride	85-44-9
Picric Acid	88-89-1
Pirimicarb	23103-98-2
Propachlor	1918-16-7
Propoxur	114-26-1
Propylene	115-07-1
Propylene oxide	75-56-9
Propyzamide	23950-58-5
Pyrazophos	13457-18-6
Pyrene - PAH	129-00-0
Pyridine (and its salts)	110-86-1
Quinoline (and its salts)	91-22-5
Safrole	94-59-7
Selenium	7782-49-2
Silver	7440-22-4
Simazine	122-34-9
Styrene	100-42-5
Styrene oxide	96-09-3
Sulphur dioxide	7446-09-5
Tetrachlorobenzene:1,2,4,5	95-94-3

Chemical	CAS Number
Tetrachlorodibenzofuran (TEQ):2,3,7,8-	51207-31-9
Tetrachlorodibenzo-p-dioxin (TEQ):2,3,7,8-	1746-01-6
Tetrachloroethane:1,1,1,2-	630-20-6
Tetrachloroethane:1,1,2,2-	79-34-5
Tetrachloroethylene	127-18-4
Tetrachlorophenol:2,3,4,6-	58-90-2
Tetramethylthiuram disulphide	137-26-8
Thallium	7440-28-0
Thiophenol	108-98-5
Thiosulfan	115-29-7
Thiourea	62-56-6
Tin (and its compounds)	7440-31-5
Tolclofos-methyl	57018-04-9
Toluene	108-88-3
Toluidine:o-	95-53-4
Toluidine:p-	106-49-0
Toxaphene	8001-35-2
Triallate	2303-17-5
Triazophos	24017-47-8
Tributylphosphorotrithioate:1,2,4-	78-48-8
Trichlorobenzene:1,2,4-	120-82-1
Trichloroethane/methyl chloroform:1,1,1-	71-55-6
Trichloroethane:1,1,2-	79-00-5
Trichloroethylene	79-01-6
Trichlorophenol:2,4,5-	95-95-4
Trichlorophenol:2,4,6-	88-06-2
Trichlorophenoxyacetic acid:2,4,5-	93-76-5
Trichloropropane:1,2,3-	96-18-4
Triethylamine	121-44-8
Trifluralin	1582-09-8
Trimethylbenzene:1,2,4-	95-63-6
Trinitrotouene:2,4,6	118-96-7
Urea, N'-(3,4-dichlorophenyl)-N,N-dimethyl-	330-54-1
Vanadium (except when in an alloy) and its compounds	7440-62-2
Vinyl acetate	108-05-4
Vinyl bromide	593-60-2
Vinyl chloride	75-01-4
Vinylidene chloride	75-35-4
Xylene (all isomers)	1330-20-7

Chemical	CAS Number
Xylene:m-	108-38-3
Xylene:o-	95-47-6
Xylene:p-	106-42-3
Zinc (fume or dust)	7440-66-6
Zineb	12122-67-7
zzAcetone - [MOE]	67-64-1
zzDichloroethane:1,1- - [MOE]	75-34-3
zzEthyl acetate - [MOE]	141-78-6
zzHexachloro-1,3-butadiene - [MOE]	87-68-3

Appendix B:

List of Industries Examined in the Analysis

US SIC	CAN SIC	Industry
101	0617	Iron ores
102	0612	Copper ores
104	0611	Gold and silver ores
106	0613	Ferroalloy ores, excluding Vanadium
131	0711	Crude petroleum and natural gas
149	0629	Miscellaneous nonmetallic minerals
229	1999	Miscellaneous textile goods
242	2512	Sawmills and planing mills
249	2592	Miscellaneous wood products
261	2711	Pulp mills
262	2719	Mills, excluding building paper
281	3721	Industrial inorganic compounds
282	3731	Plastics materials and synthetics
284	3761	Soaps, cleaners, and toilet goods
286	3712	Industrial organic chemicals
287	3721	Agricultural chemicals
289	3799	Miscellaneous chemical products
291	3611	Petroleum refining
308	1699	Miscellaneous plastics products, not elsewhere classified
323	3562	Products of purchased glass
324	3521	Cement, hydraulic
331	2919	Blast furnace and basic steel products
334	3922	Secondary nonferrous metals
335	2961	Nonferrous rolling and drawing
341	3042	Metal cans and shipping containers
344	3049	Fabricated structural metal products
346	3049	Metal forgings and stampings
347	3041	Metal services, not elsewhere classified
349	3099	Miscellaneous fabricated metal products
351	3251	Engines and turbines
353	3192	Construction and related machinery
364	3333	Electric lighting and wiring equipment
371	3251	Motor vehicles and equipment
399	3999	Miscellaneous manufacturing
491	4911	Electric services
495	4999	Sanitary services
501	5529	Motor vehicles, parts and equipment

Appendix C:

Reflexivity Statement

While this dissertation is quantitative by nature, it remains possible that my prior experiences and beliefs shaped not only the research itself, but also my interpretations of the analysis. Therefore, I am providing a reflexivity statement to allow the reader to consider the ways in which my involvement in the research may have acted upon and informed these studies (Nightingale & Cromby, 1999).

I am a middle aged white male raised in the south central United States. Prior to pursuing a PhD, I earned a bachelor of business administration in management and marketing and a master of business administration from two conservative universities. I spent nearly ten years working in the international banking software industry and my former career provided opportunities to work and live in the U.K., Germany, Switzerland, Mexico, and Panama as well as numerous cities in the United States and Canada.

My impetus for returning to university to pursue a PhD in business administration was reading Jarrod Diamond's book, *Collapse.* While I have always enjoyed nature, neither I nor anyone close to me has been directly impacted by environmental degradation or chemicals in the environment. *Collapse* simply encouraged me to more thoughtfully consider how businesses impact the natural environment, if society would be able to interpret the warning signs of an ailing environment, and if and how businesses could respond to prevent irrevocable harm. I specifically decided to pursue my studies within the school of business, because I wanted to focus on business solutions to environmental externalities.

I believe that managers collectively aspire to minimize their businesses' environmental impacts but primarily focus on economic considerations when making business decisions. I believe that the vast majority of firms abide by society's expectations defined within laws and regulations but that managers struggle to adopt socially desired change in the absence of strategic incentives, economic enticement, or uniform standards. I believe that sustainability research has the greatest opportunity to bring about timely and meaningful change when it provides an open, honest, and balanced dialogue about the challenges and opportunities that society and organizations face together.

Appendix D:

Ethics Approval for Preliminary Interviews

IVEY

Richard Ivey School of Business
The University of Western Ontario

Richard Ivey School of Business
The University of Western Ontario
1151 Richmond Street North
London, ON N6A 3K7
[redacted]
www.ivey.uwo.ca

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Adam Fremeth
Re PhD Candidate: Ryan Raffety
Review Number: 010/12 BREB
Protocol Title: Study - Gathering Executives' Input on How Property Rights Contribute to Environmental Performance Differentials
Ethics Approval Date: April 25, 2012 **Expiry Date: April 25, 2013**
Documents Reviewed and Approved: Ethics Protocol, Letter of Information and Consent Form

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This is to notify you that The Ivey School of Business Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the study or consent form may be initiated without prior written approval from the NMREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the NMREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the NMREB.

Signature: [redacted]
Roderick White
Associate Dean - Faculty Development & Research

This is an official document. Please retain the original in your files.

R. Ryan Raffety

EDUCATION

2009 - **Doctoral Candidate in Strategy & Sustainability**
Ivey Business School
Western University, London, Ontario

2007 - 2009 **Doctoral Student in Strategy** (transfer to Western)
Whitman School of Management
Syracuse University, Syracuse, New York

1997 **Masters of Business Administration** (Graduate with distinction)
Spears School of Business
Oklahoma State University, Stillwater, Oklahoma

1994 **Bachelor of Business Administration** (Management & Marketing)
Hankamer School of Business
Baylor University, Waco, Texas

REFEREED CONFERENCE PRESENTATIONS

Raffety, R, & Branzei, O. "*JV ownership coalitions and environmental performance,"* Presentation at the Annual Meeting of the Strategic Management Society, Atlanta, Georgia, October 2013. Nominated for the Best Paper Award.

Raffety, R, & Branzei, O. "*JV ownership coalitions and environmental performance,"* Presentation at the Annual Meeting of the Academy of Management (AOM), Orlando, Florida, August 2013.

Raffety, R, & Branzei, O. *"What you don't know can hurt you: Property rights, social contracts, and public health,"* Presentation to the Alliance on Research on Corporate Sustainability (ARCS) annual conference, Berkeley, California, April 2013.

Raffety, R, Fremeth, A, & Branzei, O. "*The environmental consequences of shared ownership,*" Invitation and presentation to the PhD Sustainability Academy, London, Ontario, October 2012. Runner up for the Best Paper Award.

Raffety, R, Fremeth, A, & Branzei, O. "*The environmental consequences of shared ownership,*" Presentation at the Annual Meeting of the Academy of management (AOM), Boston, Massachusetts, August 2012.

Raffety, R, Fremeth, A, & Branzei, O. "*The environmental consequences of shared ownership,*" Presentation at the Alliance on Research on Corporate Sustainability (ARCS) annual conference, New Haven, Connecticut, May 2012.

Raffety, R. "*Bigger, Better, Faster, More: The effects of growth on environmental performance,*" Presentation at the annual meeting of the Academy of Management (AOM), San Antonio, Texas, August 2011.

Raffety, R. & Bansal P. *"Red Blooded Aliens: A re-examination of foreign firms' corporate environmental performance,"* Presentation at the annual meeting of the Academy of Management (AOM), Montreal, Quebec, August 2010.

Raffety, R. & Bansal P. *"Bosom Buddies or Estranged Lovers: The environmental performance of foreign multinationals,"* Presentation at the Group on Organizations and the Natural environment (GRONEN) conference, Milan, Italy, June 2010.

Raffety, R. & Bansal P. *"Red Blooded Aliens: A re-examination of foreign firms' corporate environmental performance,"* Presentation at the Alliance on Research on Corporate Sustainability (ARCS) annual conference, Boston, Massachusetts, May 2010;

PROFESSIONAL PUBLICATIONS

Raffety, R. *"Get More from your Environmental Management System,"* Network for Business Sustainability, August 2011.

INVITED CONFERENCE PRESENTATIONS

Raffety, R. *"The State of Ivey NPRI Research,"* Invited Presentation to Environment Canada's National Pollution Release Inventory (NPRI) Multi-stakeholder Workgroup, Ottawa, Canada, November, 2010.

AWARDS & RECOGNITIONS

- Centre for Building Sustainable Value Research Award (2013)
- ERA/Ivey Doctoral Fellowship (2012 – 2013)
- Brock Scholarship (2009 – 2013)
- Ivey Plan of Excellence (2009 - 2013)
- ARCS PhD Sustainability Academy (2012)
- Syracuse University Graduate Award (2007 – 2009)
- Oklahoma State University Graduate Award (1995 – 1997)
- Beta Gamma Sigma (ΒΓΣ) – International Honor Society of Business
- Phi Kappa Phi (ΦΚΦ) – International Honor Society
- Sigma Iota Epsilon (ΣΙΕ) – National Business Management Honorarium

TEACHING

Periodic Annual	Ivey Business School *Guest Lecturer/Facilitator*, Corporations & Society (HBA core)
Fall 2008	Syracuse University *Instructor*, Introduction to Strategic Management (Management core) Student Evaluation: 4.5/5.0 Nominated for the 2007-2008 Whitman Outstanding Student Teacher Award

Primary Teaching Interests: Business Strategy & Sustainability

RESEARCH DEVELOPMENT

2013	Journal of Management Science Paper Development Workshop	Denver, CO
2012	Ivey Experimental Economics Conference	London, ON
2012	Summer Program in Data Analysis (SPIDA)	Toronto, ON
2012	Ivey Sustainability Conference	London, ON
2012	AOM ONE Doctoral Student Consortium	Boston, MA
2012	Multi-disciplinary Environmental Sustainability Workshops	London, ON
2011	Survivor Data Analysis Workshop	London, ON
2011	Social Sciences Data Analysis Workshop: Logit & Probit Models	London, ON
2011	Research Generativity & Productivity Workshop	London, ON
2010	Research Data Centre Longitudinal Data Analysis Workshop	London, ON
2008	AOM New Doctoral Student Consortium	Los Angeles, CA

SERVICE

2013 -	AACSB Assessment of Learning Committee, Simmons School of Managemnet
2013 -	Research Data & Technology Task Force, Simmons School of Management
2013 -	Academic Advisor (CSR), Simmons School of Management
2013	Reviewer, Strategic Management Society Conference
2012	New member mentor, Academy of Management Conference
2008 - 2012	Annual reviewer, Academy of Management Conference (BPS & ONE)
2010 - 2011	Vice President External, Ivey PhD Association
2010 - 2011	PhD Orientation Chair, Ivey PhD Association
2010	Judge, Network for Building Sustainable Value Sustainability in Business Award
2008	Sustainable Enterprise Partnership Conference, Syracuse NY
2008	Session Chair, Academy of Management (PNP)

PROFESSIONAL AFFILIATIONS

- Academy of Management
- Alliance for Research on Corporate Sustainability
- Strategic Management Society

PROFESSIONAL BACKGROUND

2001 - 2006 Outgoing position: *Regional Account Manager*
Incoming position: *Technical Consultant*
Temenos, USA Inc.
Select client list: Banco Santander International, Bank of China, Bank Leumi, Credit Lyonnais, Eastern Caribbean Central Bank, Fleet/First Boston, National Bank of Greece, RBTT

1997 - 2001 Outgoing position: *Systems Analyst / Consultant*
Incoming position: *Business Analyst / Consultant*
EDS - Globus Centre of Expertise
Select client list: Banco Santander International, Banque Edouard Constant, Dresdner Bank Lateinamerika, Temenos, Enron

CERTIFICATIONS

- Project Management Professional, Project Management Institute, since 2004
- Executive Certificate in Negotiation, University of Notre Dame Mendoza College of Business, 2006