Are Conglomerates Less Environmentally Responsible? An Empirical Examination of Diversification Strategy and Subsidiary Pollution in the U.S. Chemical Industry

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ABSTRACT. This study examines the relationship between corporate diversification strategy and the pollution activity of subsidiaries within the U.S. chemical industry using TRI data (EPA's Toxic Release Inventory). The subsidiaries of conglomerates were found to exhibit higher pollution levels for direct emissions than those of firms pursuing more related diversification strategies. Additionally, the subsidiaries of conglomerates exhibited more variance in overall pollution emissions compared to related diversified firms.

Over the last decade the impact of corporations on the natural environment has emerged as a highly visible issue. The obvious fact that business is a major part of the problem has gradually given way to a growing realization that business must play a more active role in devising sustainable solutions (Gore, 1992; Schmidheiny, 1992; Shrivastava, 1995). Rather than resisting this call to greater environmental responsibility, an impressive list of major corporations is leading this charge (e.g., 3M, McDonalds, IKEA). Not only are these firms acting individually for sustainability, but they are increasingly working together. In particular, firms in many industries have promoted and subscribed to various 'codes' (i.e., 'Responsible Care' in the chemical industry), and a number of global players have been actively involved in shaping the ISO 14000 series of environmental management standards. One of these standards, ISO 14001 on environmental management systems (EMS) has already been the basis for a growing number of certifications globally.

This change in attitude is attributable to a multitude of reinforcing causes. First, the true costs from environmental irresponsibility have become much clearer as a result of improved understanding of the social consequences of a host of interrelated global and regional problems (i.e., global warming, ozone depletion, deforestation, loss of biodiversity). Second, the extent of environmental regulations requires corporate compliance across a broad spectrum of business activities. In the United States, firms are now governed by over 15 000 pages of regulations, which imposes a significant burden on firms that is greatly exacerbated as firms compete globally. Third, the costs of required clean-up and related costs of protracted litigation are looming very heavily over the heads of corporations (EPA estimates that 1500 to 2500 hazardous waste sites will require cleaning up, and the companies

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generating the waste may be required to pay from 40–60% of the $6 000 000–$12 000 000 per site in clean-up costs – Buccholz, 1993). Fourth, recent surveys document the emergence of a 'green' consciousness which appears to be shaping consumer expectations (Holcomb, 1992). For example, a Roper (1990) survey cites that nearly three-quarters of the public now believes that business must be forced by government to develop environmentally safe products. Such changes provide not only greater opportunities for marketing environmentally friendly products, but also suggest that companies must pay greater heed to an array of increasingly vocal advocacy groups (Haines, 1989). Finally, a sufficient number of companies is discovering that environmental responsibility need not come at the expense of the bottom line. Although this awaits empirical confirmation, there are reports that a proactive environmental posture may be profitable by reducing costs, allowing premium pricing, lowering risks of litigation, and leading to the licensing of technologies (Monty, 1991). Such beliefs have been substantially bolstered by Porter's (1991, p. 1) observation of a positive correlation between environmental regulation and national GDP and his conclusion that:

> The resurgence of concern for the environment, then, should be viewed as an important step in regaining America's preeminence in environmental technology and its competitive edge in the international marketplace.

While it is clear that a wide range of issues related to corporate environmental performance demands both conceptual development and empirical examination, only recently have researchers begun to rise to the task (e.g., Aragon-Correa, 1998; Fowler and Dean, 1993; Shrivastava, 1995; Shrivastava and Hart, 1992). This paper adds to this growing research stream by examining a relationship of particular social interest given the frequently voiced concerns about the relatively greater short-term financial preoccupation exhibited by large conglomerate firms. Specifically, we propose to examine the relationship between corporate strategy and pollution emissions within the chemical industry. We are particularly interested in investigating two questions. First, do conglomerates (viz., firms diversifying into a wide range of industries and managing them mostly through financial controls) pollute more than other forms of corporate diversification? Second, do chemical facilities of conglomerates exhibit relatively greater variance in their pollution activity?

Background

Corporate environmental performance

One clear lesson learned from previous social issues research is that corporate social performance (CSP) is not uni-dimensional (Waddock and Graves, 1997; Wood, 1991). Indeed, one of major methodological criticisms of CSP research has been the extremely broad conceptualization of constructs in conjunction with narrow, single measure proxies (e.g., philanthropic donations, social disclosure, content analysis of annual reports). Fortunately, this gap is closing – most effectively by breaking CSP into more measurable components and, to a much lesser degree, through some progress on their measurement (e.g., the use of multiple measures and more in-depth qualitative evaluations).

Even though researchers are beginning to include corporate environmental performance (CEP) as a dimension of the broader CSP construct, similar concerns would seem applicable to any notion of CEP (Griffin and Mahon, 1997; Waddock and Graves, 1997). As such, two clarifications are necessary with respect to a CEP construct. First, we recognize that this term is overly broad and vulnerable to the same measurement problems previously alluded to. Clearly, there are multiple dimensions to this construct – corporations can comply with 'end of the pipe' regulations or be proactive through multiple avenues beyond regulation (e.g., anticipating future regulations, designing products for disassembly, seeking a green label, demanding environmental audits from suppliers). Thus, the reader should bear in mind that we are focusing on the amount of environmentally damaging industrial byproducts that are emitted into the environment. While we believe this is especially

relevant to corporate behavior related to the environment in the chemical industry, we also recognize that this is a constrained view of the broader construct. Second, the use of the word "environmental" is complicated by its residual usage in organization theory and strategic management literatures. In both these contexts it refers to virtually everything remaining after an organization is extracted from its context (i.e., all the political, economic, technological and social phenomena that may be organizationally relevant). Here we use the term "environment" in more of the lay sense to refer to the natural order and balance of earth's many ecosystems.

Diversification strategy

Firms that operate in multiple business areas are said to be diversified (Ansoff, 1984). Among larger corporations, diversification has become the rule rather than the exception, as firms seek a wide range of objectives associated with a broader scope of operations (e.g., reducing vulnerability, increasing growth and profitability, exploiting synergy). Within the domain of organizational research, the question of whether companies diversifying along related lines are better financial performers than conglomerates has been one of the primary preoccupations since Rumelt's (1974) seminal study (e.g. Bettis, 1981; Dubofsky and Varadarajan, 1987; Grant, Jammine and Thomas, 1986; Markides and Williamson, 1994). While these studies have extended our understanding of outcomes and processes associated with the relationships between diversification strategy and financial performance, other potentially relevant outcomes and processes including corporate social performance (CSP) issues are noticeably absent. Given the salience of these constructs and genuine concerns about the social consequences of mergers and acquisitions, it is interesting that so little effort has been expended to link diversification strategy to CSP. Perhaps ideological differences between strategy research, which primarily concerns itself with financial performance, and social issues research, which has paid relatively little attention to strategies, have postponed this examination.

Given its development in the strategy literature, the measurement of diversification strategy has been thoroughly examined. Measures of diversification have generally been classified as either continuous or categorical measures. The current wisdom suggests using categorical measures when one's objective is to determine differences between diversification strategies (i.e. between group differences); continuous measures, on the other hand, are better suited for studying differences among diversified firms (i.e. within group differences) (Pitts and Hopkins, 1982; Hoskisson, Hitt, Johnson and Moesel, 1993). Given our research question concerning differences in pollution levels between diversification strategies, we will limit our discussion to categorical measures.

Categorical measures generally differentiate between two broad forms of diversification: unrelated – firms with a presence in very disparate industries; and related – firms with a substantial presence in related industries. These dimensions were integrated by Varadarajan and Ramanujam (1987) into a 2 × 2 matrix that roughly corresponds to Rumelt's (1974) diversification strategy categories of dominant business, unrelated diversified, and related diversified, and Palepu's (1985) four broad diversification strategy categories of nondiversified, predominantly related diversified, predominantly unrelated diversified, and neither predominantly related nor predominantly unrelated diversified. Although we will mainly focus on the differences between unrelated and related diversification for the purpose of promulgating hypotheses, we will retain some of the other categorical distinctions for empirical purposes.

Diversification strategy and CEP

The key difference between these two dimensions of diversification is that firms with a narrow spectrum of diversification (i.e., related diversification) seek synergies among businesses that are similar along some dimension; broadly diversified firms (i.e., unrelated or conglomerate-type firms), on the other hand, rely on financial controls to track a loose collection of dissimilar

businesses (Jones and Hill, 1988; Porter, 1987; Teece, 1982; Williamson, 1975, 1985). As a result of actively managing to exploit synergies, narrowly diversified firms require a corporate headquarters that is more knowledgeable and involved in the operations of its various interdependent business units (Child, 1984; Hill, Hitt and Hoskisson, 1992; Mintzberg, 1983). These fundamentally different postures towards business units have important implications.

For one, reward structures in narrowly diversified firms are designed to reduce business unit autonomy and discourage independent actions by emphasizing mechanistic and standardized procedures (Gomez-Mejia, 1992; Gomez-Mejia and Balkin, 1992; Kerr, 1985). Kerr (1985, p. 174) suggests that reward structures characteristic of related diversified firms are designed to "impart consistency in the way managers perceive and respond to the firm's [macro] environment." As a result, the primary mechanisms used to control business units are the monitoring of behaviors, the use of complex rules and procedures, and the dissemination of the firm's culture (Galbraith, 1982; Govindarajan and Fisher, 1990; Ouchi, 1980; Rowe and Wright, 1997). Consequently, business unit decisions are influenced by criteria other than maximizing short-term financial performance. It is therefore not surprising that more narrowly diversified firms have been found to make more capital intensive investments and pursue strategies that seek to maximize long-term financial performance (Baysinger and Hoskisson, 1989; Hill and Snell, 1988; Hoskisson and Johnson, 1992; Keats and Hitt, 1988).

It is also important to note that narrowly diversified firms often strive for synergies in reputational capital across business units (Markides and Williamson, 1994). Thus, Proctor and Gamble's broad line of consumer products benefits from the firms' reputation for quality goods. Reputational capital can also be created or destroyed based on environmental performance. For example, all Weyerhauser products benefit from their repuation for progressive forestry management while Champion Paper has created a significant negative reputational "halo" from media coverage related to its pollution of the Pigeon River from its Canton, N.C. plant in the United States.

In contrast, broadly diversified firms manage business units as a portfolio of investments rather than as an active participant in business unit operations (Leontidas, 1980). As a consequence, business units are necessarily more autonomous in their decision making, being controlled by financial methods (Gomez-Mejia, 1992; Kerr, 1985). This reliance on financial controls proportedly translates into more risk averse behavior, less capital intensive investments and the pursuit of strategies that maximize short-term financial performance (Baysinger and Hoskisson, 1989, 1990; Eisenhardt, 1989; Hoskisson and Johnson, 1992; Hill and Snell, 1988; Keats and Hitt, 1988). Altogether, this posture suggests that broad spectrum diversification results in less corporate direction in the form of policies, accepted norms of behavior, and incentives to maximize short-term profits at the expense of other less rewarding outcomes. Similarly, in contrast to narrowly diversified firms, broadly diversified firms do not usually seek reputational capital at the corporate level (Markides and Williamson, 1994).

The extension to corporate environmental performance (CEP) is straightforward. In response to strategic issues related to the natural environment, broadly diversified firms would allow more subsidiary and facility discretion, yet the salience of short-term financial controls would also tend to discourage investments in long-term capital projects designed to mitigate toxic discharges. Moreover, broadly diverisified firms seek to diversify risks associated with negative environmental outcomes and publicity. These short-term financial pressures along with the corporation possessing relatively low levels of knowledge about subsidiary operations would in turn have retarded the development of comprehensive environmental policies. This suggests the following hypotheses.

H1: Subsidiaries of broadly diversified firms will exhibit poorer environmental performance than subsidiaries of narrowly diversified firms.

H2: The variance in environmental performance among subsidiaries of broadly diversified firms will be greater than the variance among subsidiaries of narrowly diversified firms.

Methodology

Sample

The sample is comprised of 555 diversified parent companies operating 2952 facilities in the U.S. chemical industry in 1989. Each of these companies is annually required to report the volume of toxic substances discharged by each of its facilities to the EPA as part of its Toxic Release Inventory (TRI). We chose to focus on the chemical industry during this particular era for several reasons. First, this is the most important industry from a toxic emissions point of view accounting for 49% of the total emissions for all industries in the TRI database. In addition, the late 1980s was a point of maximum TRI discharges. Significant reductions in releases have occurred subsequent to this program of reporting. Second, within the TRI the chemical industry was the only industry in which there was a sufficient number of facilities owned by conglomerates in which to calculate and compare variances. (As conglomerates, by definition, have such a broad range of business activity, this was obviously a constraint.) Subsequent to this period, the popularity of unrelated diversification diminished such that the number of unrelated diversified firms dropped. Third, in order to test our hypotheses it is essential to control for industry (Logsdon, 1995). Without industry control, the greater diversity of conglomerates would lead to greater variance in toxic emissions simply because of industry variation. Moreover, as the volume of toxic substances released annually varies greatly by industry it would make little sense to compare releases if one's intention is to measure environmental performance. Obviously facilities in the chemical industry are not totally homogeneous, however when aggregated by the diversification strategy of the parent it may be permissible to assume away systematic differences. In sum, the combined need for industry control, high levels of releases, and sufficient numbers of unrelated parent companies largely shaped sample selection.

As this sample includes nearly all diversified firms operating within the chemical industry at the time, depending on one's target for purposes of generalization, this may be construed as constituting the population. On the other hand, since there are a number of facilities that do not pass the EPA threshold values for reporting on certain substances, we concluded that we fell somewhat short of being exhaustive. Consequently, we will report inferential statistics while recognizing a potential for more direct interpretation of parameter values.

Measures

Diversification strategy. This study employed the two-dimensional categorical measure of diversity developed by Varadarajan and Ramanujam (1987). The two dimensions are broad spectrum diversity (BSD) and mean narrow spectrum diversity (MNSD). BSD, which provides a measure of scope, is calculated as the number of two-digit SIC (Standard Industrial Classification) categories in which a firm concurrently operates. MNSD, on the other hand, is calculated as the number of four-digit SIC categories in which a firm operates divided by the number of two-digit SIC categories which it operates – MNSD thereby indicating the depth of involvement in a chosen industry set. The mean values of both BSD and MNSD are then used as cut points to classify low-high splits along each dimension. The SIC categories used in calculating diversification strategies were obtained from the TRI database.

SIC-based measures have two advantages over the categorical measures originally devised by Rumelt (1974), which are common in much of the strategy literature. First, SIC-based measures do not require data on individual business segment revenues. This lends itself to this study as the TRI data unfortunately lacks financial information, nor are facility revenues obtainable from other public sources. Second, SIC measures

avoid the subjectivity associated with classifying firms on the basis of Rumelt's (1974) categories, thereby obviating the task of confirming inter-rater reliability (Montgomery, 1982).

Table I gives the outcomes of this 2 × 2 categorization approach along with representative firms in each cell. As is evident, the cell counts in each cell are unequal, resulting from skewed distributions of both BSD and MNSD (i.e., some firms score very high on one of these scales while the bulk of the firms have low scores). However, having ruled out the undue influence of outliers and modified the estimated variances, unequal cell counts can be accommodated (Neter, Wasserman and Kutner, 1990). Although we are primarily interested in comparing the conglomerates (i.e. unrelated diversifiers) with related diversifiers, we will retain the other two categories for empirical examination.

Corporate environmental performance. The TRI data base is categorized into three types of emissions: 1) Toxic releases into public sewage systems; 2) Offsite transfers to other waste management companies; and 3) Direct release of toxic substances to either air, land, or water. While we initially considered examining all three types of emissions, further investigation into these types of emissions in the chemical industry led us to conclude that only direct releases spoke to this study. First, direct releases accounted for 74% of the total toxic emissions released by the chemical industry in 1989. Second, 85% of the toxic substances released by the chemical industry in 1989 were classified as either cyanide compounds or non-halogenated organics (i.e. carbon-containing compounds that do not contain halogens), both of which the primary form of release was direct to either land, air, or water. In contrast, the toxic substances most often released to either sewage or transferred offsite were metals or halo-organics, which comprised less than 6.5% of all releases by the chemical industry. Third, direct releases take into account reductions in toxicity achieved by treatment methods at the producing facility before release into the envi-

TABLE I
Diversification categories

	Low MNSD	High MNSD
High BSD	**Unrelated diversified** (Broad in 2-digit SICs and narrow in 4-digit SICs *Representative firms* Hanson Industries Essex Group Union Carbide Westinghouse Williams Holdings $N = 94$	**Exhaustively diversified** (Broad in both 2-digit and 4-digit SICs) *Representative firms* Allied Signal American Cynamid General Electric United Technologies DuPont $N = 112$
1.91 High/Low cut point		
Low BSD	**Dominant business** (Narrow in both 2-digit and 4-digit SICs) *Representative firms* Vulcan Materials Airgas Smith-Kline Beecham Rayovac Upjohn $N = 246$	**Related diversified** (Narrow in 2-digit SICs and broad in 4-digit SICs) *Representative firms* SCM Glidden Ashland Oil Milliken Conagra H.B. Fuller $N = 103$
	Low MNSD	1.59 High/Low cut point / High MNSD

ronment; releases to public sewage and offsite transfers, on the other hand, are treated by entities other than that submitting the report to TRI (EPA, 1991).

In order to compare the environmental performance of each corporation participating in the industry, it was necessary to contrive a method of creating a CEP measure of aggregated facility performance for each corporate participant in the industry. The approach taken was to calculate an expected emissions value by multiplying the number of facilities operated by each corporation by the average emissions in the industry (i.e., for SIC number 28). Then the actual aggregated emissions for those facilities owned by a particular corporation was compared to this expectation. Corporations whose emissions exceeded this expectation were, relatively speaking, poorer environmental performers. Because the unrelated and exhaustively diversified firms in our sample have more facilities on average than the dominant business and related diversified firms, this score was then adjusted for the number of facilities owned by each corporation and, as a result, is more reflective of the relative "cleanliness" of each facility.

Analyses

Our first hypothesis, which predicted that subsidiaries of conglomerate firms will exhibit poorer environmental performance, was tested using a conventional two-way analysis of variance. Tukey's post-hoc multiple comparison procedure was used to determine which diversification categories were significantly different (Neter et al., 1990).

The second hypothesis, which concerns the variances of emissions across facilities, was evaluated using Levene's test for equal variances. This was selected over the more commonly used Bartlett's *F*-test because it is reportedly more robust and much less sensitive to nonnormality in the data (Snedecor and Cochran, 1980). This particular test is essentially an ANOVA based on diversification strategy category where variances are derived using absolute values (viz., the difference between facility deviation from the average value for each company). Because there are multiple firms operating multiple facilities within each diversification category, a nested designed was indicated. While a two-way design would have been preferable (so as to have examined possible interactions), we were unable to utilize such an approach as the unbalanced nested design precludes this possibility (Neter et al., 1990). Consequently, the test of the second hypothesis employed a one-way analysis of variance followed by Tukey's multiple comparison procedure.

Results

As shown in Table II, the overall test of the first hypothesis was significant, with the BSD main effect exhibiting a significant and positive association with direct releases. While both the MNSD main effect and the interaction term were nonsignificant at the 0.01 level of confidence, as we approach having the population in this study the significance of the MNSD main effect under more liberal confidence rules ($p < 0.10$) merits some discussion.

While our reasoning about the autonomy of conglomerate subsidiaries and the strength of the BSD main effect led us to anticipate high levels of direct releases in the unrelated category, the post-hoc comparisons showed that only exhaustively diversified firms were significantly unique. Given, however, that the unrelated diversified category did have the second highest level of direct releases, this underscores the effect of BSD. Yet, this by itself may not fully account for why the exhaustively diversified firms had higher values, causing us to consider alternative explanations. As a result, we examined the mean values of BSD in both of these categories and found that the BSD average for unrelated diversified firms was 2.7, as compared to 4.5 for exhaustively diversified firms. Given the relatively low cut points for both dimensions of the 2×2 matrix in Table I, the unrelated diversified category would appear to have had a disproportionate number of firms that were relatively low on the BSD dimension, while the firms in the exhaustively diversified category happened to be

TABLE II
Results of two-way analysis of variance and Levene's equal variance analysis for direct releases by diversification category

Environmental performance	Diversification categories				F-values			
	Dominant business	Related diversified	Unrelated diversified	Exhaustively diversified	MNSD	BSD	Interactions	Overall
Mean releases[a]	–529,875[c]	–235,310[d]	–76,098	206,604[c, d]	3.55*	12.46**	0.01	5.38**
Mean variances[b]	74,709[c]	352,316[d]	232,802[e]	2,083,639[c, d, e]	NA	NA	NA	16.45**

[a] For total sample, $N = 555$; for diversification categories, Dominant Business $N = 246$, Related $N = 103$, Unrelated $N = 94$, Exhaustively $N = 112$.
[b] For total sample, $N = 2952$; for diversification categories, Dominant Business $N = 736$, Related $N = 465$, Unrelated $N = 400$, Exhaustively $N = 1351$.
[c, d, e] Denote significantly different pairs of group means ($p < 0.05$), based on Tukey's multiple comparison procedure.
* $p < 0.01$; ** $p < 0.01$.

in more 2-digit SICs. Thus, the disproportionate number of firms in the exhaustively diversified category high on the BSD dimension appears to be responsible for the high levels of pollution in that category.

As a final precaution, we inspected the distributions within the cells for 'outliers' and recalculated the F-value using the diversification category with the largest variance in the denominator – a more conservative approach (Neter et al., 1990). We were left to conclude that broad spectrum diversification is related to direct releases of pollutants by subsidiaries of parent companies in this industry, thus giving support to the first hypothesis.

The Levene's test associated with the second hypothesis is also reported in Table II. The pattern of results is similar to those found previously for mean values of direct releases. While the one-way test showed significant differences in the mean variances among the four diversification strategy categories, once again the post hoc comparisons revealed that only exhaustively diversified firms were significantly different from the other categories. Because we were prohibited from using a two-way analysis, it was impossible to determine which of the two dimensions was significantly associated with environmental performance or to assess their interaction; however, from an inspection of the cells, we suspect that MNSD may be playing a somewhat larger role in determining these variances. This is based on the observation that the related diversified firms exhibit somewhat greater variance than the unrelated firms and the disproportional elevation of variance in the exhaustively diversified category.

While we continue to believe that the greater subsidiary autonomy associated with BSD firms accounts for the lion's share of these differences and thus find support for the second hypothesis, an explanation for why MNSD might contribute to levels of direct releases and the variance of direct releases among subsidiaries warrants some consideration. In this regard, we speculate that this finding is due to the mundane influences of size and complexity. Given the rapid proliferation of environmental laws and the idiosyncracies in their application among different processes, it is quite possible that the addition of similar, but not identical, facilities would provide few opportunities to promulgate effective centralized policies than might be initially assumed. At the same time, increased size and complexity may frustrate any auditing or value clarifying ambitions of the parent.

Discussion

This study appears to confirm general suspicions that chemical facilities owned by more broadly diversified parents are on average "dirtier" than facilities that are owned by more focused companies. We anticipated this finding based on straightforward reasoning that associated differences in financial controls, intention of spreading environmental risks, and concerns with building reputational capital for environmental performance. The reliance on short-term financial controls by broadly diversified firms would presumably discourage more long-term capital investments in capital equipment to treat discharges and re-configure manufacturing processes. Generally, this is consistent with other studies that suggest business units of broadly diversified firms seek to reduce their risk exposure by investing in short-term, low-risk projects (Baysinger and Hoskisson, 1989; Hoskisson and Johnson, 1992; Keats and Hitt, 1988). It is also probably true that broadly diversified firms seek to spread environmental risks in much the same way as their financial risks. These orientations and intentions would reduce top management commitment to environmental performance, inhibit the promulgation of environmental policies, and retard the development of environmental management systems throughout the organization (i.e., including its disparate business units). This is a relatively straightforward explanation and is supported by the finding that broad spectrum diversification (BSD) has the most potent effect on the level of direct releases. Beyond these arguments, we might also speculate that through leveraging synergies in firm strengths and activities (e.g. similar production processes, technology, etc.) related diversification might have a positive effect

on firm environmental performance. For example, Markides and Williamson (1994) point out that many related diversified firms share expertise in manufacturing and research and development processes across firm business units. To the extent that such sharing of process knowledge across business units results in tighter, less variable process controls and manufacturing operations, we would expect a negative relationship between more related forms of diversification and firm environmental performance.[1]

A more novel finding is that mean narrow spectrum diversification (MNSD – operationalized as the average number of four-digit SICs within the two-digit classifications) also appears to make a mild contribution to levels of direct releases. Therefore, it is likely that the more straightforward arguments associated with the type of control underlying the effects of broad spectrum diversification (BSD) must also be augmented by the influence of volume, complexity, and logistical problems associated the number of different facilities operated by the parents. This may be the case, as exhaustively diversified firms – which were found to have the highest level of direct releases – are not only in many different SICs, but also are diversified *within* each broad category. Thus, the large number of subsidiaries of such parents are likely to be exposed to stricter financial controls by a remote corporate headquarters, in addition to delays or other irrationalities characteristic of its greater bureaucracy. It is also likely that the environmental audits become more difficult to implement effectively with diversification, per se. Indeed, one basic finding of this study is that diversification *in any form* may be undesirable from an environmental point of view. At the same time, the more unrelated the diversification, the worse it appears to be. This conclusion does appear to have some anecdotal support as many case studies on environmentally enlightened firms often are single line of business firms (e.g., IKEA, Ben & Jerry's).

However, it seems unrealistic to think that many firms would abandon diversification for that purpose alone.

Limitations and implications

Despite the theoretical and empirical evidence supporting our hypotheses, this paper is nonetheless open to a fair number of criticisms. First is the age of the data. Since 1989 legislators and regulators have continued to enact increasingly stringent environmental regulations. Thus, a fundamental question is how the relationships discovered herein have held up over time, and future research is needed to address this question. One possibility is that environmental regulations have, through higher compliance standards, reduced the differences in pollution emissions between related and unrelated firms. Another possibility is that unrelated diversified firms are relatively cleaner today because of environmental regulations but they are still dirtier than related diversified firms. A recent study of chemical firm emissions by Griffin and Mahon (1997) supports of this possibility. They found that between 1990 and 1992 the relative ranking of chemical firm emissions remained unchanged. In summarizing their findings, they suggested that future research identify what firm level variables explain the consistency in emissions differences among firms in the chemical industry. Based on the findings of this study, one plausible explanation is type of corporate diversification.

A second limitation is the generalizability of results to other industries and firms operating outside of the United States. While we are confident about the findings as they relate to the chemical industry in the U.S., the fact that external and internal pressures on firms (e.g. governmental regulations) differ across industries and countries makes generalizing to other contexts difficult (Arlow and Gannon, 1982; Carroll, 1979; Porter, 1991). Future research could verify the external validity of the theoretical arguments and empirical results in this study by replicating it in other industry and country contexts.

Another limitation can be traced directly to our frustrations with the TRI database. Although the TRI reports disaggregated data, there currently exists no satisfactory weighing scheme for determining relative levels of toxicity (Griffin and Mahon, 1997). Although not a perfect solution, Logsdon (1995) argues that controlling for

industry, as was done in this study, provides a partial remedy to this problem.

A final limitation is our lack of control for production processes and products across firms within the chemical industry. Because the TRI reports no such measure and public sources are not available at the facility level, we were forced to make the uncomfortable assumption that firms within the chemical industry were similar with respect to production processes and products irrespective of diversification strategy. However, based on our previous arguments, we would suspect a relationship between diversification strategy and firm products and processes. Specifically, we would expect related diversifiers, as compared to unrelated diversifiers, to be more likely to invest in processes and products that reduce pollution emissions. Nonetheless, in the future we hope that such problems will be addressed so the TRI database will be more amenable to these types of investigations. Such data, if thoughtfully conceived and gathered, will be a boon to further research in this area. Despite these limitations, we believe that that our findings are sufficiently robust and sensible so as to be credible.

Directly speaking to the aforementioned limitation, other avenues for future research might include examining the relationship among firm strategy, production processes and products and firm emissions within the chemical industry. For example, firms with more proactive, long-term focused strategies might be more likely to invest in waste mitigating production processes or develop environmentally friendly products (Aragon-Correa, 1998). In-depth qualitative studies would also provide additional insight by identifying unique firm approaches to environmental management that are overlooked in large quantitative studies such as this one, or which are not amenable to quantitative measurement (e.g., organizational culture).

The results of this paper also have implications for policy makers and organizations. For example, market-based controls, which allow firms more discretion in where they spend their pollution abatement dollars, may be an effective alternative (Malueg, 1989). It would seem that even diversified firms would be more likely to abate their levels of pollution in the event they were paying the full cost of their actions (defined here to mean the actual cost to the firm of producing and distributing the good or service plus the social costs resulting from various "externalities"). In some ways the TRI data itself represents a partial step forward. Indeed, this system of reporting releases *and* in making this information freely available to the public has had a powerful effect on U.S. firms. Thus, external groups are in a better position to recognize externalities and press the firm for change or compensation.

A second type of alternative worth considering is voluntary consensus standards [i.e., the ISO 14000 series, Eco-Management and Audit Scheme (EMAS) or various industry codes]. While the question of whether such programs might encourage diversified firms to reduce pollution levels begs for empirical assessment, based on the arguments outlined in this paper we might speculate them to be less effective with regard to unrelated diversified firms. For example, unrelated diversified firms are characterized by competitive organizational arrangements and short-term oriented reward structures (Rowe and Wright, 1997). Research suggests that firms with cooperative structures are more effective in adopting process management programs such as ISO 14000, and short-term oriented reward structures are inconsistent with process management programs (Anderson, Rungtusanatham, and Schroeder, 1994; Dean and Bowen, 1994).

Unfortunately, one of the requirements of the EMAS – that facilities must report their significant environmental aspects and impacts – was dropped in ISO 14001. We suspect that such reporting may have had an effect analogous to TRI reporting, although such results may not have been as easily accessed and interpreted. More contemporary research on a broad range of these issues is clearly needed. In this regard, the relationship between data reporting and such efforts at empirical research is obvious.

This reasoning serves to underscore general concerns that diversified companies (as one type of firm that would be differentially less interested in adherence to voluntary standards) may need more encouragement to participate. Of course,

such reluctance is partially addressed by the ISO standards in that adherents are supposed to place pressure on their suppliers to get on board. However, there is clearly a role for government in this process by creating additional incentives for firms to develop effective environmental management systems through effective regulation. Such regulations, if thoughtfully developed, can not only improve firm environmental performance, but can also trigger firm innovation and improve firm efficiencies (Watanabe, 1992).

Finally, we might note that diversification takes many forms. Not only are their differences in the type of diversification (i.e., related versus unrelated), but there are differences in the dimensions firms use. While unbridled diversification by broad SIC category may no longer be a popular corporate strategy, geographic diversification is becoming increasingly more prevalent. If diversification is somehow categorically negative with respect to firms' pollution proclivities, a potential area for future research would be to examine the environmental outcomes from geographic diversification. One way in which diversified firms may in general be able to mitigate the proclivity to pollute is through the use of centralized environmental safety departments (Rappaport and Flaherty, 1992). Sanchez (1997) argues that large decentralized firms, such as unrelated diversifiers, will be more proactive in responding to environmental problems if environmental issue analysis is centralized within the firm.

From a policy point of view, concerns with global diversification would seem to require global solutions. While the ISO 14000 series appears to be a step in the right direction, serious questions have been raised about the efficacy of these standards, and the types of firms that will actually seek certification and what their motives will be in doing so (Gleckman and Krut, 1997). The fear is that only the "good guys" (quite often firms in single industries with long-term dependencies on resources and market) will seek certification while those firms with less committed parents will benefit as the industry broadly uses evidence of certification to forestall other, more aggressive and effective measures.

Conclusions

In conclusion, we feel that the results of this study have important implications for organizational researchers, as well as practical implications for organizations and regulatory policy makers. Taken together, the findings raise concerns about the phenomenon of corporate diversification with respect to corporate environmental performance. While in one sense firms may have less fascination with unrelated forms of diversification, this study found that even related forms of diversification have a negative influence on pollution releases. It is hoped that the current work will be the impetus for future investigations of how other organizational factors influence corporate environmental performance.

Note

[1] We would like to thank one of the reviewers for pointing this out to us.

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