Chapter 4

Greening Accounting II: Exploring Feasibility of Environmental Accounting Framework

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Additional information is available at the end of the chapter

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Abstract

Exploring the theme of greening accounting in the previous chapter led us to examine the challenges of managerial accounting in supporting firms with the environmentally conscious decision-making and ideate how integrating environmental viewpoint within accounting can be achieved through a new construct that would support firms in integrating 'environmental well-being' as a core concern. In this chapter, the argument is validated by experimenting with a real-life case study and exploring challenges to enact the proposed construct. This not only tests the feasibility of the construct from an accounting perspective, including how information generated through it could be leveraged to meet corresponding information needs of firms without sacrificing transparency and auditability, but also advances the argument of *greening* accounting to redefine how the concerned information needs of firms and stakeholders can be identified and perceived in relation to the micro-level application of sustainability.

Keywords: environmental accounting, double-entry system, externalities, accounting dimensions, case study

1. Introduction

Past decades have witnessed the efforts to integrate 'environmental thinking' within the accounting domain, where contributions from scholars and practitioners theorized how this would enable businesses to significantly reorient their behaviour towards environmental sustainability. In the previous chapter, author highlighted how the efforts in this regard have not moved significantly beyond rhetoric and why *not* having environmental concerns at the core of the prevalent accounting theories is a natural outcome of their existence, as these remain grounded within economic paradigm. This led to conceptualize a new accounting viewpoint

as a theoretical solution that would hold environmental care as its core concern, instead of investing resources in retrofitting the existing mechanisms. This chapter validates the argument by experimenting with the proposed construct, so as to test the operational feasibility of environmental accounting (EA) in capturing firm-environment exchange. Leveraging transactions from a real-life case study, the construct could not only build temporal repository of aspects (stock), but also accounted for externalized liabilities of the firm , including how these assets are handled by the firm (flow). This feasibility supports the capability to generate information for firms to improve environmental insight of its processes, products, and decisions while maintaining temporality and auditability. Learning from the study provides inputs on how this could enable accounting to shape the corporate responsiveness of firms towards nature, and redefine the boundaries of accounting theory.

2. Environmental accounting in hospitality business: a case example

To explore the pragmatic elements of EA framework proposed in the previous chapter, this section details how EA can capture firm-environment exchange to integrate externalities by using inputs from a real-life case example (Section 3), before generalizing information produced by such a framework (Section 4) and summarizing learning from the experiment (Section 5).

2.1. The project site

The case study selected to support this experiment was conducted by the author in 2012–13 to study the relevance of environmental management accounting (EMA) in the hospitality sector and to expand the knowledge base with the findings. The study involved understanding the operating environment of two co-located hotels (five-star and three-star) in the western suburbs of Mumbai, India, that are managed by concept hospitality services (CHS facilities, hereafter) (**Figure 1**), and how they managed to reduce the impact on environment. Rationale for using this case study is to generate a view on the working of a firm from an industry where mass-balance is not the primary method to establish input-output link that has not been covered very often in literature. A service organization is expected to improve our understanding of the stock and flow of environmental aspects that differ from the manufacturing organization. Readers interested in the complete case study[1] can refer to Debnath [1]. Due to limited space, only the major features of the case are highlighted here.

2.2. Analysis of key findings

The CHS facilities are Ecotel® certified —certification of environmental and social leadership in hotel/hospitality business [2]—and equipped with the infrastructural and operational arrangements to support environmental conscious operational arrangements. Both the facilities are full-service business hotels and offered boarding/lodging, boutique restaurants, bars,

[1]Out of the three case that the author conducted as a part of his PhD thesis, this one has been selected here to support the argument for *greening* accounting.

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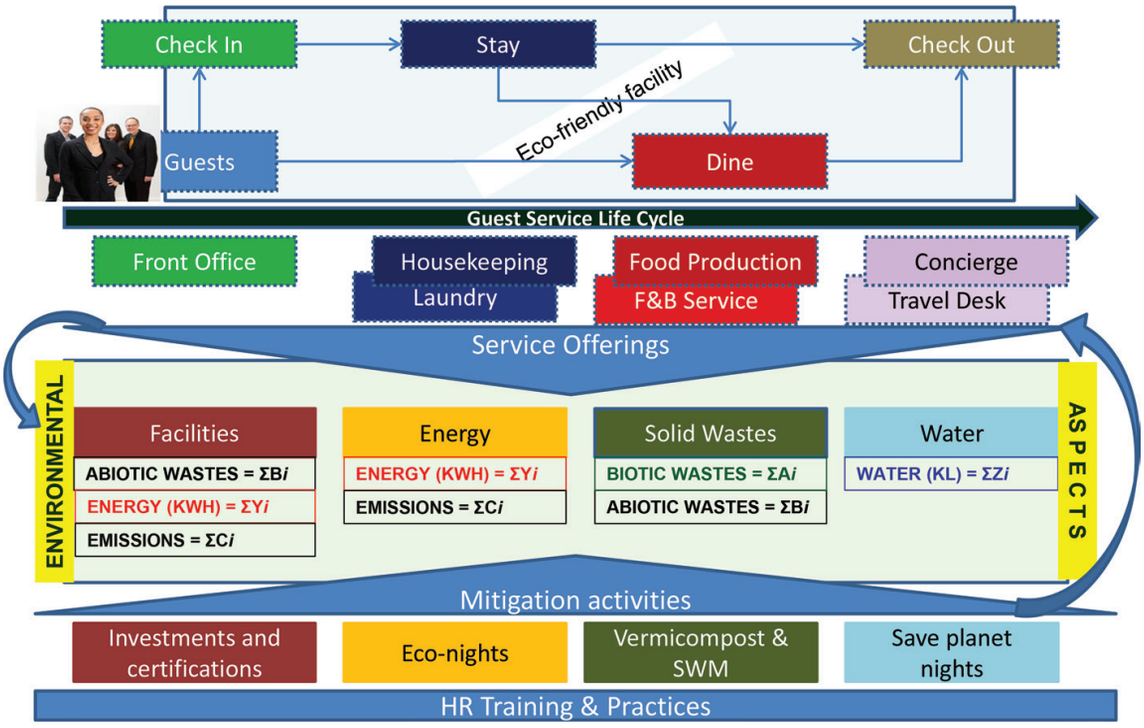

Figure 1. Operational layout of CHS (Sourced from Ref. [1]).

and lounge facilities to the business travellers along with banquet and conference halls for corporate use. Guest service lifecycle covered reservation of rooms and guest check-in, followed by stay, boarding, and checkouts. The amenities and services consumed materials, water, energy and other resources, and produced wastes as outputs. Cumulative waste quantities (solid waste and waste water) reported in **Table 1** were collected from the organizational records, whereas GHG emission due to energy consumptions is as per the norms of GHG accounting [3].

All types of solid waste were segregated at source and collected through a 4-bin system that optimized its reuse/recycling. In regards to disposal of waste, CHS had invested in developing a vermicomposting facility to treat biotic waste that converted waste to compost (bio-fertilizer), which was sold at a nominal rate. Waste categorized and collected as unfit for recycling or reusing (e.g. butter paper, oil cans, etc.) was sent to landfill (a miniscule percentage say, 1–2% by weight). CHS also routed waste water to the community ETP for recycling, from where the treated water (mainly grey water) was received back for further use. CHS had laid pipes to circulate grey water and used it for designated purposes, such as cleaning and gardening. This reduced its operational dependency on fresh water. Complete recycling of organic waste and use of grey water saved CHS from contributing to the environmental impacts that it would have otherwise if waste was disposed using conventional means. However, the tangible savings in social costs cannot be incorporated as a part of EMA construct (**Table 2**). Neither would the liability arising due to waste water generated by laundry services that it outsourced to the external commercial washers. **Table 2** details cost of environmental care for CHS as per EMA norms by keeping it restricted within the organizational boundary.

Month (Units[a])	Food production (Covers)	Garbage (mt)	Linen for wash (Par)	Water consumption (kL)			Energy (kWh)	GHG (tCO2e)
				Supply	Laundry outsourced	Total		
Apr	9069	14.8	43555	4156	7170	11326	347783	341
May	8248	14.1	51949	5140	8507	13647	353394	346
Jun	5283	10.3	35045	5899	5775	11674	332496	326
Jul	5585	10.9	39003	6356	6416	12772	352577	346
Aug	7586	11.1	54359	4906	8916	13822	368708	361
Sep	10111	11.0	45280	5632	7443	13075	357025	350
Oct	8144	11.4	57461	4344	9428	13772	380822	373
Nov	7790	10.7	47311	4041	7761	11802	341721	335
Dec	13434	9.2	52360	8956	8597	17553	347388	340
Total	75250	103.7	426323	49431	70012	119443	3181914	3118

[a]Units: kL—kilo liters; mt—metric tons; kWh—kilo watt-hours; tCO_2e—tons of carbon dioxide equivalent.

Table 1. Monthly consumption of resources.

2.3. EA: accounting for environmental care of CHS

To account for the aspects that CHS business activities generated, monetization norms were needed, so as to journalize these in the EA books. To monetize, valuation methods are used as proxies that would translate the externalized liability corresponding to the aspect. For example, externalized liability due to solid waste disposed through municipal infrastructure

As per EMA	As per the case study	Amount (in INR)
(a) Material waste	Dry and wet garbage—Bottles, packing materials, empty containers, food wastes, and others (100% recycled)—150 mt per annum	0.00
(b) Non-product outputs	Waste water (100% recycled) ~ 45,000 kL per annum	0.00
(c) Waste and pollution prevention costs	Fixed costs per annum of maintaining Ecotel certification Running cost of vermicomposting facility Operating cost of other activities with environmental considerations	250,000 +60,000[a] Unascertainable
(d) R&D expenditure	New initiatives for reducing environmental load	Not available
(e) Less tangible costs	Emission externality of ~ 4.5 $mtCO_2e$ per annum	1,015,000[b]
Total cost		1,325,000

[a]Assumed maintenance cost of vermicomposting facility (1 person @ INR 5000 per month).

[b]Emission costs at INR 225/tCO_2e (USD 4.5 at assumed exchange rate of INR 50/USD) [4].

Table 2. EMA computations for CHS.

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is pegged at INR 3500 mt^{-1} as the cost *not* internalized by CHS [5]. Externalized cost included actual cost of disposal incurred by municipalities along with externalities due to GHG generation from organic waste and social costs contributed by the informal sector. Similarly, GHG emission is valued at opportunity cost of market rate at USD 4.5 per tCO_2e (INR 225 at exchange rate of INR 50 per USD) which has been the average rate of carbon for Indian projects in voluntary emission credit market [3]. Waste water has been valued at resource replacement rate of INR 50 kL^{-1}, as followed in other EMA case studies [6]. Accordingly, environmental ledgers are drawn by journalizing entries that followed double-entry system, where respective aspect ledger (of asset nature) is debited to represent the release of specific type of waste to the common pool. These ledgers correspond to the physical nature of the aspects (waste and emissions) and reflect the environmental asset generated by the firm, akin to the finished products. Corresponding credit would go to the respective environmental account (of liability nature) so as to reflect externalized liability. A reversed entry on the other hand would reflect liability that has been annulled due to the changed processes/activities or any other reason. In simple terms, following accounting rules are abstracted from the generalized schematics for EA (as per Appendix 1) and have been used to draw the ledgers (**Tables 3–7**):

(a) Journal entries should be balanced across quantity and value.

(b) One accounting entry would always use same units of measurements.

(c) To account for more than one aspect per business transaction, each aspect would have to have its own journal entry.

(d) In case suitable monetization norm is not available for an aspect, it will remain in physical inventory.

The ledgers are interpreted as under:

(a) Ledger entries are summarized for different periods and represented combined form of t-accounts to record physical and monetary values together. However, firms can maintain separate accounts record aspect inventory and corresponding monetized liability.

Date	Particulars	Qty. (mt)	Debit (INR)	Date	Particulars	Qty. (mt)	Credit (INR)
12/12	To balance c/f	103.7	362,950	04/12	By Env. liability A/c	14.8	51,800
				05/12	By Env. liability A/c	14.1	49,350
				06/12	By Env. liability A/c	10.3	36,050
				07/12	By Env. liability A/c	10.9	38,150
				08/12	By Env. liability A/c	11.1	38,850
				09/12	By Env. liability A/c	11.0	38,500
				10/12	By Env. liability A/c	11.4	39,900
				11/12	By Env. liability A/c	10.7	37,450
				12/12	By Env. liability A/c	9.2	32,200
	Total	103.7	362,950		Total	103.7	362,950

Table 3. Solid waste (externality) T-account.

(b) Credit balance of **Table 3** reflects social externality saved by CHS due to vermicomposting to treat bio-waste, instead of using municipal solid waste disposal system. **Table 4** brings in the supply chain effects into the books of the CHS by performing resource accounting of waste water from outsourced laundry, and accounted it as an environmental liability for CHS. **Table 5** reflects equivalent carbon value of GHG emissions due to energy usage.

(c) Based on the selective performance data, these externalities created environmental obligation of around INR 3.8 million for 26 thousand guest nights (annualized) or INR 147 per guest night (**Table 7**). Accordingly, environmental liability at period-end represents monetized balance (in quantity and monetary terms) to reflect externalities, not annulled.

(d) Management information (**Table 7**) is generated based on data/inputs from the sample ledgers and can be traced back to the individual ledgers, but without positive social externalities due to knowledge sharing by the firms [7] that cannot be quantified due to lack of suitable numeraire.

Date	Particulars	Qty. (kL)	Debit (INR)	Date	Particulars	Qty. (kL)	Credit (INR)
04/12	To Env. liability A/c	7170	358,500	12/12	By balance c/f	70,012	3,506,000
05/12	To Env. liability A/c	8507	425,350				
06/12	To Env. liability A/c	5775	288,750				
07/12	To Env. liability A/c	6416	320,800				
08/12	To Env. liability A/c	8916	445,800				
09/12	To Env. liability A/c	7443	372,150				
10/12	To Env. liability A/c	9428	471,400				
11/12	To Env. liability A/c	7761	388,050				
12/12	To Env. liability A/c	8597	429,500				
	Total	70,012	3,506,000		Total	70,012	3,506,000

Table 4. Waste water (outsourced laundry) T-account.

Date	Particulars	Qty. (tCO_2e)	Debit (INR)	Date	Particulars	Qty. (tCO_2e)	Credit (INR)
04/12	To Env. liability A/c	341	76,725	12/11	By balance c/f	3118	701,550
05/12	To Env. liability A/c	346	77,850				
06/12	To Env. liability A/c	326	73,350				
07/12	To Env. liability A/c	346	77,850				
08/12	To Env. liability A/c	361	81,225				
09/12	To Env. liability A/c	350	78,750				
10/12	To Env. liability A/c	373	83,925				
11/12	To Env. liability A/c	335	75,375				
12/12	To Env. liability A/c	340	76,500				
	Total	3118	701,550		Total	3118	701,550

Table 5. GHG emissions T-account.

Date	Particulars	Qty. (mt)	Debit (INR)	Date	Particulars	Qty. (tCO_2e)	Qty. (kL)	Credit (INR)
12/12	To solid	103.7	362,950	12/12	By waste	3118	70,012	3,506,000
12/12	waste A/c To balance c/f		3,844,600	12/12	water A/c. By emission A/c			701,550
	Total	103.7	4,207,550		Total	3118	70,012	4,207,550

Table 6. Environmental liability control ledger.

Type of activity	Environmental aspects	Savings	Value (in INR)
Vermicomposting	Solid waste	Saved 104 mt reduction in wastes for landfill	+362,950
Composting of floral wastes from festivals	Solid waste	Saved 10 mt (assumed) floral wastes composted	+35,000
Outsourced linen washing	Waste water	Negative cost at replacement rate of water for ~ 70,000 kL per annum	−3,506,000
Use of non-renewable energy sources	Emissions from energy use	Negative costs of ~3.2 $mtCO_2e$	−701,550
Total			−3,809,600

Table 7. Annualized externalized liability of CHS.

3. Systemic integration of externalities within EA framework

This segment explains how EA framework adapts systematic approach of accounting to bookkeep aspects and externalized liability of firm. Although EA is exploratory in here and lacks the breadth and support enjoyed by other established accounting frameworks, which could lead to generate information that has not been studied to remove interpretive bias of decision-makers, especially to reflect how this might help firms to adapt to the changing expectations of the society. Still, it enables firms to compare its environmental performance with the economic ones, and trace its responses through indicators that can be a part of the overall enterprise risk framework.

3.1. Solid waste and its disposal

Waste is an inevitable by-product of any transformation process. Information regarding internal costs incurred in generating and disposing waste could lead to the operational improvements of the firm, as EMA proposed, whereas information on externalized liabilities is expected to improve the firms' response towards permanent cure. Even though having market mechanism to dispose waste, as in developed countries, has resulted in internalization of costs to a certain degree [8], this has also led to institutionalize 'right to waste' that is available for

firms at a price, which has not been validated to bring a permanent change in the attitude of firms. Improved information on externalized liabilities through accounting that EA aims for, would push the firms to acknowledge accountability beyond using social infrastructure, where dissemination of *valid* information translates to improved transparency for investors, others stakeholders and society at a large, to appreciate such a behaviour. EA is expected to help firms improve their overall approach towards environmental care by providing a mechanism that can directly reflect its performance in real-time. Conscientious corporate citizens like Interface Global, Patagonia, and 3M (to name a few) have developed sustainable waste reduction techniques by resorting to servicizing, cradle-to-cradle lifecycle, and other initiatives [9]. EA can support firms develop insights about their decisions (e.g. externalized liability for CHS due to landfilled waste that needs a permanent cure) by generating temporal information that remains tied to the source.

3.2. Waste water

Disposal of waste water through local or site-specific effluent treatment plant (ETP) is a common practice for firms, before releasing it to the public drainage system that ultimately releases treated water to the water bodies. However, this has not always been the case, for example, in case of developing and underdeveloped countries, where waste water could be released directly to the water bodies, resulting in severe loss of water resources. At the same time, waste water has not always been reused by developing in-house or community level grey water recycling system, where treated water could be used for reasons other than for drinking or human consumption. Missing legislative support to promote grey water recycling has also hindered the development of necessary infrastructure. With depleting levels of potable water globally and ever rising population, market mechanism to price such a scare resource would hardly do any justice to improve the situation in the long run. Mahadevia and Wolfe [10] have rightly pointed out that the next world war would be fought to control the water resources. The intent of *accounting* for waste water is to help firms understand the stress that they are contributing to within a region, which could lead to business disruptions as well [11]. This could also help firms to participate in improving the disparity within the region so as to be recognized as a valued member of the community that it serves [12].

3.3. Emission and its accounting

Emission of GHGs and non-GHGs has harmful effects on biosphere and contributes to the changing climatic conditions. While GHG accounting is a methodical approach towards inventorizing emissions [3], it remains to be integrated within accounting where loss of temporality might lead to wrong choices, as detailed by the author with reference to a different case study [13], and is universally applicable. In any case, business decisions like moving away from high energy intensive machineries and processes to the lower ones (e.g. installation of bagasse-based boiler instead of using oil-fired boilers or to optimize energy utilization by using technological solutions) depend primarily on the associated economics of it (lowering cost per kg of steam), where environmental outcomes become by-products of the decisions. The argument here is, environmental impact of a business decision can be evaluated

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better if it could be tied with the performance levels (before and after the effective change), where temporality becomes a natural requirement that EA support. Same is true for carbon trade where accounting of initial emission allowance and other related transactions would need the accountants to separate emissions accounting from corresponding financial impacts, but which cannot be achieved as discussed in previous chapter, unless accounting can guide the practitioners to account for both the areas simultaneously. Author posits that EA supports this delineation and to separately account for temporal generation/savings of emission and the underlying economics, which cannot be dealt in here due to space constraints.

3.4. Approach towards improving environmental care

As compared to EMA, where insights of environmental performance are limited within the organizational boundary of the firms (**Table 2**), EA offers information on the type of aspects and how these are being handled. For example, solid waste account of CHS details saved social cost and is treated as an asset (**Table 3**), whereas waste water account from outsourced laundry (**Table 4**) registered as liability that CHS should be looking into with improved commitment to remain a pro-environmental business that it has declared itself to be. Same is the case of emissions that CHS should be caring for. These insights could not have been possible without letting EA break the boundary of ownership and reflect how firms are contributing to the environmental duress. Although this might not resolve differences that are inherent to the industries in regards to how they operate and/or use resources (e.g. discrete manufacturing vs. hospitality business vs. mining sector), information generated and disseminated by EA could still institutionalize shared vocabulary that is the need of the hour, including devising common terminologies to express how firms might be viewing its performance as compared to others, or in analysing industry specific trends (e.g. environmental care institutionalized by extractive industry as its operating norms). The framework also generalizes the boundary to handle areas that lack computational insights like emission of non-GHG gases (like F-gases) or positive social externalities that CHS generated through the workshops it conducted for other firms to become environmentally friendly, and could be pursued as a part of future research.

4. Externalities, sustainability and accounting generalization

This section assimilates different aspects of the experiment and validates the relevance of information generated by EA in its capacity to support decision-making. While a single case study can never bring the complete set of facts to reflect the uniqueness of different industries, still it offers a good number of points to relate to generalize the capability of EA in generating information of practical relevance to support firms, and can be characterized through the needs of decision-making in managerial accounting.

(a) *Traceability*: EA creates the transactional backbone of environmental aspects to become a part of an information system and offer relevant and verifiable data for environmentally conscious decision-making without losing temporality, transparency and traceability. Traceability links pieces of information to the source event/transaction from a particular

time period (e.g. quantity of GHG emission for a quarter) and absolves EMA and corporate management information system from the need of using arbitrary methods to quantify and accumulate information on the environmental aspects and impacts.

(b) *Timeliness*: EA opens the door for the organizations to actively consider externalities as integral to the business activities, and improves transparency in the reporting of ethical negatives, that the previous chapter detailed, as mandatory for voluntary reports to drive ethical positives. Here, an accounting construct can generate information as soon as the underlying activities are recorded and available for its real-time dissemination for decision-making purposes.

(c) *Relevance*: EA allows the existing accounting frameworks to continue in 'as-is' form, which saves time and resources required to modify and institutionalize accounting to care for within a single framework. Relevance of information from managerial decision-making purposes can only be hypothesized here, as its practical utility is yet to be tested, and leaves the door open for future research to address, including how it might support the standards of sustainability and ecological accounting.

(d) *Uniformity*: EA separates the computational complexities of quantification and monetization from the accounting process. Needless to mention, identification of aspects based on the business activities and methods for quantification would need inputs and active cooperation of environmental experts, while accounting of aspects including valuation and ledgerisation can remain within the accounting domain. This not only brings uniformity to the entire process, and seeks active role of environmental management system (EMS) to establish uniformity while interpreting, as well as, disseminating information.

4.1. Valuation of externalities: generalization and cognitive limitations

Valuation of externalities and corresponding limitations to develop it as an acceptable norm in business, has been a lexicon in environmental accounting theories. Methodological improvements in developing verifiable basis of ascertaining cost of waste or in ascertaining corresponding externalities that it contributes to, is expected to support businesses with improved understanding, capturing the impacts in nominal terms and to contribute to the scholarship of ecological modelling [14–16]. However, different class of waste could follow different routes of recycling, reuse, and ultimate disposal (cradle-to-grave), or return to the material cycle (cradle-to-cradle), or anything in between. For example:

Manufacturer →

- (Recyclable waste) Recycler → Reprocessing → Entry to material chain.
- (Hazardous waste) Hazmat handler → Safe disposal.
- (Non-recyclable waste) Municipal disposal → Landfill.
- (End of life) Reclaiming for recycling → Recycler → Disposal.

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As evident, each route of disposal would generate separate set of externalities that would be specific to the movement of waste. In other words, even though firms can scan the upstream and downstream supply chains to develop inventory of externalized liabilities, it would remain relative (or incomplete). With loss of causal relationship that waste suffer after entering into the pool of common/public goods, where regional complexities and multiple interaction upon dissemination makes it difficult to trace and capture impacts, quantification and monetization of aspects would results from our contemporary, *not* comprehensive, understanding of the ecological profile of waste. This brings in the cognitive limitations in discovering how waste might interact with different receptors in nature that would always be dynamic, and accordingly, would make it impossible to cover complete set of impacts and costs to be known at any given point of time (**Figure 2**). Other than the layered nature of truth, that would get exposed as collective human knowledge would grow, it would always lead to a certain degree of uncertainty in simultaneous determination of impacts (Δi) within a complex adaptive system, along with the cost (Δc) associated in neutralizing it (analogous to the Heisenberg's uncertainty principle), and is contrary to the deterministic nature of costs and impacts that accounting theories are used to.

Accordingly, we have to acknowledge the boundary of knowledge regarding future impacts of health and ecological effects and related monetary assessment of damage/remediation/restoration to remain outside the collective knowledge base (methodological limitations). Lack of information on exact causal relationship between aspect and impacts that are time-delayed might limit interpretation of damages (cognitive limitations), along with the second and higher order impacts that fail causation (interpretive challenges). This leads to two important conclusions for EA: (a) offering interpretation of business events by accepting probabilistic nature of outcomes as against the deterministic ones, and, (b) to view cost

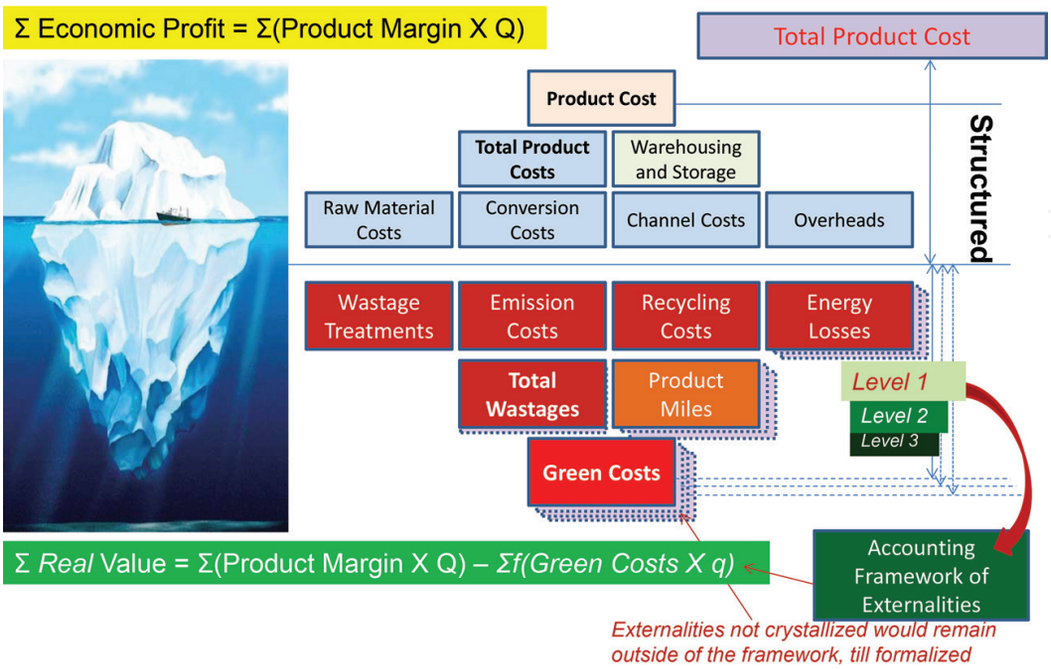

Figure 2. Layered nature of environmental impacts and costs (Sourced by Author).

only as a proxy and not an outcome of elemental interactions. Accordingly, EA would need to support multiple measurements and valuation schemes, holding these as proxies to translate firm-environment exchange.

4.2. Generalized construct of environmental accounting and sustainability

This sub-section explores how EA improves the information base and supports sustainability. Firstly, it is relevant to explain how accounting—a two dimension construct of time and money—has evolved to be the language of business from economic perspectives. EA extends it to the third dimension by bringing in calculative practices of accounting to the domain of firm-environment exchange, aiming to help firms measure its impact on environment and resources. This process also encapsulates stakeholders' demands and organizational interests to help firms identify, understand, and improve environmental performance.

Second, environmental aspects generated by business and its impacts on biosphere are subject to the cognitive limitations of human knowledge, and would remain so, until and unless intricate nature of human activities and corresponding ecological responses across time are well understood. While these cognitive limitations would lead us to explore the complete cycle of natural interaction for the sake of improving scientific accuracy, it also supports layered nature of externalities that limits our 'complete' view. Accordingly, all impacts of an aspect would not be known at all times, and so would our efforts to derive costs to abate or harvest the aspects. Continuing with the argument, externalities generated by waste is not absolute, and instead, would depend on how organizations have chosen to deal with them. So in altruist sense, it is the externalities generated by the chosen path of the waste that should be reflected as the environmental liability of a firm.

With reference to sustainability, this boundary reflects perennial nature of approximate understanding that we humans would have to live with, in regards to how we are engaged with our surroundings. Accordingly, the need for developing an accounting argument that is not dependent on frozen information of constituent elements and their reactions, as traditional accounting practices would have expected, becomes eminent. EA offers an in-principle arrangement to develop repository of the outcomes of firm-environmental interactions while preserving the capabilities of traditional accounting practices. Also, this can help firms review the very first step to deal with it, as that is within the sphere of its control, instead of investing in the efforts to analyse complete cycle, where EA can limit itself to account for the first-order impacts of the interactions. Although, such a view is proximate, it still highlights the important areas where firms should pay attention to, and redefine its accountability towards nature and society.

5. Concluding remarks

An artificial system, like accounting, imitates human requirements to study events for abstracting information so as to generate a map that would help others to navigate and/or interact with the information produced and shared. However, EMA and contemporary sustainability theories are yet to develop a construct to support and measure the *environmental*

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embeddedness of firms, the *in situ* environmental care with which firms operate, where actions and decisions of a firm are guided by the degree to which firms are upholding their commitments to be environmentally benign as agents of societal progress. While critical theories have advocated to consider the constraints within the accounting capabilities to consider these, albeit theoretically, normative view preferred to look elsewhere, mostly due of the inability of a structure that cannot wrap these challenges within the current form of enactment, pushing the need itself to the fringes of our collective conscience. The two chapters on *greening* accounting aimed at carving a conceptual space for accounting to hold the intent, i.e. having 'environmental well-being' at its core, where accounting language can be leveraged to decipher business transactions in accordance to the needs. While the second part is always easy, it is the first part that is crucial and hopes to pave for enriching accounting, from being a pragmatic solution to uphold accountability that it is ingrained in!

Appendix 1. Schematics for book-keeping environmental aspects generated by business transactions

This section provides scheme to analyse business transactions of a firms from bookkeeping perspective, reflecting how the corresponding business activities might be generating or subsuming environmental assets. While the transaction categories covered here are not exhaustive and can be enhanced subsequently, the accounting schema represents how EA separates environmental dimension of business transactions from the financial/cost accounting-related transactions.

(a) Activities that generate environmental aspects: This category of transactions would result in generation of aspects like emissions, solid waste, waste water, etc. that add to the stock of environmental assets. The corresponding liability would reflect environmental contingency arising due to the addition to common pool, where the accounting treatment would be:

Dr. Environmental asset (aspect type) Aspect Qty X Valuation norm
To Environmental liability (corresponding transaction class)

(b) Sequestration/transfer of environmental aspects: Business activities that would result in sequestering or transferring environmental assets are part of this set. For example, reuse and recycling of food waste using in-house vermicomposting facility or recycling of waste water to improve grey water usage (as CHS did from the case study) to reduce environmental load. Similarly, sale of electricity by utilities would result as transfer-out of GHG load from producer to the consumer(s). Journal entry in this case could be:

In case of sequestration:
Dr. Environmental liability sequestered Aspect Qty saved X Valuation norm
To Environmental Asset (aspect type)
In case of transfer:

Dr. Environmental liability transferred Aspect Qty saved X Valuation norm
To Environmental Asset (aspect type)

(c) Business activities earning environmental credits: Involvement of firms in community activities would result in reducing local waste and save social costs, e.g. reducing community waste by using organizational facilities, thereby helping the business to earn environmental credits. Journal entry in such cases would be to create a credit (or reward):

Dr. Environmental savings generated Aspect Qty X Social costs saved
To Environmental/Social Cost saved

(d) Permit/fees/legal charges/other environmental expenses incurred by business: These transactions are driven by organizational interactions with market and legal system to improve/regulate environmental and social considerations of the firm and would include expenses incurred in purchasing/selling permits and/or licenses, and/or any other expenditure incurred that is/are related to or impacted due to environmental obligations/decisions. These transactions would generally be accounted within the financial books, and can also be EA to accumulate financial impacts supporting environment decisions of firms.

Journal for expenditures:
Dr. Environmental Expenditure (individual head) Amount incurred
To Environmental contingency covered
Journal for income:
Dr. Environmental contingency impacted Amount incurred
To Environmental Income (individual head)

(e) Adjustment transactions in environmental ledgers: These entries would take place within the environmental ledgers to transfer balances, enter corrections, or revalue aspects due to change in quantification and/or valuation norms of the aspects. The journal entry would be:

Dr. Environmental Ledger A Change in value
To Environmental Ledger B

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