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ASSESSING INDIAN CORPORATE ECOLOGICAL INTELLIGENCE: A CASE STUDY OF SELECTED COMPANIES

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Abstract

The main objective of this paper is to establish the ecological intelligence vis-à-vis the less ecological intelligence of Indian companies and to analyze to what extent ecological intelligence influences the adoption of ecological accounting and reporting practices among Indian companies. This research began with the formulation of two hypotheses and based on them, two models were proposed. Stepwise regression was applied to test the two models of ecological intelligence and non-ecological intelligence to explore and establish the ecological intelligence of select companies. *Chi-square* test showed that the adoption of ecological accounting procedures was significantly higher in ecologically intelligent industry groups than in non-ecologically intelligent industry groups. Stepwise regression method justified the two hypotheses. The paper examines the ecological intelligence of the industry as a factor associated with the adoption of ecological accounting and control procedures. The results of the study highlight that firms should move towards triple bottom line reporting and also show how the traditional accounting information system needs to be modified to face this challenge in developing countries. The paper shows how readily ecological intelligence culture can be adopted by Indian companies.

Keywords: Ecological Intelligence; Ecological Accounting; Ecological Reporting and Auditing; Ecological Sensitivity; Ecological Management and Control.

Introduction and Rationale

A significant amount of literature has established ecological obligation as a key organizational issue in developing countries. Similarly, there is now a growing body of literature that discusses the triple bottom line concept, which forces the companies to address not only financial and economic performance but also social and ecological performance to recognize their interdependence, and to integrate them into the reporting process. Research focus on the social and accounting literature has continuously debated the need for business corporations to operate in an environmentally and sustainable manner (see for example, Thomson & Bebbington, 2007; Deegan, 2003; Gray, 2001). This body of literature has promoted the supposition that corporate ecological intelligence practices are key corporate commitments, nowadays that correspond with corporate social accountability (O'Dwyer, 2005).

The literature on this topic is broadly classified as investigating accounting practices dealing with specific issues (Rubenstein, 1990; 1991; 1992), entities (Bennett and James 1998b; Porter and van der Linde 1995; Schroeder and Winter 1997) and prescribing models or concepts that firms may consider in the introduction of ecological-related management accounting systems or procedures (Azzone et al. 1996; Bennett and James, 1997; Burritt 1997; Epstein and Roy, 1997; Krueze and Newell 1994; Parker, 1996; Russell et al. 1994; Smith and Lambell, 1997). Research studies undertaken found that corporate ecological intelligence motivated firms to undertake corporate ecological reporting (Deegan and Blomquist, 2006; Deegan and Gordon, 1996; Patten, 1992, Frost and Wilmshurst, 2000).

In spite of change in expectations, research on factors influencing ecological accounting has been limited to investigating general issues which motivate the firms to undertake ecological-related external reporting (see, for example, Belal & Owen, 2007; Cooper and Owen, 2007; Deegan and Gordon, 1996; Deegan and Rankin, 1996; Patten, 1992). Substantial previous research found that industry ecological intelligence motivated firms to undertake corporate ecological reporting (Bebbington & Thomson, 2007; Deegan and Gordon, 1996; Patten, 1992).

The arguments made by Margolis and Walsh (2003) have been explored in the expansive environmental accounting literature and factors forcing corporate ecological intelligence.

Accounting firms and global institutions efforts in standardising reporting practices are also increasing and forcing the corporate organisations to respond to the same (Owen, 2004). Further broader level of stakeholders' involvement in different environmental accountability issues has attracted research to determine the influence of particular stakeholders on corporate environmental accountability. Deegan & Blomquist (2006), Herbohn (2005), O' Dwyer & Owen (2005), O' Dwyer (2005a, 2005b) and Parker (2005) have thrown scientific focus on this emerging topic.

Over the past two decades, there has been a great deal of research in the environmental reporting practices of organisations operating in developing countries. However, there is relatively limited research on the corporate environmental accounting and reporting practices within developing countries (Islam & Mathews, 2009; Belal, 2008; Belal & Owen, 2007; Albuquerque et al. 2007; De Villiers & van Staden, 2006; Belal, 2001; 2000; Tsang, 1998; Hedge et al., 1997). Jaggi & Zhao (1996) examined Hong Kong managers' perceptions of environmental performance and environmental disclosures by their firms. Their study also examined professional accountants' perceptions of environmental disclosures. The results of the study indicate that the vast majority of manager respondents considered environmental protection to be important for Hong Kong. Teoh and Thong (1984) presented a view of corporate social responsibility accounting and reporting from the standpoint of a developing country. The study employed a personal interview questionnaire survey conducted by the authors with mainly chief executive officers in one hundred companies operating in Malaysia. Relatively, Belal and Owen (2007) used the applied interview method to study the motivation of top management towards the corporate environmental management. Most importantly, it is established that research using interviews with stakeholders is lacking (Owen, 2008)

The above studies highlight that companies operating in developing countries disclose environmental information on only on a limited scale (Belal, 2008). Further contribution is given by Villiers and van

Staden (2006) who used annual report content analysis to investigate the environmental disclosure practices of South African companies. However, there has been little application of these ideas to developing economies. It is clear that corporate environmental disclosure practices have matured in some parts of the developed world, but they remain a strange phenomenon for the developing world. In fact, these studies have not influenced Indian companies to a large extent as most Indian companies are not sensitized towards ecological responsibility.

Prior Research

Recently, a growing number of studies appear to have made significant contribution to the corporate environmental accounting reporting literature with suggestions for well-designed further research. Key research findings on the corporate environmental reporting practices of Organisations are highlighted by the following researchers.

Analyzing the impact of environmental issues on managerial accounting, implication of environmental requirements upon an entity's performance and the variables that affect environmental disclosures in annual reports were investigated by Lungu *et al.,* (2009). Share price relation to environmental disclosure was reported by Owen (2008). Bebbington and Thomsaon (2007) and Belal & Owen (2007). Cooper & Owen (2007) examined how accountability of organization towards environmental disclosure is established through democratic concern. Deegan (2007) and Kolk (2007) have introduced social and eco-justice in addition to those of eco efficiency of Organisations.

Introduction of ecological accounting by companies has been highlighted (see for example, Bennett and James, 1998a; Ditz et al. 1995; Epstein, 1996). A number of studies have observed that such practices have resulted in cost savings (Schroeder and Winter, 1997) and competitive advantage (Porter and van der Linde, 1995). Such research has corresponded with discussion on the development of appropriate accounting systems and the advantages of such processes and increased attention on triple bottom line reporting by entities (see for example, Dow Chemical's Public Report, 1999; and Shell Report, 1998; 1999; 2000 for the progression of this concept

in a business entity), and in the literature (Atkinson, 2000; Bennett and James, 1997; Ranganathan, 1998; Ranganathan and Willis, 1999; Sharma 1999; Whittaker, 1999).

There has also been considerable discussion of the role of the accountant and accounting in ecological management (see for example, Barbera 1994; Burritt and Gibson, 1993; Kestigian, 1991; Milne, 1996; Willits and Giuntini, 1994). The emphasis has been on activities where accounting can assist in improving ecological management; for example, the identification and allocation of ecological-related costs (Burritt, 1997; Krueze and Newell, 1994), the accountants' role in strategic management (Smith and Lambell, 1997), in capital investment decisions (Epstein and Roy, 1997), or as an extension of the traditional audit function (Label and Tandy, 1998).

The research surrounding the triple bottom line and sustainable development is part of an evolving discussion of the importance of the firm in achieving a more holistic level of accountability. There is also a growing recognition that traditional accounting practices are not able to provide this accountability. The measurement of the three aspects of the triple bottom line (financial/ economic performance, ecological performance and social performance), and their integration has elevated the accounting profession.

The major focus of environmental accounting research within the context of developing countries has been confined to general descriptions of corporate environmental disclosure practices on a limited scale. During the period of the 1990s to 2000s there was a notable absence of research contribution to the environmental accounting and disclosure practices from the perspective of developing countries.

Application of environmental accounting by Indian companies is not well demonstrated, as it is not mandatory on the part of Indian companies. Even some companies are voluntarily disclosing their contribution towards safeguarding the environment via annual reports, but they are not uniformly structured and the accounting for and disclosing of environmental responsibility are left to the discretion of the companies. On the other hand, the concept of being ecologically sensitive is borrowed by some Indian companies too even though it is not mandatory in India (Rao, 2000). Fast growing companies like SAIL, CCI, BHEL, TISCO, TATA MOTORS,

WIPRO, NTPC etc. have made some efforts in disclosing their contribution towards nature in response to the demands from different stakeholders.

Corporate ecological responsibility is increasingly used as a significant tool for assessing overall performance of an organization whose operations are influencing the ecological well-being of the nation at large. Environmental accounting is increasingly regarded as supplementing new dimensions of corporate financial accounting and reporting, facilitating disclosure on protection of nature. Environmental accounting is important at the national level too as it presents the conservation of a nation's common resources by the organization. Therefore, it is accepted that environmental accounting is considered as a new approach towards financial reporting it answers these questions: who is responsible for protecting the natural resources and how?

The concept has been well accepted and is being used in several developed countries as a useful measure for establishing firms' contribution towards nature. Literature on the application of environmental accounting in developing countries is only beginning.

It is surprising to note that very little research is available on environmental accounting and reporting practices of Indian companies (Dutta, 1993; Mishra et al. 1997; Rao, 2000; Banerjee, 2002; Sarkar, 2004; Chauhan, 2005; Prasad & Sandhya, 2008; Prakash, 2006; Roy, 2008; Pal, 2011; Qureshi et al., 2012).

This can perhaps be an indication that environmental accounting is not popular amongst the Indian companies, but is more likely to be an indication that accounting researchers should focus more empirical research on corporate environmental accounting and reporting practices of Indian companies by providing a a tool kit of guidelines.

The present study contributes to the body of knowledge through an analysis of the adoption of ecological accounting and disclosure practices by India companies. In this study, it is hypothesized that firms operating in the more ecologically intelligent industries will have developed more comprehensive ecological accounting practices than firms in less ecologically intelligent industries. Exploring these hypotheses, this paper is designed as follows. A review of ecological accounting is furnished in the first section. Second, hypotheses are stated with respect to the relationship between the

development of accounting practices and the ecological-intelligence of the firm. Data analysis and results are shown in the third section. Discussion and conclusions are drawn from the analysis in the final section.

Objectives and Hypotheses

The increased attention on ecological issues has drawn more heavily on those companies which are identified as more ecologically sensitive entities engaged in the natural resource, petroleum, manufacturing and the chemical industries (see Lungu et al. 2009, Owen, 2008, Deegan, 2007). As a result, the industry in which the firm operates has been identified as a factor influencing the level of corporate social disclosure, although the justification for such influence has been shown to be varied (see for example, Cooper & Owen, 2007; Deegan & Blomquist, 2006; Herbohn, 2005; O' Dwyer, 2005; Parker, 2005; O' Donovan, 2002; Milne & Patten, 2002). The observed variations in the level of social responsibility reporting are possibly due to a number of influences; for example, different regulative ecological, community perceptions and expectations of performance (Kolk, 2008, Frost & Wilmshust, 2006; Moneva et al., 2006), or industry membership as a major source of a firm's public exposure, or political visibility (Kelly 1981; Panchapakesan and McKinnon, 1992; Patten, 1991; Roberts, 1992). It can be anticipated, therefore, that a firm within the retail industry will have different ecological management procedures and policies than a similar sized firm in the extractive or chemical industry. In other words, the activities undertaken increase the scrutiny of the firm by a diverse group of interested stakeholders (Owen, 2008).

Research on ecological reporting practices has not explored the internal corporate practices necessary to support such reporting practices. Firms operating in the more ecologically intelligent industries are faced with increased pressure to improve ecological performance. Moreover, the management in more ecologically intelligent industry groups is more likely to identify ecological performance as important, and to divert resources to improve ecological-related performance (Altenburger Schaffhauser-Linzatti, 2007)). In these firms, it would be expected to find a more formal ecological management system, thereby placing the firm in a better position to assess environmental information for the external reporting process. Observation

of increased reporting by firms operating in ecologically intelligent industries may then be a function of both increased demand for ecological related information, and a corresponding increased sophistication of an ecological management system that generates such information (Deegan, 2007).

With the above background, this research was designed to meet the following objectives:

1. to demonstrate the present practice of ecological accounting and reporting practices among Indian companies.

2. to establish the ecological intelligence of Indian Companies visa-a-vis less ecological intelligence of companies.

3. to analyse to what extent ecological intelligence influences the adoption of ecological accounting and reporting practices among Indian companies.

4. to provide a platform for further research and to stimulate Indian companies to adopt ecological accounting and reporting practices.

To fulfill the above objectives, the following hypotheses were formulated.

H1 Companies in ecologically intelligent industries are more likely to introduce ecological accounting procedures than firms in less ecologically intelligent industries.

H2 Companies in ecologically intelligent industries are more likely to externally disclose ecological information than firms in less ecologically intelligent industries.

The above two hypotheses led to the construction of the following two models for testing:

1. to form the relationship between internal ecological accounting procedures and the ecological intelligence of the companies.

2. to establish the relationship between ecological intelligence and the degree of disclosing ecological information in annual report.

For the above two models, variables concerning internal ecological accounting procedures were considered as independent variables and the score of the company on its ecological intelligence was considered as the dependent variable. Accordingly data were collected.

Research Methods

The study considered the adoption of ecological accounting procedures by select Indian companies, hypothesizing that companies in the more ecologically intelligent industry groups are more likely to have adopted such procedures.

For the purpose of selecting the corporate ecological intelligence firms, this study identified 130 companies trading on the Bombay Stock Exchange and National Stock Exchange (representing companies from different industry groups) whose operation are environmentally sensitive as grouped by the Pollution Control Board of India.

The study considered the following five broad perspectives of corporate ecological intelligence for testing the two hypotheses and for verifying two models developed accordingly (Figure 1). Further, each broad factor was divided into sub factors influencing corporate ecological sensitiveness.

1. the companies provide ecological information to some extent through formal accounting information system (Guthrie et al., 2007)

2. the companies tend to practise formal accounting procedures for select ecological issues generated (Deegan, 2002; Mathew, 1997).

3. the companies practise cost-benefit analysis of various variables account for broad environmental issues and accounting for resulted variations accordingly.

4. the companies tend to practise ecological audit of their activities (Albuquerque et al., 2007).

5. the companies tend to disclose ecological information to the different stakeholders through various sources of disclosure (Lungu et al., 2009; Owen, 2008; Prasad & Sandhya Sri, 2008; Parker, 2005).

The influence of all these factors and their respective sub-factors with the corporate ecological sensitiveness is explained in Figure 1. Integration of ecological information into the existing information depends on other factors like budgeting system, capital budgeting, performance appraisal information and investment reporting. Ecological investment appraisal and risk assessment information are also considered to be important factors to integrate ecological communication into the existing information.

Ecological reporting is considered to be the important factor to influence corporate ecological sensitiveness. Reporting should be done either through annual reports or reporting other than annual reports. Since ecological reporting is not mandatory in India, in this study, ecological reporting other than annual reports was also considered.

The concept of ecological cost-benefit is altogether a new concept to Indian firms. To be ecologically sensitive, the firm should adopt the practice of weighing costs and benefits of its operations from the ecological point of view. For the purpose of this study, seven sub factors were identified for weighing costs and benefits from the ecological view point.

The ecological audit of a firm's operation needs to be initiated. For this purpose, this study considered waste audit, energy audit besides general ecological audit as important components of ecological audit, which is a key factor in corporate ecological sensitiveness.

Standalone accounting procedure which is an important component of ecologically sensitive is highlighted in this study. The study identified ten sub factors considered to be important components of ecological accounting.

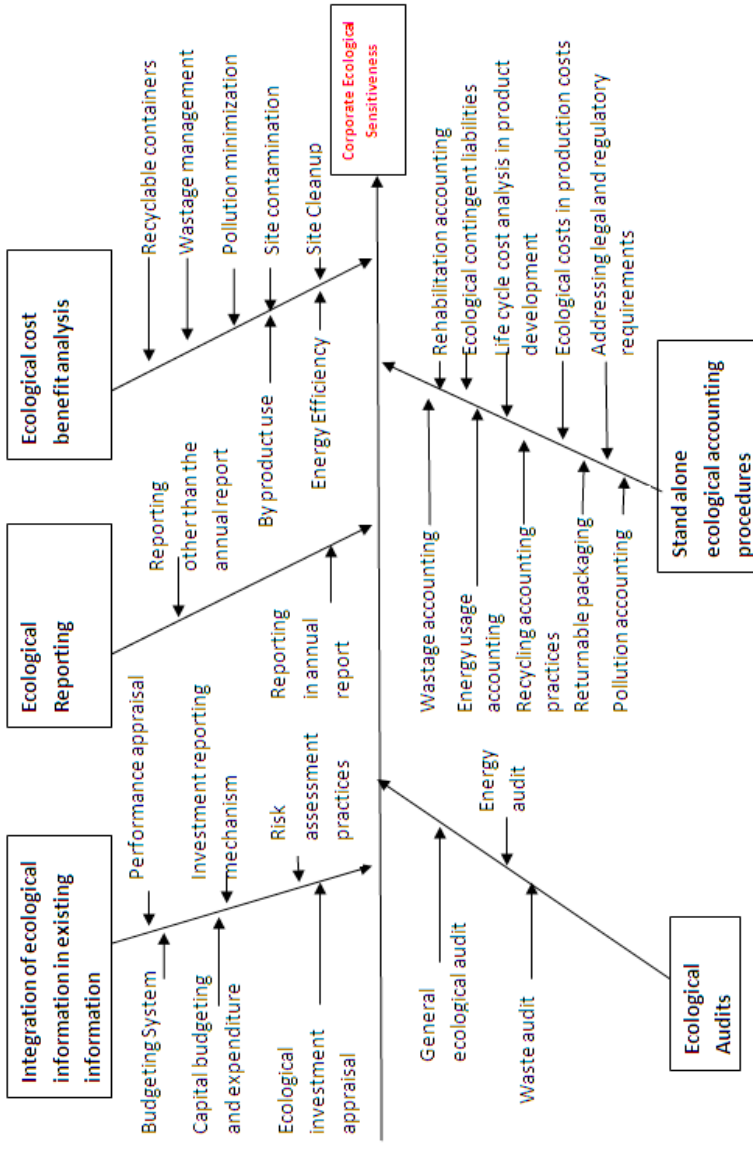

Figure1: Cause and Effect Diagram of factors influencing corporate ecological sensitiveness

Data for this study were collected through a mailed questionnaire posted to each of the Chief of Accounting and Finance Departments of 130 Indian Companies listed on BSE & NSE companies in October 2009. The Chiefs of the Accounting and Finance Departments were selected as they are

responsible for overseeing the overall accounting functions within their companies and have knowledge of ecological issues addressed by the companies.

In total, the questionnaire was posted to 130 companies, and 91 responses were returned. The final sample included 59 firms identified as being involved in ecologically intelligent industries, and 32 in less ecologically intelligent industries. Further, all the companies had some level of impact upon the environment.

The ecologically intelligent sample included 14 companies from fertilisers, 15 from chemical, 10 from petrochemicals, 12 from pharmaceutical companies, 8 companies from steel and iron manufacturing. These companies are considered as the most sensitive towards environmental issues.

A test of non response bias was undertaken by applying the early late hypotheses technique that suggests that late returns are often similar to non response.

Proximity matrix was constructed by using Euclidean distance to identify how much the highly intelligent and lesser intelligent companies differed in their response towards different ecological practices carried out in the company. The following methodology was used for calculating Euclidean distance.

Euclidean distance metric is the most popular distance function to calculate the proximity between any two points. The higher the value, more distant or more different the two points are. The equation for calculating Euclidean distance between two points 'i' and 'j' with 'p' dimensions is as follows:

$$d(i,j)= \sqrt{| x_{i1} - x_{j1} |^2 + | x_{i2} - x_{j2} |^2 + ... + | x_{p} - x_{p} |^2}$$

$$\text{i.e., } d(i,j) = \sqrt{\sum_{m=1}^{p} (x_{im} - x_{jm})^2} \sqrt{\sum_{m=1}^{p} (x_{im} - x_{jm})^2}$$

The scores obtained by different factors for ecological and non ecological industries were used to calculate Euclidean distance. The distance metric value obtained was used to quantify the difference between ecological and non ecological industry based on those factors.

Stepwise regression is a process of building a model by successively adding or removing variables based on the *t*-statistics of their estimated coefficients. This will help in understanding the relative significance of different factors that contribute to the model proposed in the hypotheses.

Stepwise regression was applied to test the two models of ecologically intelligence and non-ecological intelligence to determine the ecological intelligence of select companies.

Data Analysis and Results

The results discussed below indicate that there are differences between the more and the less ecologically intelligent firms. However, while the descriptive data identify numerical differences, they are often not statistically significant.

The data were analysed from five important aspects of adoption of ecological accounting and reporting by both ecological intelligence and less intelligent companies:

1. Introduction of ecological information within the existing accounting system, which is the first step in the adoption of ecological accounting and reporting in a company.

2. Standalone ecological accounting procedure which deals with identification, measuring, recording and the analysis of specific ecological issues.

3. Cost-benefit analysis

4. Ecological audit

5. Ecological reporting either through annual reports or other sources

The analysis of descriptive results of the survey, with an independent sample chi-*square test* portrays whether the adoption of ecological accounting procedures is significantly higher for companies classified as operating in ecologically intelligent industry groups. Similarly proximity matrix test was administered to cluster the responses of the both intelligent and non intelligent firms.

Table 1 identifies the specific areas within the management information system of the respondents' firms where ecological issues are incorporated into the existing system, which is highlighted by previous studies (see for example Owen, 2008: Belal & Owen, 2007). Based on the results from the survey, the following table portrays the commitment of Indian companies in incorporating ecological information into the exiting accounting information system.

Table 1: Integration of ecological information in existing systems

	Intelligent N= 59	Non Intelligent N= 32
The budgeting system	39	16
Capital budgeting and expenditure	45	11
Ecological investment appraisal	37	9
Performance appraisal	32	9
Internal reporting mechanisms	39	10
Risk assessment practices	50	11

The above table indicates that although a greater proportion of intelligent organisations includes ecological information within all identified existing systems, integration of capital budgeting and expenditure information is highlighted which is significant at 0.9952 ($p < 0.005$).

Stand Alone Ecological Accounting Procedures

Recently, growing interest on the part of the accounting firm and global institutions has also forced Indian companies to adopt and practise accounting for ecological issues generated (Owen, 204). Another important step in the

introduction of ecological accounting is the identification and analysis of specific ecological issues. The specific issues identified for analysis include waste, energy usage accounting, accounting recycling, returnable packaging/ containers, pollution, accounting for rehabilitation, ecological contingent liabilities, life cycle cost analysis in product development, ecological costs in production costs and addressing legal regulations.

Respondents were asked to identify if specific ecological issues were analysed by their firm's accounting information system. The data from intelligent and less-intelligent industries were analysed, and are summarized in Table 2.

Table 2: Specific ecological accounting procedure undertaken

	Intelligent N= 59	**Non Intelligent N= 32**
Accounting for wastage	28	10
Energy usage accounting	34	12
Recycling accounting practices	33	13
Returnable packaging/containers	31	12
Pollution accounting	34	19
Accounting for rehabilitation	30	7
Ecological contingent liabilities	28	6
Life cycle cost analysis in product development	22	4
Ecological costs in production costs	24	3
Addressing legal and regulatory requirements	43	11

It is clear that the adoption of accounting procedures by the more ecologically intelligent industries for rehabilitation accounting, life cycle cost analysis, ecological costs in production costs and product costing is significantly greater than for the less ecologically intelligent industries which is significant ($0.945\ p < 0.005$).

Ecological Cost-benefit Analysis

Ecological cost-benefit analysis may be undertaken on issues such as energy efficiency, by-product use, recyclable containers/packaging, waste management, pollution minimization, site contamination and site cleanup (see for example, Deegan, 2005; Schaltegger et al, 2000; Parker, 2000).

Respondents were asked to identify areas of cost-benefit analysis in which ecological concerns had been included. The data and results of analysis are summarized in Table 3.

Table 3: Specific ecological cost-benefit analysis

	Intelligent N= 59	Non Intelligent N= 32
Energy efficiency	28	18
By product use	27	11
Recyclable Containers/packaging	22	9
Wastage management	32	18
Pollution minimization	28	12
Site contamination	31	14
Site cleanup	33	10

The results shown in the above table indicate that there is a significant difference for the adoption of cost-benefit analysis of waste management, pollution minimization and site contamination at 0.05 i.e.($0.9965\ p < 0.005$, $0.9864\ p < 0.005$, $0.9912\ p < 0.005$) respectively.

Ecological audits

Bennett and James (1997) highlighted ecological impact assessment as the fifth aspect of ecological-related management accounting practices. Respondents were asked to identify whether the specific ecological audits had been implemented by their organization or not. The data on the adoption of ecological audit procedures and resulted analysis are summarized in Table 4:

Table 4: Conduct of ecological audit

Type of audit	Intelligent (N = 59)	Less Intelligent (N = 32)
General ecological audit	31	14
Waste audit	32	9
Energy audit	29	12

Table 4 indicates that a significantly greater proportion of firms in the more ecologically intelligent industries has undertaken general environmental audits (0.9963 $p < 0.005$).

Ecological reporting

Previous studies have shown that ecologically intelligent is an influential factor associated with external ecological reporting (Parker, 2005). To test that the sample examined in this study could be considered comparable to prior research that investigated industry ecological intelligence on reporting practices, respondents were asked to indicate whether their Organisations disclosed ecological information in the annual report or in other sources of external disclosure. This is displayed in Table 5.

Table 5: External reporting of ecological information

Type of reporting	Intelligent (N=59)	Less Intelligent (N=32)
Reporting in the annual report	35	14
Reporting other than the annual report	23	7

Table 5 indicates that there is a significantly higher adoption of ecological reporting practices by firms in the more ecologically intelligent industries at (0.963 $p<0.05$). This correlates with prior research on ecological reporting practices (Deegan, 2007, Kelly 1981; Mathew, 1995; Roberts, 1992).

Similarities in response for each case by highly intelligent and lesser intelligent companies were done by considering the Euclidian distance between the two responses. Proximity matrix was derived to determine the difference in response by the two companies for each case. The lesser the value, the more similar the response is.

From the above proximity matrix, there is a huge difference of opinion regarding risk assessment and lesser difference regarding the budgeting system and performance measurement and appraisal given by the respondents in respect of high and less intelligent companies.

Table 7: Proximity Matrix for Table 2

Less Intelligent Companies	High Intelligent Companies									
	Wastage	Energy usage	Recycling	Returnable packaging / containers	Pollution	Accounting for rehabilitation	Ecological continent liabilities	Life Cycle cost analysis in product development	Ecological costs in production costs	Addressing legal regulations
Wastage	262.7	---	---	---	---	---	---	---	---	---
Energy usage	---	405.2	---	---	---	---	---	---	---	---
Recycling	---	---	234.2	---	---	---	---	---	---	---
Returnable packaging / containers	---	---	---	226.2	---	---	---	---	---	---
Pollution	---	---	---	---	3.02	---	---	---	---	---
Accounting for rehabilitation	---	---	---	---	---	839.5	---	---	---	---
Ecological continent liabilities	---	---	---	---	---	---	824.2	---	---	---
Life Cycle cost analysis in product development	---	---	---	---	---	---	---	614.5	---	---
Ecological costs in production costs	---	---	---	---	---	---	---	---	980.003	---
Addressing legal regulations	---	---	---	---	---	---	---	---	---	1482.6

From the above proximity matrix, it is clear that there is close similarity of responses regarding pollution but much difference is seen in case of addressing legal regulations.

Table 8: Proximity Matrix for Table 3

Less Intelligent Companies	High Intelligent Companies						
	Energy Efficiency	By prod-uct use	Recyclable containers/ packaging	Wastage Manage-ment	Pollution Minimization	Site Contamination	Site Cleanup
Energy Efficiency	77.2641	---	---	---	---	---	---
By product use	---	129.5044	---	---	---	---	
Recyclable containers/ packaging	---	---	83.9056	---	---	---	---
Wastage Management	---	---	---	4.0401	---	---	---
Pollution Minimization	---	---	---	---	99.20	---	---
Site Contamination	---	---	---	---	---	77.2	---
Site Cleanup	---	---	---	---	---	---	609.102

From the above proximity matrix, it is surprising to note that there is much similarity of opinion regarding the waste management, but there is a difference in terms of the site cleanup.

Table 9: Proximity Matrix for Table 4

Less Intelligent Companies	High Intelligent Companies		
	General Ecological Audit	Waste Audit	Energy Audit
General ecological audit	77.2641	---	---
Waste audit	---	681.7321	---
Energy audit	---	---	135.7225

It can be understood from the above proximity matrix that there is much similarity of opinions regarding performing a general ecological audit but not much on performing a waste audit.

Table 10: Proximity Matrix for Table 5

Less Intelligent Companies	High Intelligent Companies	
	Reporting in the annual report	Other than the annual report
Reporting in the annual report	242.4249	---
Other than the annual report	---	292.41

From the above proximity matrix, it is seen that there is some difference of opinion regarding the reporting in both annual report and other than the annual report.

Stepwise multiple regression was used to test the effectiveness of the model. The combined scores of the three broad variables in case of internal procedures adopted and two broad variables in case of reporting were considered for this purpose. The results are tabulated in Table 11 and Table 12 with regard to the two hypotheses formed.

Table 11: Results of stepwise regression

Variable	B	Std Beta	F	R^2	t	Sig
Ecological accounting within existing system	.695	.706	88.403	.498	9.402	.000
Cost-benefit analysis	.375	.326	61.111	.572	4.179	.000
Ecological accounting procedures	.281	.246	48.171	.611	3.149	.002

The variable that is first entering into the equation is Ecological accounting within Existing system (F=88.403, p<=0.001)) accounting to 49.8% of variance. The other variables to enter into the equation are in the order of Cost-benefit (F=61.111, p<=0.001) with combined variance of 57.2% and

Ecological accounting procedures (F=48.171, p<=0.001) with a combined variance of 61.1%.

Table 12: Results of stepwise regression

Variable	B	Std Beta	F	R^2	t	Sig
Auditing	.632	.593	48.275	.344	6.948	.000
Reporting	.228	.314	35.323	.433	3.854	.000

The variable regarding Audit entered into the equation (F=48.275, p<=0.001) with a variance of 34.4%. The regression equation gained a variance of 43.3% with the introduction of Report variable (F=35.323, p<=0.001).

Discussion and Conclusions

The objective of this research was to examine whether the ecological-intelligence of the industry would influence the firm's ecological-related management accounting. It was therefore hypothesized that firms in more ecologically intelligent industries would adopt ecological-related management accounting procedures more frequently than the less ecologically intelligent industry group.

The results of the analysis confirmed that for the study sample, a significantly greater number of firms in ecologically intelligent industries reported ecological information (Table 5), which is consistent with prior research on reporting practices.

The analysis has reported differences between the two samples for specific activities. However, these primarily related to actions associated with the intelligent industries, such as site contamination and cleanup (Table 3) and rehabilitation (Table 2). These observations may be more a reflection of companies being active in areas that are peculiar to their industry, in which regulations are imposed, rather than a general increased commitment to ecological-related management accounting.

It is further noticed that a significant difference was observed on issues relating to ecological costs included in production costs (Table 2), and the costing system (Table 1). Firms classified as ecologically intelligent would have a greater impact upon the ecological, hence, it would be expected that they incurred greater costs associated with the ecological concerns. It is therefore not surprising to find that they are more likely to be aware of ecological-related costs.

In respect of general ecological audits, which would include compliance audits, it is not surprising to observe a significant difference due to the greater regulatory restrictions imposed upon these firms. The results on specific audits relating to waste and energy did not show a significantly higher level of adoption by ecologically intelligent industries. This may be because waste and energy usage is a significant source of cost to firms whatever their industry activities.

This research shows that for ecological issues of a general nature, there was no significant difference in the level of adoption of ecological accounting procedures. For example, no significant difference was observed in the adoption of accounting for waste, energy usage or recycling. Such issues may be considered relevant to a firm regardless of the industry in which it operates. This observation may also highlight a limitation in the dichotomous generalization of industries that does not account for specific ecological issues. Hence, the significant observation for rehabilitation (which is an issue of concern primarily for the mining industry) would be

expected, but also, it is not surprising to observe no significant difference in the adoption of accounting for recycling. Such a limitation does present itself as an area for further research using a more refined means of classifying industry, and matching with issues that are relevant to the industry.

It is witnessed that there was a significant difference observed in the adoption of ecological reporting, which is consistent with prior research. The failure then to observe a significant difference in the adoption of ecological-related management accounting practices may suggest alternate factors motivating the adoption of reporting and management systems. Additionally, it is observed that there are not clear links between the generation of accounting information and the disclosure of ecological information within the annual report in respect of sensitive industries.

The proximity matrix shows that there is a difference in the opinions of the both the intelligent and non intelligent firms in respect of two hypotheses which is in accordance with the hypotheses formed.

Stepwise regression justified the two hypotheses and showed the effectiveness of the model proposed. It is observed that the more ecologically intelligent the organization is, the more it is likely it is to adopt ecologically accounting procedures and is more likely disclose ecological information.

The results have highlighted that the level of adoption for many activities was limited. This may not be unexpected for firms operating in the less ecologically intelligent industries, but certainly raises questions of those firms in the ecologically intelligent industries. Such observations provide some support for prior discussion that has been critical of traditional management accounting in its inability to adequately monitor and allocate costs associated with ecological activities. Further research as to why firms have not identified the adoption of accounting for certain activities needs to be conducted.

It is established in conclusion, that 'ecologically intelligent' firms are more likely to adopt ecological accounting procedures which are associated with significant ecological related issues for the specific industries. Hence, this study provides conclusive evidence that the ecological-intelligence of the firm's operations will necessarily result in increased the likelihood of the

development of ecological accounting procedures. The results of this study highlight a concern as firms move toward triple bottom line reporting and raise challenges as how the traditional accounting information system will be adapted to meet the change in the nature of the reporting framework that will be required, and how readily the culture of the organisation can assimilate the change.

Notes:

Energy audit: It is an inspection, survey and analysis of energy flows for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s).

Waste audit: It is a formal, structured process used to quantify the amount and types of waste being generated by an organisation. Information from audits will help identify current waste practices and how they can be improved.

Waste accounting: It uses financial information to support waste minimisation programs and to monitor and improve efficiencies in producing goods and services.

Waste management: It is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is a distinct practice from resource recovery that focuses on delaying the rate of consumption of natural resources. All the waste materials be it solid, liquid, gaseous or radioactive, fall within the remit of waste management.

Accounting for pollution: This section of accounting deals with accounting for all types of charges/expenses invested for abating pollution commitment of the firm. Pollution accounting accounts for plantation of trees, maintenance of pollution free vehicles, maintenance of plant and machinery from emitting pollutant emissions.

Risk assessment: There is wide range of uses for environmental risk assessment and, although the specific methodology and the responsibility for carrying out the assessment may vary, the core principles and the key stages of the process are fundamentally the same in each case. Assessment of risk is a prerequisite for all kinds of capital expenditure in case of ecologically

sensitive industries. Ecologically sensitive firms initiate ecological risk assessment as a customary practice for all kinds of long-term expenditure. The firms pay more attention to various environmental hazards, where as risk assessment practices are not fully oriented to non ecologically sensitive firms. These firms in general do not practise risk assessments associated with different types of expenditure. One of the main reasons for non-implementation of risk assessment is lack of legal requirements. Most of these firms do not even disclose assessment practices.

Legal regulations: Even legal regulations are not mandatory in India, ecologically sensitive firms took voluntary lead and adopted environmental friendly measures. The same is not followed in case of ecologically non-sensitive firms. Enforcement of Environmental law is still in its infancy in India.

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