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RESEARCH ARTICLE

ENVIRONMENT ACCOUNTING: A CURRICULUM MODEL TO INDIAN ACADEMIA

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ABSTRACT

Business creates assets to self by using natural resources by creating social environmental liabilities by degradation of environment. Traditional double entry financial accounting is more concern about quantification of business transactions in terms of money. Traditional money measurement concept accounting is limited when it comes to measuring natural wealth degradation. We are behind the times... Jet pilots don't use rearview mirrors. If we want to account for the environment, it is necessary to look ahead. Developing future accountants who can measure quantitatively the environmental degradation depends on the present commerce and management teachers who have ability to understand and teach the methods to measure, costs related to environmental degradation. It is a pleasure, challenge and duty of the commerce and management faculty throughout the world in particular in India to understand the importance of implementation of environmental accounting as a part of university curriculum as a nation building exercise. The present paper aims to discuss the significance of environmental accounting in Indian university curriculum. The data required for the study have been collected from primary and various secondary sources. This research is descriptive in nature. Understanding reliable estimates of environmental damages, upstream/downstream costs of pollution, recovery from the market (carbon credit), cost of management activities, research and development costs, costs for social programs and costs for handling environmental damage will help commerce teachers to inculcate knowledge in commerce students and the government to implement the environmental accounting in the near future in India.

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INTRODUCTION

Global sustainability, Sustainability Operations, Sustainability Development (SD), Environmental Protection, Green Accounting (GA), Corporate Social Responsibility (CSR), Environmental Accounting (EV), Environmental Auditing (EA) etc., are some of the widely spoken topics of the current situation. Teachers are the pillars of a nation. Commerce and Business teachers have taught financial accounts in a well structured and conventional method. Three rules of accounting, concepts and conventions are taught at the undergraduate and post-graduate commerce related courses such as Bachelor of Commerce (B.Com), Bachelor of Management (BBM), Post-graduate in Commerce (M.Com), Master in Business administration (MBA) and other commerce related courses. The conventional method of teaching of accounts from Pre-University to Post Graduate Degree level and its relevance have its own advantages, but slowly its importance is reduced in the corporate world as there are packages such as Oracle, can handle volume of accounting transactions. It becomes need

of the hour to wake up and be aware of the changes in the corporate world and restructure Accounting curriculum in the wake of environmental degradation. The business world requires effective decision planners rather than data entry handlers. Decisions making abilities can be developed by integrating quantitative and qualitative accounting information rather studying those subjects in isolation. It is necessary to understand the importance of accounting of environmental degradation. University teachers in India have to understand the importance and incorporate environmental accounting as part of university syllabus. Various legislations on environment pollution, Accounting Standards on environment accounting, the Cost Accounting Standards on Pollution Control-14 (CAS-14) to measure and standardization of environmental degradation, Oracle Environmental Accounting and Reporting and green accounting awards, strict Pollution Control Boards' norms in measuring environmental degradation in quantitative terms will help to achieve the longstanding due of environmental accounting in India" (Muninarayanappa and Augustin Amaladas, 2013). It is a service to the nation by every commerce and management teachers to effectively to implement environmental accounting now so that the future accountants can effectively understand and use such knowledge at the working place.

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Objective of the study

This paper mainly focuses on the following major objectives:

1. To study the present trend in teaching environmental accounting in India as a part of university curriculum under commerce stream.
2. To develop and understand broader area of Environmental Accounting
3. To study the ways and means to implement environmental accounting as a part of university curriculum.

MATERIALS AND METHODS

Tools for data collection

The study mainly focuses on secondary sources such as research articles from journals, working papers, and industrial web sites. The necessary primary data also have been collected from field visits and personal observations with industry and academic experts. The present descriptive paper is designed to accomplish on experiences detailing the environmental accounting in curriculum to Indian Academia.

Limitations

1. The paper focuses only on corporate environmental accounting disclosed in the financial statements.
2. The paper focuses on teaching of environmental accounting in colleges and universities in India.
3. The designed syllabus for environmental accounting is only a model. It can be modify according to the need of industry at the time frame.

RESULTS AND DISCUSSION

“Environmental accounting is taken to mean the identification and reporting of environment related cost such as liability cost and costs related to waste disposal. It is accounting for any costs and benefits that arise from change to a firm’s products and processes where the change also involves a change in environmental impact” (The Chartered Accountant, November 2005). The environmental liabilities are defined as “The legal obligation related to management use, handling or release of potentially harmful substances and owning such substances locations (The US Comprehensive Environmental Response Act). This act is also known as “Superfund Act”. This Act was passed in 1989 in the USA which empowers the EPA to take initiative to clean up the environment by creating civil liability on the polluters, recover response costs and payment for the damages to flora, fauna, and wildlife environment. The global Climate Treaty, Kyoto Protocol, the Biodiversity Treaty, the Law of the Sea, Carbon Credit, disclosure in Financial Accounting Statements the environmental degradation, The Confederation of Asian and Pacific Accountants (CAPA) established a temporary Task Force in June 2008 to conduct a Preliminary Survey on Environmental Accounting and Corporate Social Responsibility (EA/CSR) are favorable climates for environmental protection globally. ICAI (The Institute of Chartered Accountants of India), ICMA (Institute of Management Accountants of India) have issued accounting standards (CAS-14) and cost accounting rules respectively with

respect to environmental accounting. These standards and guidelines are mainly to disclose environmental liabilities in the financial statements. It is necessary to value pollution and emissions by the damage they cause. In principle, it is vital to develop both appropriate accounting systems and reliable estimates of environmental damages. This subject reviews the analytical and accounting questions involved in designing and estimating environmental accounting. Environmental accounting needs to work as a tool to measure the economic efficiency of environmental conservation activities and the environmental efficiency of the business activities of a company as a whole. One of the issues highlighted by the global financial crisis of 2008 was the failure of the traditional financial reporting as a tool to identify fundamental business risk.

Environmental Accounting and University Syllabi-Academic Faculty Observations

ICAI-University of Madras joint education program syllabus contains Financial Accounting, Corporate Accounting, Cost and Management Accounting and Practical Auditing subjects under B.Com course, however, Environmental Accounting is not a part of the syllabus. However, at the Post-graduate level in commerce (M.Com.) Social Responsibility Accounting chapter exists, but nothing is done constructively. Department of Commerce under the University of Calcutta which was established in 1922 offers a subject called Advanced Corporate Accounting and Accounting Standards as a part of their specialization at the M.Com level. From the personal observation of Dr. (CA) Sanjib Kumar Basu, Calcutta University, “Environmental Accounting is not included in our undergraduate syllabus, but a topic on 'Recent developments in Accounting' includes environment accounting and reporting in our post graduation, which I used to teach earlier. The main reason is the subjectivity of the disclosure part. As such no objective assessment is developed till date” The Pune University offers a subject called Advanced Accounting (Expert knowledge) at the postgraduate in commerce, however failed to include environmental accounting as a part of the syllabus. At St. Joseph’s College of Commerce (Autonomous), Bangalore, a well-known institution in the city of Bangalore, India does not incorporate Environmental Accounting either as a part of the subject or syllabus. “Accounting is maintained primarily for statutory reasons in India. Environmental Accounting is not implemented because it is not statutory” Prof. Ravi Richard, a senior faculty at St. Joseph’s College of Commerce, Bangalore. Even the Bangalore University, India insists on Environmental education at the undergraduate courses, but the syllabus of commerce curriculum does not contain Environmental Accounting. It becomes a national and international duty of all enterprises to fulfill the Kyoto Protocol international agreement requirements to protect environment. Environmental arguments come from the heart, but in today's world based on economics, it's hard for arguments of the heart to win," said Pavan Sukhdev.

Observation by other researchers

1. There are no standards developed in environmental accounting. Different frameworks are proposed by different

- authors (Rees 1995). But now there are standard measurements of environmental pollutants in almost all polluting industries as per the Environment (Protection) Rules, 1986.
2. Some guidelines are issued by Ministry of Environment 2002, Japan. It is a guiding force and the foundation to improve the environmental and financial performance for certain organization (Deegan 2003).
 3. Basic structure is agreed by most authors such as external environmental accounting, environmental management accounting and other environmental accounting (Lanen 1994, Bartolommeo, M. 1998, Jasech 2001 and Burritt et al 2002).
 4. Environmental accounting has to record monetary units and physical units as well (UN CSD 2001 and Deegan 2003).
 5. Traditional accounting had faced the challenge to improve materials efficiency (Horngren and Foster 1987).
 6. The United States Environmental Protection Agency (EPA) provides a framework for identifying environmental costs. Environmental costs are divided into four categories. a) Conventional company b) potentially hidden c) contingent d) image/relationship costs.
 7. The costs are divided into:
 - a) Regulatory costs (environmental law related costs)
 - b) Compliance cost (regulatory cost)
 - c) Compliance costs (Voluntary cost)
 - d) Contingency costs (Cost of remedying and accidental pollution costs)
- Companies normally ignore contingent costs if the law is not imposed on such cost. Most of the governments try to reduce pollution by encouraging industries to purchase pollution prevention projects.
8. Past, present and future costs of environmental activities are important.
 9. There are four basic environmental liabilities:
 - a) Soil contamination
 - b) Ground contamination
 - c) Surface water contamination
 - d) Air emissions.
 10. Accrual concept of accounting is applied in cleanup liabilities:
 - a) Regulatory requirements
 - b) Legal requirements
 - c) Acquisition and divestiture proceedings
 - d) Good business practice
 11. Due to ISO 14001 certification of companies Environmental Management System has been increased in 2009 as compared to 2007.
 12. Negligible number of companies discloses environmental accounting information on project planning and management and social costs but there is no consistency in their reports which are reported quantitatively (financial figures).
 13. There are positive correlation between:
 - a) Environmental Reporting And Profitability,
 - b) Environmental Reporting And High Debt To Equity (Dr. V.K Gupta, IIM, Indore),
 - c) Environmental Reporting And Size Of The Company,
 - d) Environmental Reporting And Most Polluting Industries
 - e) Environmental Reporting and Environmental Performance (Dr. V.K. Gupta, IIM, Indore)

14. In India companies have to supply detailed information on:
 - a) Emission of specific toxic chemicals
 - b) Pollutants
 - c) Effluents
 - d) Damage to the environment
 - e) The community health
 - f) Ratios indicating environmental performance

Research Studies of Environmental Accounting – Industries

1. Chettinad Cement

Tamil Nadu: Tamil Nadu Pollution Control Board and Central Pollution Control Board have fixed standard norms for measuring environmental pollution in quantitative terms as per the Environment (protection) Rules, 1986. Online daily reports on emission, level of pollutants every hour is reported and monitored by the pollution control boards. Chettinad Cement has three units in and around Karur and Dindigal, Tamilnadu strictly follow norms prescribed and reported online to the respective Pollution Control Boards both to the Tamil Nadu and the Central Government. For Cement plants, including Grinding Units, located in critically polluted or urban areas with a population of one lakh and above (including 5 Km distance outside urban boundary): Particular matter is 100mg/Nm³. New Cement Kilns, including Grinding Units to be installed after the date: Particular Matter is 50mg/Nm³ in India. The table-1 explains pollution discharged to environment/unit of output break up details to arrive quantity of pollutants discharged by one of the Cement Industries in Karur district, Tamilnadu, India (Name of the industry is protected).

Refer: Appendix Table:1

1. **Pepso Co's:** PepsoCo purchased 1 billion kilowatt-hours of renewable energy in April 2007, offsetting 100% of its electricity use for the following year (Horovitz 2007).
2. **News Corporation:** The Chairman and Chief Executive Officer Mr. Rupert Murdoch made a statement that his company would be carbon neutral by 2010.
3. **Quantas:** Quantas is concerned about the issue of climate change. The customers can choose to fly carbon neutral by offsetting customers' share of flight emissions with just a small contribution. The carbon offset payment will go towards Australian-based abatement projects that have achieved greenhouse Friendly approval.
4. **Toyota Industries** regards environmental accounting, which evaluates the effectiveness of the company's environmental activities from the perspective of cost. It is a critical tool for corporate management and information disclosure. This Industry is continually striving to enhance its environmental accounting system. Until recently the main focus of this form of accounting had been application in information disclosure, through such media as the Social & Environmental Reports. In future the company will work to improve the system to allow its use in managerial decision-making by clarifying its compilation objectives and the target areas of environmental accounting.
5. **Xerox Company:** Industrial companies may cut costs and enhance environmental performance at the same time by

redesigning inflexible or wasteful routines. For example take the case of Xerox Company, in late 1980s the Company's market share declined and its profit margin eroded substantially due to emergence of new entrants in the market. In 1990, the Company's management responded to the challenge with a new management initiative – the Environmental Leadership Programmed – that eventually included waste reduction efforts, product “take-back” schemes, and environment-friendly design. By the mid-1990s, Xerox's large manufacturing complexes environmental costs may be hidden, contingent and image building or such costs may be a part of allocated costs of the asset used for prevention of environmental degradation. The Chartered Accountant April 2006 in Webster and New York was sending only 2% of its hazardous waste to landfills. The Company then labeled the programme an unqualified success (Business & the Environment (2006), pp. 46-47).

6. **John Craxford Plant Hire Ltd:** John Craxford Plant Hire Ltd, had to not only pay £85,000 in costs and fines but also got £1.2m of its assets seized. This was because it had illegally buried waste and also breached its waste and pollution permits. All Officers including junior employees are facing criminal prosecution for knowingly breaching environmental regulation.
7. **Thermal Power Generation in Andhra Pradesh:** High efficiency Electro-static precipitators (ESPS) are installed to control Suspended Particulate Matter (SPM) in the fuel gas. All new plants are designed for the SPM level of 100mg/NM³ a limit set by the Andhra Pradesh Pollution Control Board (APPCB).
8. **Oil Refinery Company in Victoria, Australia,** was fined for three spills of fuel oil from a jetty. The chairman of the Victorian Protection Authority said "the company needs meet their standards, but at the same time it has to meet the standards the community demands" (Toyota Industries on Social Environmental Report (2006)).
9. **FUJIFILM Holdings:** The objectives of environmental accounting in Fujifilm holdings is that :
 - i) "To provide accurate quantitative information on volumes and economic effects to interested parties within and outside the group
 - ii) To provide numerical environment-related information useful for decision making by management and supervisors at the working level" (FUJIFILM Holding, "Environmental Accounting" (2007)).
10. **Betabatim village, Goa, India:** Take back your garbage home- The village assembly has passed resolution that 'garbage brought and generated in Goa by tourists should be taken back by tourists to their home towns' (IANS).
11. **Talcum powder manufacturing company:** 'One of the companies producing talcum powder in Maharashtra, India has been using ethylene oxide in its skin powder for infants could turn into carcinogenic and cause permanent damage to skin' (Business Line).
12. **Thermal Power Generation in Andhra Pradesh:** High efficiency Electro-static precipitators (ESPS) are installed to control Suspended Particulate Matter (SPM) in the fuel gas. All new plants are designed for the SPM level of 100mg/NM³ a limit set by the Andhra Pradesh Pollution Control Board (APPCB), India.

Research studies of Environmental Accounting- Organisations

The world bodies have developed disclosure schemes on environments. Some are voluntary in nature. The voluntary disclosure schemes are from Carbon Disclosure Project (CDP), Japan Voluntary ETS (JVETS) and California Climate Action Agency (CCAR). The regulatory disclosure scheme from the US State of New Mexico's mandatory green house gas reporting, the California Global Warming Solutions Act (2006), National greenhouse and Energy Reporting System (NGERS) and the Australian Government's National Greenhouse and Energy Reporting Act 2007.

Research Studies of Environmental Accounting- Other agencies

SETAC (The Society of Environmental Toxicology and Chemistry)

Guidelines were issued by the Society of Environmental Toxicology and Chemistry (SETAC) in 1993, a multi-disciplinary, a code of practice and ethics requires that company which manufactures are required to take back their products after consumers use. It is also known as Take-back Legislation. It is worth to note that German companies have to collect packaging materials. Some companies like Ciba-Geigy, Church & Dwight and Dow Chemical have adopted Life Cycle Costing technique in health care, pharmaceuticals, agricultural products and chemicals. The Union Carbide corp. (UCC) has issued clear guidelines regarding environmental costs. This company demarcated between capital and revenue expenditures. Environmental expenses means all non-capitalized environmental costs charged to income statement (The Institute of Management Accountants 96317-1996). The Pollution Prevention Benefit Manual was issued by the U.S Global Environmental Management (GEMI) which has provided frame-works to identify environmental costs.

SAARC (The South Asian Association for Regional Cooperation)

The SAARC was established in 1985 with seven members' countries such as India, Bangladesh, Bhutan, Maldives, Nepal, Pakistan, Sri Lanka and Afghanistan. One of the charters of the SAARC is that regional cooperation among the eight nations for promoting the welfare and improving the quality of life of the people of the region. They have agreed to honor individuals and organizations for outstanding contributions and achievements in the fields of environment protection (Wikipedia).

ICMA, India

"The Cost Accounting Standards on pollution control-14 (CAS-14) was issued by the Cost Accountants of India. This standard gives broad outline on principles and methods of classification, measurement, assignment of costs to product or service and the presentation and more importantly disclosure in cost statements. It brings uniformity and consistency in the

principles and methods of estimating the pollution control costs with reasonable accuracy.” (Muninarayanappa and Augustin Amaladas (2013). In the present environment in the educational sector, it is necessary to prescribe an appropriate syllabus on Environmental Accounting. The following syllabus is proposed at the undergraduate and postgraduate commerce and management university curriculum. It also covers reference section for the study.

***Proposed Environmental Accounting Syllabus

[Syllabus For Commerce And Management Courses At The Undergraduate/Postgraduate Semester Scheme (Six Months)]

Objectives

To study world trend on environmental accounting

To understand the various pollutants and measurements

To account for environmental degradation and its disclosure in the financial statements.

Module 1: Introduction - Environmental Accounting:-

General view - Objectives of Environmental accounting-Kyoto protocol and ISO 14001. **Types of Accounting:** Financial accounting, Non-Conventional accounting, Social responsibility accounting, Corporate social responsibility accounting, Environmental reporting, Triple bottom line Accounting, Sustainability accounting and Environmental Management Accounting.

Module 2: Environmental Accounting Practices: In developed and developing countries such as USA, Europe, Australia, Japan, Taiwan and Thailand and Guidelines issued by Ministry of Environment 2002, Japan regarding environmental accounting

Module 3: Understanding of terms and symbols and Types of Pollutants/Effluents: pH, Oil and Grease, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand(COD), Suspended Solids, Phenols, Sulphides(S), Sulphates(SO₄²⁻), Ammonia, TKN, P, SO₂, NO_x, Particular Matter(PM), Flourides(F) Carbon Monoxide(CO), Nickel and Vanadium(Ni + V), Opacity %, VOC reduction, Cardium(Cd), Nikei(Ni), Zink(Zn), Hexavalent, Chromium(Cr), Copper(Cu), Lead(Pb), Iron(Fe), Suspended Solids, Phenolic compounds(C₆H₅OH), Ammonium Nitrogen (N), Bio-assay Test(90% survival of fish after 96 hours), CER(Carbon Emission Reduction) and HFC23.[To be taught by Chemistry Professors]

Module 4: Standards for emission or Discharge of Environmental Pollutants:- The Environment (Protection) Rules, 1986 for Petroleum Oil Refinery, Sugar industry, Thermal Power Plants, Cement plants, Caustic soda industry, Manmade Fibers, and other industries.

Module 5: Environmental costs and estimation: Regulatory Costs, Hidden Costs(Uprfront), Voluntary environmental costs, Conventional Company costs, Back end costs and Contingency Costs.

Module 6: Methods to measure: Cost Benefit Analysis, Managing environmental costs, Capital budgeting decisions, Full cost accounting, Life cycle costing and Total quality Environmental management and measurement of Carbon Credit.

*** Proposed Syllabus Developed by Dr. M. Muninarayanappa, Bangalore University and Prof. L. Augustin Amaladas, St. Joseph's College of Commerce, Bangalore.

Further Reading

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4. Three construction organization mainly centering on the Japan Federation of Construction Contractors “ Environmental accounting guidelines in the construction industry” (Interim report).
5. The Japan Gas Association “ Guidelines on the introduction of environmental accounting in city gas companies” (FY 2000 version).
6. Guidelines are issued by Ministry of Environment 2002, Japan
7. Research Articles and working papers on Environmental Accounting
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It is widely accepted by researchers that there are not much trained professionals in India to understand and implement environmental degradation both quantitatively and monetarily. “Environmental issues have been incorporated in management curriculum in different forms. However environmental accounting, as a subject, is not yet present in MBA curriculum of a business school” (J K Pattanayak, Mitali Sen and Balram Choubey). The professional bodies such as ICAI and ICMA have come out with accounting and cost accounting standards but there must be trained personal in the industry to implement environmental accounting. The curriculum proposed above has covered different types of accounting both conventional accounting and environmental accounting, environmental accounting practices in other countries, understanding of terms and symbols and types of pollutants/effluents, standards for emission or discharge of environmental Pollutants, environmental costs and estimation and methods to measure environmental degradation. Commerce and management students, by acquiring skills on environmental degradation quantitatively and monetarily it helps them when government enforcing the implementation of environmental accounting of polluting industries in India. Following are some of the important measurement techniques to calculate environmental degradation quantitatively and monetarily.

Measurement techniques

First of all it is difficult to define environmental cost. Having defined such costs are difficult to separate out and identify. Having done all of the above it is difficult to control such costs unless they are correctly identified. In 2003, the UNDSO came out with four management accounting techniques such as input/output analysis, ABC (Activity Based Costing), Lifecycle Costing and Flow Cost Accounting for the identification and allocation of environmental costs. These are referred to later under 'different methods of accounting for environmental costs'.

Input/outflow analysis

What comes in must go out. Input must be equal to output. Suppose for every 100 Kg of input, 80 Kg output and the remaining physical quantity either as scrap or waste. The waste material may have environmental impact either in the form of pollutants or add additional costs to treat effluents before being let into field or water resources or air. Here, we know the physical quantities and in monetary terms too.

Activity-based costing

The allocation of internal costs to cost centres and cost drivers is based on the activities cause to the costs under ABC. Environmental Accounting point of view, the environmental hidden costs on general overheads is appropriated based on environmental cost drivers (Student Accountant Issue 15/2010).

Life Cycle Costing

Every product has life from the time it is produced till it is thrown into the dust bin or reused and also has environmental effects at every level. Environmental consequences are studied and accounted for arising from production of product, environmental effects while on use by consumers, and at the time of disposal at the end of its life.

Flow cost Accounting

Costs of material, system and delivery and disposal are calculated mainly to reduce the quantity of materials having a positive effect on the environment but also to the business in reduction of total costs in the long run.

Shadow prices of pollutants

Using the estimated output function, the shadow price of a pollutant is estimated in terms of units of good output foregone for one unit reduction in pollution. Example: Thermal Power Generation in Andhra Pradesh sells a unit of electricity on the average of Rs. 3.60 per unit. Power generated is considered as good output where as NO_x, SO₂ and SPM are bad outputs as they are pollutants. Using this price, shadow prices of pollutants could be expressed in rupees for a representative plant of APGENCO as 1043, 5867 and 11539 respectively per ton reduction of SPM, NO_x SO₂.

How to measure Carbon credit?

"One CER (Carbon Emission Reduction) is equivalent to one tonne of carbon dioxide reduced. Each tonne of HFC23, a by-product of the refrigerant gases production process, is equivalent to 11,700 tonnes of carbon dioxide" (The Economic Times, July 31, 2007).

Conclusion

It is the time to look forward to understand the importance of environmental accounting practices. At the University curriculum plays a vital role in changing environment to teach to measure and costs of environmental degradation. Commerce fraternity has duty to fulfill Kyoto protocol vision of green global economy. Learning different polluting agents and their impacts on the environment is the need of the hour even though some are technical in nature but it is not impossible to understand. Without understanding the cause and cost of polluting agents it is difficult to train commerce students to face the challenges of reduction in pollution and environmental degradation. By training commerce students, we will be able to fulfill the dream of green environment. It is necessary to learn chemical components such as Sox, Nox, CO₂, VOC, air pollution, method to measure such pollutants, costs of polluting agents, industries involved in pollution, ways and means to reduce pollution and their costs to implement, costs incurred at the business site, environment damage prevention costs, global environmental protection costs, resource cycling costs, upstream/downstream costs, recovery from the market (Credit), cost of management activities, research and development costs, costs for social programs and costs for handling environmental damage. To understanding the above deliberations will help commerce teachers to inculcate and implement the environmental accounting in the near future. It is the right time and in the hands of the teachers to train the required commerce and management students to implement the present world's requirements through accounting

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Appendix

Table 1. Pollution discharged to environment/unit of output break up details to arrive quantity of pollutants discharged by a Cement Industry in Tamilnadu, India (Name of the industry is protected)

Assessment year	Stock attached to	Ave. Temp Deg C	Ave. Vel (M/S)	Area (Sq.m)	Ave.SPM (mg/Ncum)	Ave.Flow Ncum/Hr	Average emission Discharged	
							(mg/day)	(Kgs/day)
2012-2013	VRM/KILN Bag house	126	15.53	6.472	24.1	335652	193738334	193.738
	Cooler vent ESP							
	Cement Mill-Bag house	265.4	9.1	9.625	23.5	173281	97855246	97.855
	Cement Mill-II Bag house	92.2	10.9	7.071	29.9	223742	160557259	160.557
	Coal Mill Baghouse							
	CPP Boiler ESP	104.6	11.6	2.5423	28.08	80678	54370518	54.371
		77.67	11.32	1.54	27.2	53236	34790791	34.791
		113	5.03	12.56	18.0	299586	129421152	129.421

Average gas flow per day: 27988200 Ncum/day
Average dust emission per day: 670733300 mg/day
Average dust concentration: 611934672/32813328 mg/Ncum
: 23.96 mg/Ncum
