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A model for conducting experimental environmental accounting research

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Abstract

Purpose – The purpose of this paper is to survey the research methods employed in the extant environmental accounting literature, finding few experimental studies. The need for more experimentation in the literature is discussed, as well as how experiments' unique methodological advantages can help address important environmental accounting issues. These issues culminate in a proposed model for conducting experimental environmental accounting research.

Design/methodology/approach – A synthesis of the environmental accounting literature emphasizes the research methods, and, advantages and disadvantages of each method, as well as why and how experimental designs can contribute to the environmental accounting literature. Finally, the paper proposes and analyzes a framework for conducting environmental accounting experiments.

Findings – Experiments can provide unique contributions to the environmental accounting literature. Relative to traditional accounting information, environmental accounting information comprises lower levels of user familiarity which may hinder effective processing of these non-traditional data. These characteristics make the organizational display of these data, and their combination with non-environmental metrics, a particular and unique concern. The proposed model considers the impact of environmental strategy on the implementation of environmental information systems, which in turn influences evaluation effectiveness of decisions based on environmental accounting information. Stakeholder influences, management communication of environmental issues, and evaluation scales also influence these relationships.

Research limitations/implications – The model assumes environmental information generates from within the entity (i.e. private firms, public agencies, etc.). Future research can enhance and/or modify the framework to include information design and capture from non-entity end-users (e.g. stakeholders), as well as empirically test the model's relationships.

Practical implications – The framework provides factors to consider to design more effective environmental accounting information systems. Also, the model's factors should aid researchers in developing robust experimental designs for environmental accounting studies.

Originality/value – This is the first paper to propose a framework for conducting experimental environmental accounting research.

Keywords Accounting information, Decision making, Accounting research, Social accounting

Paper type Literature review



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I. Introduction

Research in environmental accounting has evolved from a discipline afforded sporadic attention (pre-1990s) to an increasingly important focus of academic dialogue (literature reviews include Gray, 2002; Mathews, 1997; Owen, 2008; Parker, 2005). Throughout this emergence, scholars embraced a number of research methods to address multiple environmental accounting issues, including case studies (Ball, 2005; Cho, 2009), archival (Clarkson *et al.*, 2008; Patten, 2005), interviews (Perez *et al.*, 2007; Solomon and Solomon, 2006), and ethnography (Dey, 2007). However, few published experiments inform the environmental accounting literature (Kaplan and Wisner, 2009; Milne and Patten, 2002).

Experiments provide unique advantages (and disadvantages) for inquiry. Experiments can enrich the environmental accounting literature by isolating and exploring variables that influence other variables. For example, the way an environmental report displays accounting information may influence the information's decision weight in a manager's evaluation. Experiments are also uniquely suited to test psychological theory that predicts and explains why certain behaviors or actions occur. These types of findings benefit a number of stakeholders. Regulators learn future implications of potential environmental policies when lab settings create and test conditions that include the proposed policies. Management, lenders, and investors can construct environmental reports that make it cognitively easier to analyze environmental data for evaluations and investment decisions that better achieve an entity's objectives (both private firms and public agencies). This serves the public interest because society better understands how entities can be sensitive to the environmental consequences of their actions.

This paper provides guidance for an experimental approach to conducting environmental accounting research. To accomplish this objective, a general overview of the environmental accounting literature classified by research design provides a context for the unique contributions (and drawbacks) of the different research methods utilized in the literature. After acknowledging the scarcity of experimental studies in the literature, this paper then explores how experiments can uniquely contribute to the literature. Finally, guidance for an experimental approach to answering environmental accounting research questions aids academicians interested in pursuing this research track. Specifically, psychological theories and prior accounting research findings provide a foundation to propose a model for conducting experimental environmental accounting research. The model's sensitivity to the unique and unfamiliar nature of environmental data advance efforts to create sustainable environmental accounting information systems.

II. Literature review

Scope

The formal scope of the literature review consists of searching the Elton B. Stephens Company database for journal articles with the keywords "environmental accounting" and "environmental disclosure." Results were then narrowed to include accounting journals. Particular emphasis was given to the accounting journals that have been the most proactive in publishing environmental accounting research, including *Accounting, Auditing & Accountability Journal*; *Accounting, Organizations, & Society*; *Accounting & the Public Interest*; *Critical Perspectives in Accounting*; and *European Accounting Review*.

Special consideration was also given to the *Journal of Business Ethics* and *Advances in Environmental Accounting & Management*[1]. Some environmental accounting studies were informally included if:

- they were omitted from the formal search results; and
- I felt that they would help to analyze a research method[2].

While I believe this paper provides an adequate resource for a comprehensive review of environmental accounting research, the main objective of the review is to provide an overview of the environmental accounting issues addressed by the different research methods found in the literature.

This review focuses on a variety of approaches found in the environmental accounting literature: literature reviews, critical analyses, archival methods, and case studies and other qualitative methods. Table I summarizes the environmental accounting literature cited in this paper, which are classified by research method.

SEA literature compilations

There are many literature compilations of social and environmental accounting (SEA)[3] research and updated statuses on the state of the literature (Table I, Panel A includes a summary of these compilations). Mathews (1997) gives one of the earliest SEA reviews with a look at the past generation of studies, including over a 100 empirical citations and scores of citations on normative writings and philosophical discussions. A chronological approach organizes the studies, and a trend analysis aids in synthesizing the literature by different time periods. This review provides an excellent introduction to the SEA literature.

Later reviews build on Mathews' compilation by updating the literature while analyzing the studies from a particular lens, usually with a focus on a journal's specific contribution to the environmental accounting literature. With a focus on *Accounting, Organizations & Society* papers, Gray (2002) reviews SEA studies from the late 1970s to the early 2000s (over 130 citations), and he observes that the foundation for SEA accounting has emerged as a hybrid between traditional accounting and (increasingly) more contemporary critical accounting perspectives. Deegan (2002) introduces a special issue of SEA research in *Accounting, Auditing & Accountability Journal* by reviewing and analyzing the current SEA literature (about 125 citations). He details legitimacy theory's role in the SEA literature, and then uses this framework to provide a context for the papers in the special issue. The legitimacy theory framework suggests that companies operate with society's permission, and their business actions seek to legitimize their operational existence. The legitimacy framework highlights the motivations behind managerial decisions to disclose (or not disclose) environmental information.

Parker (2005) reviews SEA studies (about 50 citations) from the late 1980s to the early 2000s and suggests that a diversity of theoretical perspectives (vs one unified approach) to SEA enhances understanding. Owen (2008) focuses on SEA studies in *Accounting, Auditing & Accountability Journal* from 1988 to 2007 and other journals from 2004 to 2007 (about 125 citations) and observes a shift away from a management focus to more stakeholder involvement and socially oriented results. Although Owen acknowledges an advancement of studies in recent years that indicate more researcher engagement with entities (such as field studies and interviews), both he and Parker call

| Authors | Results |
|---|---|
| <p><i>Panel A. Critical analyses and literature compilations (n = 27)</i> Bebbington and Larrinaga-Gonzalez (2008), Hopwood (2009), Mackenzie (2009), Cook (2009), Braun (2009), Engels (2009), Lohmann (2009) and Callon (2009) Bebbington <i>et al.</i> (2007)</p> | <p>Analyses of carbon trading schemes. Issues covered include carbon reporting, political considerations and market complexities of implementing a trading system, and cost-benefit analyses of carbon markets (note: Engels (2009) includes survey data)</p> <p>Suggests a dialogic approach (repeated communicative process among participants that edit and enhance the action to be realized) could benefit the SEA research objective of instilling effective social accountability</p> <p>Suggests that analyzing environmental disclosures from a reputation risk management perspective may yield insights on disclosures that complement analyses from presently-used frameworks such as legitimacy theory</p> |
| Bebbington <i>et al.</i> (2008) | <p>The authors call for an end to sustainable development as we know it because its current structure leads to counterproductive manipulation by various entities. A conscious cultural evolution can help achieve this objective, and accounting's role in this change is analyzed</p> <p>Uses sustainability issues as a topic to analyze how a dialogic approach can aid the development of accounting systems through (agonistic) democratic channels that promote critical analysis and multi-perspective dialogues of the accounting issues</p> |
| Birkin <i>et al.</i> (2005) | <p>Suggests a framework matrix to consider when addressing environmental-related business activities in an accounting information system. Components are considered from the operational, market, and societal levels</p> |
| Brown (2009) | <p>Describes FEE's (Federation des Experts Comptables Europeens) activities with respect to environmental accounting issues. The FEE has taken the initiative in Europe for promoting and advancing environmental accounting issues for the profession to consider and deliberate</p> |
| Brown <i>et al.</i> (2005) | <p>Deegan introduces a special issue of <i>Accounting, Auditing & Accountability Journal</i> by discussing current issues in social and environmental reporting, and then uses legitimacy theory as a common framework to connect the other papers appearing in the special issue. The goal is to better appreciate the motivations behind managerial decisions to disclose (or not disclose) environmental information</p> |
| Collison and Slomp (2000) | <p>A linguistic analysis of false dualisms within environmental accounting suggests these terms contribute to reduced research flexibility (and thus, productivity). Addressing these dualisms could broaden the scope and flexibility of environmental accounting research</p> |
| Deegan (2002) | <p>Describes FEE's (Federation des Experts Comptables Europeens) activities with respect to environmental accounting issues. The FEE has taken the initiative in Europe for promoting and advancing environmental accounting issues for the profession to consider and deliberate</p> |
| Everett (2004) | <p>Deegan introduces a special issue of <i>Accounting, Auditing & Accountability Journal</i> by discussing current issues in social and environmental reporting, and then uses legitimacy theory as a common framework to connect the other papers appearing in the special issue. The goal is to better appreciate the motivations behind managerial decisions to disclose (or not disclose) environmental information</p> |

(continued)

Table I.
Summary of select
environmental
accounting studies

| Authors | Results |
|--------------------------|--|
| Gray (2002) | <p>Analysis of the social accounting (which includes environmental) studies in <i>Accounting, Organizations & Society</i> from the late 1970s to the early 2000s. There is a need for more empirical studies and more involvement with practitioners. Social accounting foundation emerges as a hybrid between traditional accounting and (increasingly) more contemporary critical accounting perspectives</p> |
| Gray (2006) | <p>Contemporary capitalism is antagonistic to environmental stewardship. SEA research can help shed light on mainstream accounting's concept of "value," suggesting that the current perspective of value is not effective when considering recent data on Earth's sustainability</p> |
| Gray (2010) | <p>Critical analysis of what sustainability means in an accounting context for entities, individuals, and society at large. Critically discusses views and mindsets of sustainability and whether sustainability information is sufficiently captured by traditional accounting mechanisms</p> |
| Gray and Collison (2002) | <p>Fundamental changes are needed to the accounting education curriculum for the accounting profession to be effective contributors within society's addressing of environmental issues</p> |
| Lehman (1999) | <p>Suggests that modern communitarianism may be more productive than the current paradigm of environmental (and social) accounting, which restricts efforts to effectively promote and determine accountability for corporate-induced environmental damages</p> |
| Mathews (1997) | <p>A generation of SEA studies is analyzed. A chronological perspective organizes the findings, and a trend analysis aids in synthesizing the literature</p> |
| Milne (2002) | <p>Studies looking to support positive accounting theories in social and environmental disclosures do not fully ground their arguments with the notion that managers try to maximize wealth.</p> |
| Owen (2008) | <p>Regardless, there is weak evidence that this motivation drives environmental disclosures Analysis of the SEA studies in <i>Accounting, Auditing & Accountability Journal</i> from 1988 to 2007 and other journals from 2004 to 2007. Acknowledges an advancement of empirical studies in recent years, but echoes the need for more empirical studies and more involvement with practitioners. Suggests an SEA research shift away from a management focus to more social activism and stakeholder involvement</p> |
| Parker (2005) | <p>Analysis of the SEA studies from the late 1980s to the early 2000s. Suggests that different theoretical perspectives (vs one unified approach) to conducting SEA research is healthy and enhances the literature. There is a need for more empirical studies and more involvement with practitioners</p> |

(continued)

| Authors | Results |
|---|---|
| Patten and Freedman (2008) | Assesses the findings of a GAO analysis on the state of environmental disclosures. Authors suggest the GAO analysis indicates too much discretion and leeway for corporations to disclose environmental accounting information, as well as ineffective enforcement activities |
| Reynolds and Mathews (2000) | Suggests using ethical frameworks to address environmental accounting issues. This alternative perspective can help accountants expand current economic-focused accounting principles and applications to include environmental and social transactions in businesses' dealings with society |
| <i>Panel B. Archival studies (n = 33)</i> Aerts and Cormier (2009) | For Canadian and US firms, environmental disclosures in annual reports positively impact perceived environmental legitimacy via press coverage, but this impact is hindered if the firm operates in an ESI. Also, reactive, but not proactive, environmental press releases positively impact perceived legitimacy. Negative past legitimacy of a firm, but not annual report disclosures, seems to impact future environmental press releases |
| Al-Tuwaijri <i>et al.</i> (2004) | For S&P 500 firms, there are positive links between environmental performance, financial performance, and environmental disclosures when endogeneity among these variables is considered. This suggests that environmental stewardship and economic success are not adversarial objectives. Also, findings support economic theories of discretionary disclosure, but disclosed environmental information is a predictor of future environmental performance |
| Blacconiere and Northcutt (1997) | The market values environmental disclosure information. Specifically, chemical companies with more pre-1986 environmental disclosures received better market reactions compared to companies with environmental cost information disclosed by the Environmental Protection Agency's (EPA) relating to the Superfund Amendments and Reauthorization Act of 1986, which indicated greater environmental cost risks. Findings suggest investor perceptions that corporate disclosures are an indicator of the company adequately mitigating environmental cost risks |
| Blacconiere and Patten (1994) | Investors responded more favorably (i.e. not as negatively) to chemical companies that disclosed environmental information more thoroughly before the 1984 Union Carbide chemical leak incident in Bhopal, India. Findings suggest investor perceptions that corporate disclosures are an indicator of the company adequately mitigating environmental cost risks |
| Cho <i>et al.</i> (2008) | Finds a positive correlation between oil and chemical companies' political campaign contributions and congressional votes against more stringent environmental disclosure legislation. Results suggest that companies use political tactics to limit disclosure obligations |

(continued)

| Authors | Results |
|-------------------------------|---|
| Cho and Patten (2007) | <p>Poor environmental performers and companies from ESIs disclose more compared to other firms. Specifically, poor environmental performers in industries that are not environmentally sensitive disclose more non-monetary environmental information compared to good environmental performers in non-ESI (no differences found among ESI firms). Poor environmental performers in ESI disclose more monetary environmental information compared to good performers of ESI as well as bad performers of non-ESI. The findings support a legitimacy framework for environmental disclosures</p> |
| Cho <i>et al.</i> (2006) | <p>Using a sample of 119 American firms operating in ESIs, this study finds that companies with higher political lobbying efforts have increased environmental disclosures and lower environmental performances, suggesting a management strategy to influence environmental regulatory procedures</p> |
| Cho and Roberts (2010) | <p>Poor environmental performers, as indicated by a toxicity score based on the EPA's toxics release inventory, release more environmental disclosures in both substance and form on their entity websites</p> |
| Cho <i>et al.</i> (2010) | <p>Corporations with poorer environmental performances disclose environmental information with more optimistic and vague language in their annual reports than corporations with better environmental performances</p> |
| Clarkson <i>et al.</i> (2004) | <p>In a sample of pulp and paper companies, environmental capital expenditures yielded gains for low-polluting companies, but not their high-polluting counterparts. Also, investors utilize data on companies' environmental performances to assess future environmental liabilities that are yet to be recognized</p> |
| Clarkson <i>et al.</i> (2008) | <p>US companies involved in ESIs have a positive relationship between voluntary environmental disclosures and environmental performance. Findings support economic theories of discretionary disclosure and not social-political frameworks such as legitimacy theory. However, the social-political frameworks help predict disclosures of environmental information that are not a hard commitment by companies pressured by external stakeholders for better environmental performances</p> |
| Cormier <i>et al.</i> (2004) | <p>Proposes a model on corporate environmental reporting. Survey and archival data support the model, which focuses on establishing an association between a manager's views of a stakeholder entity and the manager's decision to disclose environmental information, as well as the degree of the disclosure</p> |

(continued)

| Authors | Results |
|--|---|
| Criado-Jimenez <i>et al.</i> (2008) | A content analysis on Spanish companies' financial statements revealed that Spanish standard setters who established environmental disclosure regulation Instituto de Contabilidad y Auditoria de Cuentas (ICAC-2002) show potential to improve both the quantity and value of environmental disclosures. However, voluntary disclosures appeared to be used for image management purposes, perhaps to mitigate any negative effects resulting from required disclosures |
| de Villiers and van Staden (2006) | Environmental disclosures in South African companies increased from 1994 to 1999, but then decreased for both general and specific environmental disclosures until 2002. Suggests that the decrease was a form of legitimizing strategy because companies perceived less pressure to legitimize their operations, and thus less environmental disclosures were deemed more beneficial |
| Freedman <i>et al.</i> (2003) | American utilities had an overall reduction in emissions between 1990 and 1995, but they disclosed less (although not significant) Clean Air Act information in 1995 (the beginning of the first phase) than when the Act's major amendments were passed in 1990. One possible explanation is there was more legal risk uncertainty in 1990 (shortly after the regulation's passage) than in 1995, when utilities were more confident of complying with the new regulations. Thus, stakeholder pressure in the form of legal risks had subsided, reducing the need for legitimizing actions |
| Freedman and Stagliano (2008b; CPA) | The study finds mixed results for companies with coal-fired factories that need to comply with provisions of Phase 2 of the US Clean Air Act (sulfur dioxide emissions reduction). Companies disclosed little in advance on their efforts to comply with Phase 2. 1999 disclosures appeared associated with companies in jeopardy of meeting Phase 2s 2000 compliance date, and 2001 disclosures were not linked with emissions levels but with an impending deficit of sulfur dioxide trading allowances. Thus, motivation for disclosure is vague |
| Freedman and Stagliano (2008a; Accounting and the Public Interest) | Using data from the Toxics Release Inventory, they find no relationship between high-volume polluting companies' pollution and the degree of their environmental disclosures in other sources. They also find no relationship between the companies' amount of carcinogenic releases and their environmental disclosures in financial statements |
| Joshi <i>et al.</i> (2001) | An analysis of steel mills reveals that only about 10 per cent of environmental statutory compliance costs are explicitly classified as such; the rest are embedded in other accounts. Interviews with company personnel reveal they largely underestimate the extent of the embedded environmental compliance costs |

(continued)

Table I.

| Authors | Results |
|-----------------------------|---|
| Jose and Lee (2007) | Content analysis of environmental disclosures on web sites of the 200 largest firms in the world show that companies perceive environmental issues as a competitive advantage instead of a regulatory burden. Disclosures also suggest changes in business structures to aid in addressing the growing strategic importance of environmental issues |
| Karim <i>et al.</i> (2006) | A study of 51 firms in ESIs finds negative correlations between environmental footnote disclosures and American firms' level of business outside of the USA (because of fear of being perceived as a polluter), as well as the firm's earnings volatility (because of fear of bad news exasperating low earnings periods) |
| Li <i>et al.</i> (1997) | Firms increase disclosures of environmental information when they are more likely to pollute, when stakeholders become more aware of the firms' environmental liabilities, and when threats to acquiring regulatory costs decline |
| Magness (2006) | Companies with more active strategic postures release more environmental disclosures. However, financial performance does not appear to influence the disclosures' substance |
| Magness (2010) | Using a signaling theory framework, investor reactions to an accident in the Canadian mining industry are more favorable to companies with prior environmental disclosures, particularly with disclosures on information about upper-level company involvement in environmental issues. These disclosures may signal management competence in reacting to environmental matters. Financial disclosures, however, provide different signals, showing a disconnect between investors and management |
| Mobus (2005) | In a sample of oil refineries, there was a negative correlation between firms with a mandatory negative environmental disclosure and subsequent adherence to environmental regulations. |
| Murray <i>et al.</i> (2006) | A legitimizing strategy is suggested because a firm with a negative disclosure would not wish to legitimize its actions with positive environmental announcements (in the form of a voluntary disclosure), presumably because the voluntary disclosure loses its image management value Found no relation between UK companies' stock returns and their environmental and social disclosures. However, there was a positive relationship between a company's level of disclosures and the consistency of their financial returns (i.e. high-disclosure levels correlated with consistently high returns, and vice versa) |
| Neu <i>et al.</i> (1998) | Environmental disclosures are positively linked to financial and regulatory stakeholders, but negatively linked to stakeholders that may be considered less influential and important to the company (such as environmental groups). The different clout of these stakeholders impacts the type of communication strategy utilized in these disclosures |

(continued)

| Authors | Results |
|---|---|
| Patten (2000) | An analysis of 95 American firms' annual reports show that environmental disclosures in annual reports not related to Superfund information increased after the advent of Superfund disclosures. Social and political pressures to legitimize operations may explain the disclosure increases |
| Patten (2002) | There is a negative correlation between environmental disclosures and environmental performance, and the correlation is more pronounced among firms in non-ESIs. Social and political pressures may explain the negative correlation. Bad environmental performance leads to pressure to disclose, and ESIs are not affected as much by this pressure because they are already under more scrutiny |
| Patten (2005) | Projections of financial report environmental disclosures for pollution management equipment do not associate with the actual environmental expenditures. Results suggest these environmental projections have little value, there is non-compliance of proper environmental disclosures, and disingenuous projections are used for legitimacy |
| Patten and Crampton (2003) | A content analysis of 62 American corporate websites suggests that companies are not serious about accountability for environmental issues. Although web site disclosures provide new environmental information about the entity, there is a bias against negative environmental disclosures |
| Ruf <i>et al.</i> (2001) | A positive link exists between corporate social performance and financial performance. Stakeholder theory suggests these results indicate that firms better serve their shareholders when they address other stakeholder concerns |
| Walden and Stagliano (2003) | Content analysis of annual reports from 53 US firms reveal what type of environmental information is found in disclosures. Information on environmental expenditures, contingent liabilities, and pollution abatement factors are the most common, but the quality of this information is not correlated with environmental performance |
| Warsame <i>et al.</i> (2002) | A matched-pair analysis of Canadian firms shows that the quality of an environmental disclosure increases in response to a preceding year's environmental fine (i.e. a discrediting event). This suggests that managers use post-fine environmental disclosures for legitimacy |
| <i>Panel C. Case and other qualitative studies (n = 17)</i> Antheaume (2004) | Explores the implementation of three different full cost environmental accounting methods at a company. The avoidance cost method may be inconsistently higher or lower than the damages cost method. Regardless of the cost method used, society is not covering for the difference between recorded costs and actual environmental harm. Environmental degradation is suggested as evidence of this claim |

(continued)

| Authors | Results |
|---------------------------------|---|
| Ball (2005) | Analyzes a local UK Governmental entity to show how the implementation of environmental accounting concepts may provide a catalyst for organizational change despite the ultimate success of the accounting system. The change occurs via factors that result in the "deinstitutionalization" of the organization's structure (Case study) |
| Ball (2007) | A Canadian city council is studied to analyze how environmental accounting initiatives can reflect an activist role as proponents of organizational changes in environmental matters |
| Bartolomeo <i>et al.</i> (2000) | Describes perspectives on the direction of European companies' environmental management accounting systems. Environmental cost accounting initiatives were sporadic, and future implementations may be more successful with smaller, economically justifiable approaches as opposed to major changes in environmental cost systems. (case study and interviews) |
| Cho (2009) | A large oil company's communications are analyzed in the wake of two environmentally damaging incidents. Company communications attempted to legitimize its existence via image enhancement, disclaimer, and deflection tactics. Stakeholder interviews revealed negative perceptions of the company's actions, suggesting their legitimizing actions were not effective |
| Darnell <i>et al.</i> (2009) | Surveys of manufacturing entities show a positive link between perceived influences from regulatory and internal (employee) stakeholders, but not external society stakeholders, and the usage of external environmental auditing. Also, the presence of perceived internal stakeholder influences is a determining factor in whether an entity conducts any internal and external environmental audits |
| Dey (2007) | Chronicles an organization's attempt to implement SEA procedures. The attempt failed, but the process contributed to fundamental changes within the firm (and not all changes were good). Considers business factors that may interact or reduce an implemented accounting system's effectiveness in achieving business changes |
| Herbohn (2005) | Chronicles an Australian Governmental entity's unsuccessful attempt to implement the damages cost method of a full cost environmental accounting system. Managers and stakeholders differed on if and how environmental values should be converted to financial metrics for analysis. Other hindrances included costs and complexities of valuation methods |
| Islam and Deegan (2008) | Interviews with executives from a company operating in a developing country reveal stakeholder pressures on their social and environmental disclosures. These pressures lead to an increase in company disclosures. The findings support legitimacy, stakeholder, and institutional theories as frameworks for analyzing companies' environmental disclosures (archival methods also used.) |

(continued)

| Authors | Results |
|------------------------------|---|
| Jones (2003) | Studies an ecological accounting model that aims to account for an entity's impact on biodiversity. The model provides a format for a company to report on natural assets (e.g. wildlife) levels |
| Kuasirikun (2005) | Interviews and a survey with Thai accountants reveal a positive disposition towards developing SEA practices in the Thai accounting profession. Suggestions on developing SEA include ensuring that accountability regulatory boards include representatives for social and environmental (as well as financial) constituencies |
| Lodhia (2003) | Interviews from accountants in a developing country (Fiji) reveal low levels of participation in environmental accounting activities due to an inadequate environmental expertise and limited mandatory disclosure requirements |
| Masanet-Llodra (2006) | Case study on a company in the Spanish ceramic tiles industry. Environmental accounting systems are used more extensively for internal planning compared to external disclosures. Companies may be reluctant to disclose the information, which contradicted the company's claims to be eager to disclose environmental information to stakeholders |
| Perez <i>et al.</i> (2007) | Companies utilizing a specific environmental management system, the European Community's Eco-Management and Audit Scheme, affect environmental-related business changes via employees' awareness of and training in the company's environmental issues. Other factors include inter-department cooperation, managerial dedication, environmental cost accounting applications, and environmental considerations in strategy development |
| Rahaman <i>et al.</i> (2004) | A public entity in a developing country (Ghana) incurs environmental accounting costs to legitimize its actions to funding entities, which ultimately makes its services unaffordable to the local people it was established to serve |
| Solomon and Solomon (2006) | Interviews with institutional investors reveal the utility of private communications of SEE disclosures. Private SEE disclosures are becoming more informative and effective for stakeholders, helping to compensate for perceived inadequate public disclosures used in making informed decisions. A dialogic process is developing, where companies are becoming more proactive privately in providing stakeholders' desired SEE information, which aids the public disclosures |
| Wisner <i>et al.</i> (2006) | A US survey of 179 firms supports the importance of organizational and management dedication in achieving good environmental performance, and this association also correlates with good financial results |

(continued)

| Authors | Results |
|---|---|
| <i>Panel D. Experimental studies (n = 5)</i> Chen <i>et al.</i> (2010) | With participants playing the role of jurors, the study finds that disclosing negative future regulatory environmental information over the internet leads to lower litigation awards. These awards are reduced even further when the environmental information's display is visually augmented and improved |
| Cho <i>et al.</i> (2009) | Disclosing environmental and social information on more media rich web site designs improve user perceptions of trust to depend on an entity's own disclosed information and positively view the entity's actions on environmental and social issues, but the more visually enhanced web sites do not lead to more positive views on the entity |
| Kaplan and Wisner (2009) | Balanced scorecards that use a fifth perspective to consolidate the metrics may lead to less decision weight of the data compared to spreading the data throughout the traditional perspectives unless communication of the unique strategic objective is emphasized. Emphasizing the management communication had no impact on evaluations when the unique strategic objective's data were spread out over the traditional four scorecard perspectives, thus showing the importance of emphasizing the strategic objectives via management communications. The information used in a fifth perspective and management communications were based on environmental information |
| Kennedy <i>et al.</i> (1998) | The information description of environmental liability disclosures are manipulated (none, minimum, maximum, range, or best estimate). Participants anchored on the description, resulting in different perspectives on an experimental company's investment risk and the extent of the company's environmental liabilities. The "maximum" description of a company's environmental liability disclosure was perceived as higher company riskiness than the "minimum" description. Anchoring effects on the minimum description led to a misapplication (an underestimation) of the actual maximum value of an environmental liability, which can affect management and investment decisions |
| Milne and Patten (2002) | Companies can disclose positive environmental information in their annual reports to mitigate negative investor reactions to required negative environmental disclosures relating to Superfund laws. This mitigation only occurred in experimental settings for a long-term investment strategy; the positive information actually made the negative investor reactions worse in short-term investment scenarios, which may suggest an investor rewarding the company with a poor environmental performance for short-term risk |

for more involvement with practitioners and stakeholders. However, Parker subscribes to a managerial approach to advancing SEA research, while Owen believes this perspective limits SEA research because of conflicts between managerial economic objectives and SEA accountability goals.

In summary, the SEA literature compilations review the research from a number of different perspectives, with particular emphasis on the different frameworks utilized throughout the studies. There is an ongoing debate on whether a management perspective is an appropriate avenue for conducting SEA research or whether there is a conflict of interest between managerial self-interests and stakeholder sustainability objectives. This tension will be further discussed during the analysis of the proposed model for conducting experimental environmental accounting research.

Critical analyses

In addition to literature compilations, environmental accounting researchers produce critical analyses to critique the research stream's direction and/or suggest guidance for future research paths (Table I, Panel A). Brown *et al.* (2005) introduce a framework matrix to consider environmental-related business activities in an accounting information system. Components are considered from the operational, market, and societal levels. Bebbington *et al.* (2008) suggest that analyzing environmental disclosures from a reputation risk-management perspective may yield insights on disclosures that compliment analyses from presently used frameworks such as legitimacy theory.

Other analyses advance the notion that the current paradigm of SEA studies restricts efforts to effectively promote and determine accountability for corporate-induced environmental damages (Mathews, 1995). According to Gray (2006), contemporary capitalism is antagonistic to environmental stewardship (similar to Owen's views mentioned previously). Thus, SEA research can help shed light on mainstream accounting's concept of "value" because Gray believes that the current perspective of value is ineffective when considering recent data that question Earth's sustainability (see Gray, 2010, for a critique on the essence of what sustainability actually means in an accounting context). Birkin *et al.* (2005) call for an end to sustainable development as we know it because its current structure leads to counterproductive manipulation by various entities. A conscious cultural evolution can help achieve this objective, and the authors analyze accounting's role in this change. Others advocate reform of the accounting educational system to address environmental issues (Gray and Collison, 2002). Other alternatives suggested to traditional paradigms include modern communitarianism (Lehman, 1999), a current misapplication of positive accounting theory (Milne, 2002), linguistic analyses of false dualisms in contemporary environmental accounting (Everett, 2004), using ethical frameworks to address environmental accounting development issues (Reynolds and Mathews, 2000), accounting activism (see Ball's, 2007, case study), and using a dialogic approach (Bebbington *et al.*, 2007; Brown, 2009).

Understanding and considering the political landscape may provide insight on what helps or hinders the development of environmental accounting initiatives. This rings especially true for politics surrounding environmental regulations because these legal rules will undoubtedly affect future environmental accounting disclosures. Some critical analyses incorporate political factors that influence environmental accounting changes. Collison and Slomp (2000) provide an European account, describing The Federation

of European Accountants' (FEE) activities with environmental accounting issues. The FEE has taken the initiative in Europe for promoting and advancing environmental accounting issues for the profession to consider and deliberate.

Patten and Freedman (2008) assess the findings of a Governmental Accountability Office (GAO) analysis on the state of environmental disclosures, suggesting the GAO analysis indicates too much discretion and leeway for corporations to disclose environmental accounting information, as well as ineffective enforcement activities. In addition to environmental disclosures, governments influence the establishment of economic mechanisms such as carbon trading markets (Bebbington and Larrinaga-Gonzalez, 2008). The rapidly increasing interest in carbon trading underscores a special issue in *Accounting, Organizations, & Society*, which analyzes carbon reporting, political considerations and market complexities of implementing the trading system, and cost-benefit analyses of carbon markets (Braun, 2009; Callon, 2009; Cook, 2009; Engels, 2009; Hopwood, 2009; Lohmann, 2009; MacKenzie, 2009).

In sum, the literature's critical analyses cover a wide variety of assessments on the state of the environmental accounting literature. Major focuses of these critiques include:

- evaluating the prospects of successful implementation of environmental accounting initiatives within the contemporary business climate; and
- regulatory developments and its implications on environmental accounting issues.

Archival studies

Studies using legitimacy theory. Archival studies rely on empirical data that derive from real world occurrences and are not created in a laboratory setting. The archival environmental accounting studies appear to explore two broad categories (Table I, Panel B). First, many authors invoke a legitimacy theory framework (discussed previously) to help explain why companies disclose environmental information. Neu *et al.* (1998) find environmental disclosures positively linked to financial and regulatory stakeholders (proxied by profits and news articles referring to environmental fines, respectively), but negatively linked to stakeholders that may be considered less influential and important to the company (such as environmental groups). The different clout of these stakeholders impacts the type of communication strategy utilized in these disclosures. Magness (2006) sees more disclosures among companies that actively manage their image with powerful stakeholders (i.e. an active strategic posture). However, financial performance does not appear to influence the disclosures' substance.

Aerts and Cormier (2009) compliment Magness' legitimacy finding by showing that environmental disclosures in annual reports positively impact perceived environmental legitimacy via press coverage. However, this impact lessens if the firm operates in an environmentally sensitive industry (ESI). Also, environmental press releases that are reactive (but not proactive) in responses to environmental issues positively impact perceived legitimacy. Firms' media exposure to prior negative environmental events (i.e. negative past legitimacy), but not annual report disclosures, seem to positively impact future environmental press releases.

Mobus (2005) finds another consequence of negative past legitimacy. Specifically, there was a negative correlation between oil refineries with a mandatory negative environmental disclosure and subsequent adherence to environmental regulations.

The author suggests a legitimizing strategy because a firm with a negative disclosure would not wish to legitimize its actions with positive environmental announcements (in the form of a voluntary disclosure), presumably because the voluntary disclosure loses its image management value. Another study suggests image management tactics being used for voluntary environmental disclosures (Criado-Jimenez *et al.*, 2008). A content analysis on Spanish companies' financial statements revealed that Spanish standard setters who established environmental disclosure regulation (ICAC-2002) show potential to improve both the quantity and value of disclosures. However, voluntary disclosures appear to be used for image management purposes, perhaps to mitigate the negative effects resulting from required disclosures (see Hooghiemstra, 2000, for views on explaining these image management tactics with a more broad corporate communication framework).

Cho and Patten (2007) find that poor environmental performers and companies from ESIs disclose more compared to other firms. Specifically, poor environmental performers in non-ESIs disclose more non-monetary environmental information compared to good environmental performers in non-ESI (there were no differences found among ESI firms). Poor environmental performers in ESI disclose more monetary environmental information compared to good performers of ESI as well as bad performers of non-ESI. The findings support a legitimacy framework for environmental disclosures. Cho and Roberts (2010) find similar legitimacy attempts; poor environmental performers, as indicated by a toxicity score based on the EPA toxics release inventory (a US Government's database on national industrial chemical emissions), release more environmental disclosures in both substance and form on their entity web sites. Web site environmental disclosures have been criticized for not being serious about accountability because of their bias against negative environmental disclosures (Patten and Crampton, 2003).

In another study on legitimizing actions, Warsame *et al.* (2002) use a matched-pair analysis of Canadian firms to show that the quality of an environmental disclosure increases in response to a preceding year's environmental fine (i.e. a discrediting event). This suggests that managers use post-fine, i.e. penalty, environmental disclosures for legitimacy. In a similar trend on responding to an environmental event, an analysis of 95 American firms' annual reports show that environmental disclosures in annual reports not related to Superfund information increased after the advent of Superfund disclosures (Patten, 2000). Social and political pressures to legitimize operations may explain the disclosure increases.

Not all studies support legitimizing behavior. For example, Freedman and Stagliano (2008a) analyze the toxics release inventory (described previously) and find no relationship between high-volume polluting companies' pollution and the degree of their environmental disclosures in other sources. They also find no relationship between the companies' amount of carcinogenic releases and their environmental disclosures in financial statements. Also, Freedman and Stagliano (2008b) find mixed results for companies with coal-fired factories that need to comply with provisions of Phase 2 of the US Clean Air Act (sulfur dioxide emissions reduction). Companies disclosed little in advance on their efforts to comply with Phase 2. The 1999 disclosures appeared associated with companies in jeopardy of meeting Phase 2's 2000 compliance date, yet 2001 disclosures were not linked with emissions levels but were linked

with an impending deficit of sulfur dioxide trading allowances. Thus, motivation for disclosure seems vague.

Legitimizing activities are often cited to interpret data from developing countries. de Villiers and van Staden (2006) find environmental disclosures in South African companies increased from 1994 to 1999, but then decreased for both general and specific environmental disclosures until 2002. They suggest that the decrease was a form of legitimizing strategy because companies perceived less pressure from stakeholders to legitimize their operations, and thus less environmental disclosures were deemed more beneficial. This explanation may explain why American utilities disclosed less (although not significant) Clean Air Act information in 1995 (the beginning of the first phase) than when the Act's major amendments were passed in 1990 (Freedman *et al.*, 2003); there was more legal risk uncertainty in 1990 shortly after the regulation's passage than in 1995, when utilities were more confident of complying with the new regulations. Other empirical evidence suggests that the political pressure to disclose environmental information can be mitigated. Cho *et al.* (2008) find a positive correlation between oil and chemical companies' political campaign contributions and congressional votes against more stringent environmental disclosure legislation, suggesting that companies use political tactics to limit disclosures. As a result, fewer disclosures are required to legitimize the companies.

Legitimization may also explain why firms give systematically inaccurate environmental expenditure projections. Patten (2005) finds no association between financial report environmental disclosures for projected pollution management equipment and their actual eventual environmental expenditures. Results suggest these environmental projections have little value due to non-compliance of proper environmental disclosures and disingenuous projections are used for legitimacy purposes (Laufer, 2003). "Hidden" environmental costs provide another explanation for inaccurate environmental information. Joshi *et al.*'s (2001) analysis of steel mills reveals that only about 10 per cent of environmental statutory compliance costs get explicitly classified as such; the rest are embedded in other accounts. Interviews with company personnel reveal they largely underestimate the extent of the embedded environmental compliance costs compared to actual expenditures.

Associations between disclosures and performance

A second general category of archival research explores the relationships between environmental disclosures, environmental performance, and/or financial performance. Overall, the results vary in the direction and magnitude of these associations. Li *et al.* (1997) find increased disclosures of environmental information when firms are more likely to pollute, when stakeholders become more aware of the firms' environmental liabilities, and when threats to obtaining regulatory costs decline. Cho *et al.* (2006) find that companies with higher political lobbying efforts have increased environmental disclosures and lower environmental performances, suggesting a management strategy to influence environmental regulatory procedures. Patten (2002) finds a negative correlation between environmental disclosures and environmental performance, and the correlation is more pronounced among firms in non-ESIs. Social and political pressures may explain the negative correlation. Bad environmental performance leads to pressure to disclose, and ESIs are not affected as much by this pressure because they already receive more scrutiny.

Sociopolitical pressures may also help explain findings of negative correlations between environmental footnote disclosures and both American firms' level of business outside of the USA (fear of being perceived as a polluter) and firms' earnings volatility (fear of bad news exasperating low-earnings periods; Karim *et al.*, 2006). Cho *et al.* (2010) find a similar usage of disclosures when considering the language of US annual reports; the worse the corporate environmental performance, the more optimistic and vague the environmental disclosure language in the entity's annual report.

Al-Tuwaijri *et al.* (2004) find different results from Patten (2002) when they consider endogeneity among environmental performance, financial performance, and environmental disclosures. They find positive links, suggesting that environmental stewardship and economic success do not have to be adversarial objectives (see Frooman (1997) and Orlitzky *et al.* (2003) for meta-analyses providing general support for a positive relationship between corporate socially responsible behavior and financial performance). Ruf *et al.* (2001) use stakeholder theory to explain a broader positive link between corporate social performance and financial performance, suggesting that firms better serve their shareholders when they address other stakeholder concerns. Indeed, environmental disclosures on company web sites suggest that companies perceive environmental issues as a competitive advantage instead of a regulatory burden (Jose and Lee, 2007). In contrast to the above results, Murray *et al.* (2006) find no relation between UK companies' stock returns and their environmental and social disclosures. However, there was a positive relationship between a company's level of disclosures and the consistency of their financial returns (i.e. high disclosure levels correlated with consistently high returns, and vice versa).

In another study on market reactions, Blacconiere and Northcut (1997) show that the market-valued environmental disclosure information surrounding US environmental regulations in 1986 (the Superfund Amendments and Reauthorization Act). Specifically, chemical companies with pre-1986 environmental disclosures received better market reactions compared to companies with environmental cost information disclosed by the EPA relating to the legislation and indicating greater environmental cost risks. Investors seem to view corporate disclosures as an indicator of the company adequately mitigating environmental cost risks such as regulatory burdens. This finding supports Blacconiere and Patten's (1994) earlier analysis of a different critical event – the 1984 Union Carbide chemical leak incident in Bhopal, India. In this study, investors also appeared to respond more favorably (i.e. not as negatively) to chemical companies that disclosed environmental information more thoroughly before the incident occurred. Magness (2010) echoes this favorable response to prior environmental disclosures in a study on investor reactions to an accident in the Canadian mining industry. In this study, investors react particularly favorable (i.e. moderate negative reactions) to companies disclosing that they have upper level company involvement in environmental issues. In a sample of pulp and paper companies, Clarkson *et al.* (2004) show that environmental capital expenditures yield gains for low-polluting companies, but not their high-polluting counterparts. Also, investors utilize data on companies' environmental performances to assess future environmental liabilities that are yet to be recognized.

Clarkson *et al.* (2008) attempt to resolve tension in the different frameworks used to explain the link between environmental disclosures and environmental performance. Specifically, they conclude that US companies involved in ESIs have a positive relationship between voluntary environmental disclosures and

environmental performance. These findings support economic theories of discretionary disclosure and not social-political frameworks such as legitimacy theory. However, for companies experiencing pressure for better environmental performance by external stakeholders, the social-political frameworks do provide a structure for predicting disclosures of environmental information when the company has not made a hard commitment to disclose the information.

Overall, archival environmental accounting studies have tested, with much success, the legitimacy framework's ability to support the pattern of environmental disclosures observed among companies. One consequence of the evidence supporting legitimacy theory results in the possibility that firms disclose environmental information simply to gain permission from society to operate. Thus, if society is appeased by only a firm's level of information disclosure (i.e. words but not necessarily action), then improved environmental performance cannot be a guaranteed outcome. This may explain the studies that found no association (Walden and Stagliano, 2003) or failed to find a positive (Patten, 2002) correlation between environmental disclosures and environmental performance. However, other studies reviewed find a positive relationship between disclosure and performance (both environmental and financial), which would support more economic-based disclosure paradigms (i.e. firms disclose because they can back up their information claims, thus it is their competitive advantage to disclose) compared to socio-political frameworks such as legitimacy theory (Clarkson *et al.*, 2008). Model misspecification, e.g. not considering endogeneity among the variables, may be driving these conflicting results (Al-Tuwaijri *et al.*, 2004), so this debate would benefit from more research.

Advantages of archival research methods include analyzing data from a broad portion of the test population, so results can be fairly generalized to the whole population. Since financial data usually captures consistent and high-quality information, archival methods are a good approach to addressing financial environmental accounting inquiries. However, an archival study can only suggest correlations between two variables because the variables are not manipulated and isolated (i.e. "turning one dial at a time") (Shadish *et al.*, 2002). Thus, the archival method cannot show causation as well as why an association between variables exists.

Case and other qualitative methods

SEA researchers employ case studies^[4] and other qualitative methods to gain detailed and unique insight from the practitioner perspective (Table I, Panel C). This local and particular knowledge sharing can greatly benefit entities wishing for a starting point on how to address environmental issues. For example, Bartolomeo *et al.* (2000) use interviews with case studies to assess the state of environmental management accounting systems among European companies. They find environmental cost accounting initiatives to be sporadic, and future implementations may be more successful with smaller, economically justifiable approaches as opposed to major changes in environmental cost systems. A more detailed European case study to consider is Masanet-Llodra's (2006) study on a company in the Spanish ceramic tiles industry. She finds environmental accounting systems to be used more extensively for internal planning compared to external disclosures. Companies may be reluctant to disclose the information because of what the information signals to interested stakeholders about the company's environmental performance. This reluctance to disclose

contradicted the company's claims to be eager to disclose environmental information to stakeholders.

Lodhia (2003) interviews accountants in Fiji and finds similar results to the above studies, noting that low levels of participation in environmental accounting activities relate to inadequate environmental expertise among accountants and limited mandatory disclosure requirements. However, Kuasirikun (2005) finds a more positive disposition towards developing SEA practices among Thai accountants. The various results seem to be influenced by local cultures, traditions, politics, and the sophistication of established accounting and business institutions in these regions.

Not all environmental accounting implementations end in success, but valuable lessons and knowledge can still be gleaned by studies of unsuccessful attempts to incorporate environmental accounting initiatives within traditional accounting information systems. For example, Ball (2005) analyzes a local UK Governmental entity to show how the implementation of environmental accounting concepts may provide a catalyst for organizational change regardless of the implementation's ultimate success. The change occurs via factors resulting in the "deinstitutionalization" of the organization's structure. Also, Herbohn (2005) chronicles an Australian Governmental entity's unsuccessful attempt to incorporate environmental externalities into the entity's accounting system (the damages cost method). Managers and stakeholders differed on if and how environmental values should be converted to financial metrics for analysis. Other hindrances included costs and complexities of the valuation methods.

In another full cost accounting case study (with a quasi-experiment added), Antheaume (2004) explores the implementation of three different full cost environmental accounting methods at a company, finding that the avoidance cost method may be inconsistently higher or lower than the damages cost method. Regardless of the cost method used, society does not cover the difference between recorded costs and actual environmental harm. Environmental degradation is suggested as evidence of this claim. One way to better capture environmental degradation includes having a better understanding of an entity's natural assets inventory, such as wildlife. Jones (2003) accomplishes this by reporting on a mostly successful implementation of an ecological accounting model aiming to account for an entity's impact on biodiversity.

In addition to describing real-world actions, case studies can also explore frameworks (such as legitimacy theory) to help place these actions in local and particular contexts. For example, Cho (2009) analyzed a large oil company's communications in the wake of two environmentally damaging incidents. Company communications attempted to legitimize its existence via image enhancement, disclaimer, and deflection tactics. Stakeholder interviews revealed negative perceptions of the company's actions, suggesting their legitimizing actions were ineffective. In another case study, Rahaman *et al.* (2004) find a Ghanaian public entity's legitimating actions increased its environmental accounting costs, ultimately making its services unaffordable to the local people it was established to serve.

Stakeholder perceptions provide informative insight into the effectiveness of environmental disclosures. For example, Solomon and Solomon's (2006) interviews with institutional investors reveal the utility of private communications of social, ethical, and environmental (SEE) disclosures. More informative and effective private SEE disclosures help compensate for perceived inadequate public disclosures used in making informed decisions. A dialogic process continues to develop among entities

and stakeholders (Bebbington *et al.*, 2007), wherein companies become more proactive in providing stakeholders' desired SEE information. This process ultimately informs and enhances the entities' public disclosures.

Dey (2007) uses an ethnographic approach to chronicle an organization's attempt to implement SEA procedures. Similar to Ball (2005) and Herbohn's (2005) findings, the implementation failed, but the process contributed to fundamental changes within the firm. However, not all of these changes were good, as there were concerns that the social accounting system was having the opposite effect of being used to reposition the company away from its core altruistic values. Thus, Dey's account considers business factors that may interact or reduce an implemented SEA system's effectiveness in achieving business changes.

Perez *et al.* (2007) compliment Dey's finding on organizational change for environmental issues with interviews of companies utilizing a specific environmental management system, the European Community's Eco-Management and Audit Scheme. This scheme affects environmental-related business changes via employees' awareness of and training in the company's environmental issues. Other factors include inter-department cooperation, managerial dedication, environmental cost accounting applications, and environmental considerations in strategy development. Indeed, a US survey supports the importance of organizational and management dedication in achieving good environmental performance (Wisner *et al.*, 2006).

In another example of case studies using frameworks consistent with other research methods to help explain results, Islam and Deegan (2008) use interviews and content analysis with executives from a company operating in a developing country (Bangladesh) to reveal stakeholder pressures on their social and environmental disclosures. These pressures lead to an increase in company disclosures. The findings support legitimacy, stakeholder, and institutional theories as frameworks for analyzing companies' environmental disclosures (see de Villiers and van Staden, 2006, for another study that uses the legitimacy framework in a developing country context).

Advantages of case studies, interviews, and ethnographic approaches include a more detailed analysis of a particular business or governmental operation or process. Compared to archival methods, these qualitative methods allow for more diverse and in-depth inquiries, something that garners particular importance with relatively new interest in environmental cost accounting issues and related environmental management decision making. A limitation to qualitative methods includes relatively small sample sizes, which may restrict the findings' generalizability to include only entities with characteristics that are represented in the study's sample. Also, causality is difficult to show since variables are not manipulated (Shadish *et al.*, 2002). Nevertheless, these methods may be especially beneficial to SEA research because they provide real-world examples of how entities adapt to environmental accounting issues.

III. The case for experimental studies

Experimental studies manipulate variables of interest while controlling for other variables (Falk and Heckman, 2009). Few published environmental accounting studies employ experimental methods (Table I, Panel D); experimental studies could represent as low as 1 per cent of the SEA literature (Parker, 2005). Kennedy *et al.* (1998) manipulate the information description of environmental liability disclosures (none, minimum, maximum, range, or best estimate). Participants anchored on the description,

resulting in different perspectives on an experimental company's investment risk and the extent of the company's environmental liabilities. Specifically, participants given the "maximum" description of a company's environmental liability disclosure perceived more company risk than those given the "minimum" description. This is important for environmental disclosure policies because many disclosures require the minimum value of an environmental liability. One possible result is a misapplication of the minimum value due to anchoring by underestimating the actual maximum value of an environmental liability.

In another study on manipulating environmental disclosures, Chen *et al.* (2010) find that disclosing negative future regulatory environmental information over the internet leads to lower litigation awards. These awards are reduced even further when the environmental information's display is visually augmented and improved. Disclosing environmental and social information on more media rich web site designs have also been shown to improve user perceptions of trust to depend on an entity's own disclosed information, as well as positively view the entity's actions on environmental and social issues (Cho *et al.*, 2009). Milne and Patten (2002) place participants in an investment setting and show that companies can disclose positive environmental information in their annual reports to mitigate negative investor reactions to required negative environmental disclosures relating to Superfund laws. This mitigation only occurred in experimental settings for a long-term investment strategy; the positive information actually made the negative investor reactions worse in short-term investment scenarios (suggesting a reward for short-term risk for the offending company?). These studies help provide cognitive explanations for how environmental information is utilized when making managerial, investment, and legal decisions.

Kaplan and Wisner (2009) find balanced scorecards that use a fifth perspective to consolidate unique metrics may lead to less decision weight of those metrics compared to spreading the data throughout the traditional perspectives unless management emphasizes communication of the unique strategic objective. Emphasizing the management communication had no impact on evaluations when the unique strategic objective's data were spread out over the traditional four scorecard perspectives, thus showing the importance of emphasizing the strategic objectives via management communications. The information used in a fifth perspective and management communications were based on environmental information, so this finding would benefit managers considering whether to include environmental information within traditional balanced scorecard perspectives or create an extra fifth perspective containing only environmental information.

The above studies show how experiments can contribute to the SEA literature. One way to view environmental accounting experiments is that the laboratory settings create "imagined ecologies" that provide insight on how to better account for environmental information. Experiments allow for the manipulation of one variable while holding other variables constant. This shows how one variable's manipulation (the independent variable) changes another variable (the dependent variable). This causality cannot be shown as clearly or definitively in archival or case study methods because the researcher does not systematically manipulate one variable while holding other variables constant (Shadish *et al.*, 2002)[5].

Because experiments manipulate one or more variables of interest, they can explore underlying psychological phenomena to explain various behaviors resulting

from cognitive processing of accounting information (Libby *et al.*, 2002). This approach allows for testing of causality between higher order constructs by designing experiments with variables that operationalize the constructs under investigation. For example, a researcher might investigate the link between the constructs “data organization” and “decision outcome” when analyzing environmental data. One way to operationalize data organization includes manipulating data in a four- or five-perspective balanced scorecard (this example is a simplified version of Kaplan and Wisner, 2009), and management evaluations of these data can represent decision outcome. The psychological framework used to explain the relationship between the variables can be that similar items grouped together for analysis that give a consistent signal are discounted more than when analyzing the items separately. In other words, decision makers analyzing grouped data use a “divide and conquer” decision heuristic (Shanteau, 1988). The result should be that less decision weight on the “similar” data would occur when the data are grouped together for analysis (in a fifth scorecard perspective) compared to when the data are scattered throughout the other scorecard perspectives. Experiments are ideal for testing the asserted causality between variables.

Experiments also contain an advantage for analyzing future courses of action. Using Kaplan and Wisner’s study as an example, their findings help managers using a scorecard determine whether they want to use four or five perspectives in future evaluations. Experiments’ ability to “look forward” to imagined possibilities can serve as a public interest function by informing current policy debates on proposed accounting changes. For example, one of Financial Accounting Standards Board’s (FASB) current projects involves developing guidance on accounting for emissions trading schemes (Mills and Kuhaneck, 2009). Experiments can provide deeper insight on how FASB should proceed on future guidance by exploring issues such as individual decision making with management (e.g. how to disclose certain information where environmental accounting standards allow flexibility), investors (e.g. how different environmental disclosures affect the cognitive processing of information as well as the investment decision outcome), and auditors (e.g. how auditors conduct different auditing tests on environmental accounting standards, as well as assess the effectiveness of these tests).

Experiments have distinct advantages and disadvantages. Experiments usually require higher sample sizes than case studies. Experimental findings have reduced generalizability compared to archival findings (i.e. external validity concerns; Swieringa and Weick, 1982), but increased generalizability compared to case studies. Another generalizability issue is whether experiments are so controlled in a laboratory setting that their results do not carry any meaning compared to a case study or ethnographic research immersed in a real-world scenario. Thus, data from experiments are not as “rich” as data from methods such as case studies.

IV. A proposed model of useful areas for the application of experimental methods in environmental accounting research

Experiments can help address environmental accounting issues that currently receive little attention in the SEA literature. Specifically, psychological factors may cognitively impact the effective utilization of environmental accounting information. Experiments are uniquely designed to explore these issues because laboratory settings can be used to create specific cognitive processes and to observe how these processes impact

the evaluation of the accounting information. Other research methods, such as archival and case studies, can report the end result (e.g. evaluation result or decision reached), but they are less able to determine what cognitive mechanisms led to the particular result observed. For example, Herbohn's (2005) case study documented the unsuccessful attempt to include environmental externalities in a governmental entity's accounting system. Experimental methods can provide more insight on how to make the next attempt be successful by exploring methods and conditions in which externalities can be presented, accepted, and effectively utilized by the various stakeholders.

Understanding how environmental accounting information gets processed is important because this knowledge can be used to help ensure that the data are used as intended in a decision setting. Since environmental information may be unfamiliar to end-users (Brown *et al.*, 2005), it remains a special challenge to better understand how to integrate these unique data into an accounting information system so that inhibitive cognitive factors do not decrease effective information processing. As firms and entities focus more on integrating environmental accounting information into their information systems (Antheaume, 2004; Ball, 2005; Dey, 2007; Herbohn, 2005; Masanet-Llodra, 2006), it would be useful for studies to explore factors that may provide a better understanding of how to more effectively implement environmental accounting information systems. This understanding is crucial for those wishing to produce environmental data while being sensitive to multiple stakeholder perspectives. Thus, this paper proposes a model of useful areas for the application of experimental methods in environmental accounting research that is designed to advance efforts to create sustainable environmental accounting information systems (Figure 1).

The model advances important factors that a researcher may wish to consider when designing an environmental accounting experiment. To summarize the model, an entity's environmental strategy impacts the environmental information system's design, which in turn influences the evaluation effectiveness of a decision that involves environmental accounting information. Stakeholder influences impact the type and magnitude of the entity's environmental strategy. Management communication of environmental issues moderates the influence of strategy on the environmental accounting information system. Management communication of environmental issues and evaluation scale moderates the influence of the information system on evaluation effectiveness. The model is explained more fully below. Prior literature is cited to justify

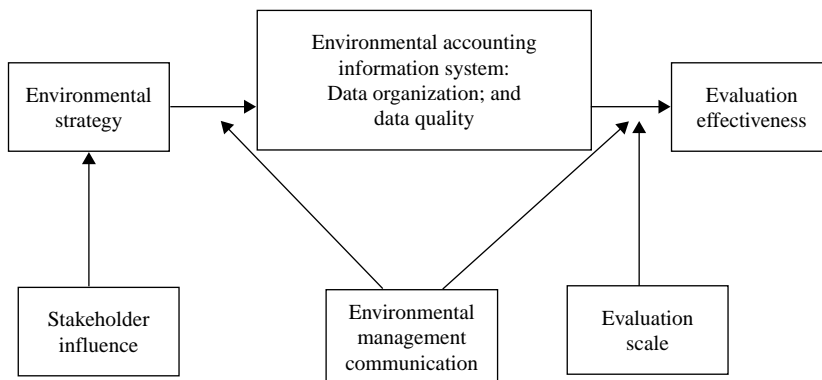


Figure 1.
A model of useful areas for
the application of
experimental methods in
environmental accounting
research

the importance of the model's factors and to highlight their considerations in past environmental accounting research. In addition, the paper discusses how experimental methods can extend and enhance knowledge of how these factors affect both the development of environmental accounting information systems and a decision maker's processing of environmental accounting information.

*Factors influencing environmental accounting information system design:
environmental strategy and stakeholder influence*

An entity's environmental strategy indicates both the entity's dedication and motivation to incorporate environmental stewardship in its daily activities; this may affect both external and internal reporting demands of an environmental accounting information system. A firm only interested in legitimizing its actions to society or appeasing its stakeholders (Islam and Deegan, 2008) may outfit their information system differently than a firm that finds it economically beneficial to aggressively pursue an environmental stewardship strategy (Clarkson *et al.*, 2008). Also, governmental and not-for-profit entities may have different considerations from for-profit firms when developing their environmental strategies since no profit motive exists (Ball, 2005; Herbohn, 2005). Even within governmental agencies, strategies will vary depending on whether an objective relates to environmental stewardship of the agency's actions or establishment and enforcement of environmental regulations (Cormier *et al.*, 2004) for a model on corporate environmental reporting, which considers company management assessments of stakeholder influences on a company's environmentally related actions).

Stakeholders' power (or lack thereof) to influence an entity's actions can impact the entity's environmental objectives and strategies (Aerts and Cormier, 2009; Darnell *et al.*, 2009; Magness, 2006; Neu *et al.*, 1998). Communications from an entity's management concerning environmental issues may positively or negatively impact the development of a system, as noted in a number of case studies (Ball, 2005; Dey, 2007; Herbohn, 2005). Thus, an entity's strategy towards environmental stewardship will impact the environmental accounting information system developed, and the types and level of management communications on environmental issues moderate this effect.

Experimental methods can contribute to the literature by focusing on these factors in ways that extend the archival and case study findings. Specifically, the reported associations within these studies can be extended with experiments to better understand why the associations exist. Environmental strategies can be manipulated in a laboratory setting (e.g. stakeholder appeasement strategies, pro-environmental versus pro-economic strategies, etc.) to help determine which entity strategies result in certain manager decisions that influence the ways that environmental data are implemented into an accounting information system. Stakeholder influences can be manipulated (e.g. strong external pressures, weak interactions with the entity, etc.) and studied to observe how decision makers respond to these pressures when forming the entity's environmental strategy. The model suggests that the environmental strategy employed determines the way in which an entity's environmental information system is implemented.

Environmental accounting information systems

After considering how stakeholder influences and an entity's environmental strategy molds the implementation of an environmental information system, the model

emphasizes considering data organization and data quality in designing experiments on environmental accounting information systems. Relative to traditional accounting information, environmental accounting information comprises lower levels of user familiarity (Gray and Bebbington, 2001), which may hinder effective processing of this non-traditional data. This unfamiliarity may very well be contributing to the resistance organizations experience when an environmental accounting initiative struggles to make progress (Ball, 2005; Dey, 2007; Herbohn, 2005).

Experiments can explore any potential underlying psychological mechanisms that may contribute to organizational resistance (Ball, 2005) or cognitive difficulties (Kaplan and Wisner, 2009) associated with effectively using environmental data. The current literature is mainly silent on providing these types of explanation; experiments have the potential to extend the literature by determining why certain behaviors and decisions are observed.

To provide an example of psychological factors that may be important to explore in an environmental accounting context yet does not receive much attention in the extant literature, consider the following about the nature of environmental data. The organizational display of environmental data, and their combination with non-environmental metrics, warrants a particular and unique concern to decisions involving environmental information because of the unfamiliarity and potential complexity of this non-traditional data. Different types of data organization and different levels of data quality are well-known factors that impact the cognitive processing of information (Schkade and Kleinmuntz, 1994), so it is important to understand these cognitive influences on the capturing and presentation of environmental data in the implementation of accounting information systems. A better understanding of why behaviors and decisions occur would be helpful in determining how to mitigate factors such as cognitive biases in the processing of environmental information. Data organization and data quality are further explored below.

Data organization

The organization component of displayed data relates to the data's visual structure (Schkade and Kleinmuntz, 1994). For example, a traditional way to organize a balanced scorecard's data is to classify and present the data in four perspectives (financial, customers, internal business processes, and learning and growth). When new data are considered to be included in the scorecard, there is debate on whether the new data's organization should result in a new, fifth perspective, or whether the data should be embedded within the traditional perspectives. In Kaplan and Wisner's (2009) study, these "new data" are environmental metrics. In their experimental design, the data organization's manipulation includes a four-perspective scorecard in which environmental data embed within the traditional four perspectives, or a five-perspective scorecard in which a standalone fifth perspective isolates and groups environmental data together.

Another way to analyze data organization in an evaluative context includes considering its evaluation mode. In separate evaluation (SE) mode, alternatives are presented and evaluated sequentially. In joint evaluation (JE) mode, alternatives are presented and evaluated jointly (Fischhoff *et al.*, 1980). For example, assume a manager must analyze evaluations from three employees who are competing for the same

promotion within the firm. If the employee analyzes the candidates for promotion in SE mode, then the manager will analyze each candidate's information one at a time. She will finish analyzing the first candidate before moving on to evaluate the second candidate. However, if the manager evaluates the candidates in JE mode, then she will analyze the candidates' information together and at the same time. When alternatives are analyzed in JE mode, direct comparisons can be made between the alternatives (and thus establish a reference point) that are not available for evaluations made in SE mode.

Data quality

Another consideration of environmental accounting information system design is the environmental data's quality. Data-quality issues may hamper attempts to integrate environmental accounting issues within an entity. For example, Herbohn's (2005) case study on incorporating environmental externalities into an entity's accounting system described disagreements on how to convert environmental values into financial metrics. Data quality is an important consideration for determining what environmental accounting information can aid decision makers in evaluations (Antheaume, 2004).

The data's characteristics that alter its evaluability as an attribute largely determine data quality. Attribute evaluability refers to the difficulty or simplicity in which an attribute can be processed when making decisions (Hsee *et al.*, 1999). An attribute's evaluability may change depending on the attribute's scaling, or the measurement's scale, as well as the information available to analyze the attribute, such as descriptions of environmental liability disclosures (Kennedy *et al.*, 1998). The cognitive psychology literature has explored how different scaling may alter one's evaluation of and decisions on alternatives in a decision-making context. Examples of scaling differences include comparing decimal usage with fractions (Johnson *et al.*, 1988) and words with numeric data (Schkade and Kleinmuntz, 1994). Scaling will be further discussed later.

Attribute scales can be classified as either common or unique (Stone and Schkade, 1994). Common scales consist of measurements used regardless of the information context. For example, a rating scale of 1 to 10 can be used to describe a diverse set of data, such as customer satisfaction, car safety effectiveness, or a baseball team's fan loyalty. Unique scales consist of measurements distinctive to a specific information context (i.e. a contextually relevant scaling). Using the above examples, customer satisfaction may be measured by the number of complaints received by a customer hotline, car safety effectiveness may be determined by the annual number of reported injuries in car accidents, and fan loyalty may be represented by average attendance at the ballpark. These cognitive psychological factors are particularly relevant to environmental accounting information because their metrics usually contain characteristics that are different from traditional, financial metrics that information users are accustomed to analyzing for decision making.

Environmental information is usually non-financial or qualitative in nature. These unique scales "cost" more cognitively to accurately process compared to more familiar common scales (Stone and Schkade, 1994). To properly process these unique-scaled attributes, a decision maker must have information that provides context to the attribute being analyzed. Examples of this information include the range of a metric's values, the metric's mean value based on benchmarks, and values that represent goals or objectives for that metric. Analyzing attributes that lack this evaluability information

may lead to inaccurate assessments, improper weighting of the attributes, and ultimately inaccurate evaluations and decisions. Thus, data quality must be considered carefully when constructing an environmental information system.

It remains difficult for cost accountants to properly capture environmental accounting information, much less present the data in a meaningful way for managers to utilize (see Johnson, 1998, for a discussion on developing environmental metrics). Also, existing accounting systems do not effectively capture and display environmental data for decision making (Brown *et al.*, 2005; Gray and Bebbington, 2001), so managers may make decisions that use both traditional measurements containing adequate evaluability information and environmental measurements that do not have adequate evaluability information (and are thus difficult to evaluate). Environmental accounting information is largely unfamiliar and non-traditional, so they may not be weighted the same as traditional and more familiar financial information.

The extant literature has not explored these environmental data factors in detail, perhaps because the more utilized research methods cannot effectively and efficiently consider data quality and data organization influences on environmental accounting issues. Experimental methods can help provide insight on these issues and how they impact the capturing, presentation, and processing of environmental accounting information. Future research in these areas can use the unique advantages of experimental methods to contribute a better understanding of these concepts, resulting in a more informed academy for environmental accounting and reporting topics.

Factors moderating environmental accounting information system influences on evaluation effectiveness

This paper defines evaluation effectiveness as the degree to which an assessment that leads to a decision successfully carries out the entity's intentions and goals (e.g. good environmental stewardship). The model considers moderate that may impact how an implemented environmental accounting information system influences evaluation effectiveness: evaluation scales and management communications of environmental issues. These factors are discussed in the context that there are psychological issues that may impact the evaluation effectiveness of decisions that are based on environmental accounting information, and experimental methods can help provide better insight on these cognitive issues.

Evaluation scales consist of the manner in which decision makers make an assessment of alternatives. For example, decision makers may choose one alternative over another, or they may rate how much they like each alternative separately using a Likert scale (e.g. "on a scale of 1 to 7", with 7 meaning "strongly like" and 1 meaning "strongly dislike"). The evaluation scale used in evaluations may moderate the impact of environmental information systems on evaluation effectiveness because different scales lead to different cognitive assessments of the information.

Another factor that may moderate the influence of environmental information systems on evaluation effectiveness is how management communicates environmental strategies and objectives within the organization. Kaplan and Wisner's (2009) scorecard study emphasizes this point. In their experiment, they manipulate management communication of a unique environmental strategic objective while participants evaluate balanced scorecards with different data organizations (four- or five-perspective scorecards). They find that scorecards that use a fifth perspective to consolidate

the metrics may lead to less decision weight of the data compared to spreading the data throughout the traditional perspectives unless management emphasizes communication of the unique (environmental) strategic objective. Emphasizing the management communication led to no difference in evaluations regardless of the data's organization, thus showing the importance of emphasizing the strategic objectives via management communications. Thus, the level of management communication relating to environmental issues may moderate the impact of environmental information system design on evaluation effectiveness.

V. Conclusion

This paper reviews and synthesizes the environmental accounting literature with a focus on the accounting journals that have been the most proactive in publishing environmental accounting studies. The review is designed to demonstrate the different research methods utilized in the literature while noting a scarcity of experimental studies in the field. The advantages and disadvantages associated with each research method are emphasized, followed by an explanation of why and how experimental designs can contribute to the environmental accounting literature. Finally, this paper proposes a model for conducting experimental environmental accounting research designed to advance efforts to create sustainable environmental accounting information systems. The model focuses on areas that experimental methods can effectively explore to help extend the environmental accounting literature.

Relative to traditional accounting information, environmental accounting information has lower levels of user familiarity. As a result, the organizational display of these data, and their combination with non-environmental metrics, is of particular and unique concern. This paper analyzes how some attributes of environmental data may impact cognitive processing and decision making in order to guide future environmental accounting research and practice. This insight informs practitioners wishing to establish more effective environmental accounting information systems. The implications from this discussion also encourage researchers conducting environmental accounting experiments to consider the importance of environmental data attributes in their experimental designs, as well as other factors that may ultimately impact the evaluative effectiveness of decisions involving environmental accounting information.

The model's approach has limitations. Specifically, the model "views the world" from the entity's perspective. That is, the model assumes the individuals designing and implementing the environmental accounting information system work for the entity that creates the environmental information. Thus, an inherent bias (and expectation) exists that the workers who develop the accounting system will provide the information that best achieves the entity's own environmental (and perhaps financial) objectives. While some scholars utilize this managerialism perspective to address environmental accounting research questions (Parker, 2005), others view this approach to be ineffective because management's goals and world views may not be consistent with environmental accounting research or societal objectives (Gray, 2002; Owen, 2008). Thus, some may argue that this managerialism approach limits the model's ability to consider the information design and capturing needs of non-entity decision makers (e.g. various stakeholders). Future research can extend or modify the model to address this limitation.

It is important to note that the model proposed in this paper is for conducting environmental accounting research using experimental methods. This study does not claim a unifying framework that explains the model's components. The intent of the model is to provide guidance on factors and issues that experimental research methods may be able to effectively address in extending the environmental accounting literature; it is not an attempt to provide a vigorous theoretical, explanatory framework for the extant experimental environmental accounting literature. However, developing such a model would be a valuable contribution for future research.

This study's model provides other avenues for future research. Various types and levels of management communications on environmental issues may influence the model's variables differently. Different communications may have varying amounts of influence on different environmental strategies' impact on the development of environmental information systems. Some evaluation scales may be more effective for environmental-related decisions compared to other scales. Practitioners would greatly benefit from experiments that determine which data organizations (Alewine and Stone, 2010) and forms of data quality (Alewine, 2010) result in the most effective decisions involving environmental accounting information. These factors can provide the foundation for environmental accounting experimenters to explore future environmental policy initiatives, allowing experimental designs to "look forward" and serve as an important public interest function. Ideally, environmental accounting research will someday advance so that other scholars suggest modifications or additions to this model, or better yet, replace it altogether.

Notes

1. The latter journal was not listed in the EBSCO database, so it was excluded from the keyword search results.
2. I have undoubtedly accidentally excluded articles that deserve recognition in the environmental accounting literature; I apologize for these omissions, as they are my own error.
3. This paper focuses on the environmental accounting literature, although literature reviews in this area usually include social accounting studies as well.
4. These research method categories are artificially constructed. For example, many case studies include archival data for analysis, and thus may be considered a specific type of archival method.
5. See Falk and Heckman (2009) for a review of the how the social sciences may benefit from conducting experiments.

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