



Handelshögskolan
VID GÖTEBORGS UNIVERSITET

**Environmental Management Accounting (EMA),
Management Accounting including Environmental Management
- a literature review**

Magisteruppsats i företagsekonomi
Ekonomistyrning
den 8 februari 2008
Handledare: Olov Olson
Författare: Per Jonäll

Environmental Management Accounting (EMA), Management Accounting including Environmental Management - a literature review

Tutor: Olov Olson

Author: Per Jonäll

Abstract

Problem: A strategic issue is to consider future threats and changes that can generate new or higher costs for the company. A strategic operational issue could be to consider if there are costs today that the company are not aware of the size of, because costs are hidden in overhead accounts or in accounts not expected and not accounted for in a structured way. If costs are made visible they can be managed with cost savings and other benefits resulting.

Regarding environmental costs, future internalisation of costs for external effects is expected through increasing governmental and consumer pressure. Costs associated with environment as for example costs for electricity, like the electricity bill when recorded and periodized, are also likely to accumulate in overhead accounts.

What research exists today that includes environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance?

How could this eventual knowledge support decision making in companies towards better environmental performance today?

Purpose: The purpose of this thesis is to search for results from eventual research that include environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance. Research results found, according to the purpose, will be reviewed.

Approach/Method: Review of articles in academic journals.

Findings: A UN promoted Environmental Management Accounting (EMA) methodology was found that uses an environmental cost assessment scheme that gathers environmental costs in a structured way for decision making. The method reveals that existing, regulated, corporate environmental costs today could be twice as high as the environmental costs companies disclose in their annual reports. This gives potentials for large cost savings for, and strategy reconsiderations in, companies. The largest cost category often turns out to be, according to the EMA method: *Material purchase value of non product output*.

Conclusion: Environmental Management Accounting, EMA, can likely support decision making in companies towards better environmental performance today, through structured cost assessment that support effective decision making, better environmental performance, more effective and future-proofed product mixes, strategies and investments.

Further Research: What characterise good environmental business performance? What characterise sustainable business performance? How large can a sustainable resource, material and energy, flow be for a business operation?

Table of contents

1	Introduction	4
1.1	Purpose of thesis.....	4
1.2	Pressures for environmental performance and disclosure.....	5
1.3	The effect of conceived time perspectives	6
1.4	How can companies adapt to increasing external pressures	7
1.4.1	Corporate self-interest	7
1.4.2	Possible opportunity with the internal perspective	7
2	Method	10
2.1	Literature search method.....	10
2.1.1	Error sources	12
2.1.2	Journals and publication years	12
2.2	Review method.....	12
2.3	Analysis method.....	13
2.4	Transparency	13
3	Review.....	14
3.1	Overall article review	14
3.2	Review according to topics found in the academic articles	18
3.2.1	Environmental Management Accounting, conceptions	18
3.2.2	Environmental Management Accounting, depending factors	23
3.2.3	Environmental Management Accounting, some corporate results.....	29
3.2.4	Environmental Management Accounting, experiences.....	32
4	Analysis and Discussion.....	34
4.1	Environmental Management Accounting, conceptions	34
4.2	Environmental Management Accounting, depending factors	35
4.2.1	External pressures	35
4.2.2	Corporate Environmental sensitivity.....	35
4.2.3	Traditional role of Accountants and Accounting	36
4.2.4	Lack of exchange of information and knowledge within the corporation	37
4.2.5	Importance of consistency in information systems	37
4.2.6	Implementation aspects of Environmental Management Accounting	38
4.2.7	Environmental Management Systems as catalysts.....	38
4.3	Environmental Management Accounting, some corporate results.....	39
4.3.1	Environmental Management Accounting implemented.....	39
4.3.2	Costs visible, savings possible	40
4.4	Environmental Management Accounting, experiences.....	42
4.4.1	Result in case study questioned by company	42
4.4.2	Practice opportunities and criticism	43
4.5	How these approaches increase understanding and knowledge.....	44
4.6	Issues discussed in the introduction	44
4.6.1	Pressures for environmental performance and disclosure.....	45
4.6.2	The effect of conceived time perspectives	45
4.6.3	How can companies adapt to increasing external pressures	45
4.6.4	Purpose of thesis.....	46
5	Conclusion.....	48
6	Further Research	49
7	Literature	50
8	Appendix	52
9	To Practice: Environmental Management Accounting, Procedures and Principles.....	53

1 Introduction

The global distribution of corporations operations today are so extensive that the world can be stated as a corporate world or in a system view a corporate globe. A system view is, in this thesis, considered to consist of knowledge of how the system works, its limitations and possibilities and how to maintain the system for, the case of the earth reasonably an endless, long time. To apply a system view is likely an effective approach to at least try to describe how natural systems respectively human culture systems works (Andersson and Wolff, 1996, Owen, 1992).

The globe has its natural systems and mechanisms that natural sciences try to describe. Interfering with these natural systems are human cultural systems and its created industrial world that social sciences try to describe. The interference of the human industrial system with “external effects” from a human industrial system view, on the human cultural system itself and on the natural world, has been recognised by both science fields. Difficulties to combine these, the economic and the ecological perspective, are discussed in for example Plogner (Plogner, 2004).

One example of an external effect, that is concluded in general today, originates from the industrial world’s extensive turn around of fossil fuels, which is realised not to be sustainable. This situation has occurred because the industrial world hasn’t kept track on by-products as carbon dioxide, nor accounted for it nor managed it. Just recently attempts have started to manage or to some extent control carbon dioxide flows. This point to that future successful business strategies probably are less based on turning around material and energy or doing so in a more sustainable way.

The industrial world consists of three main actors: producers, consumers and government (Andersson and Wolff, 1996) who all are responsible and acting in different ways that influences the society and the environment and which of all are subjects for research. The focus in this thesis is in accounting and support for better decision making in companies towards sustainable business performance:

What research exists today that includes environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance?

How could this eventual knowledge support decision making in companies towards better environmental performance today?

1.1 Purpose of thesis

The purpose of this thesis is to search after results from eventual research that include environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance. Eventual research results found, according to the purpose, will be reviewed. Eventual found knowledge of depending factors for a corporation’s environmental performance in relation to accounting will be analysed to see if the questions can be answered. Also eventual knowledge gaps and needs of further research will be analysed.

1.2 Pressures for environmental performance and disclosure

Government and consumers, including other stakeholders will likely increasingly exercise pressure on companies to increase their environmental performance and to disclose their environmental performance in a transparent way. Although this thesis doesn't deal with, or have a focus on external disclosure, external financial or environmental reporting, such issues come up in connection with the focus on internal accounting, management accounting.

Consumers

Consumers have to some extent power to influence a development towards sustainability since they are the ones giving, on their choice, companies their income, or not. Consumers have the power to demand products or services with better environmental performance or the possibility to choose not to consume. Increasing awareness and means of communication of customers, forces producers to produce consumer demanded services and products in a more sustainable way (Plogner, 2004). The effect of consumers pressure on corporations behaviour is discussed and questioned in the literature (Valor, 2005) but there are examples of boycotting of products as for Shell in 1996. Shells insistence on dumping an old oil platform in the North Sea made German consumers, in Berlin, to cease buying Shell petrol. Gasoline sales dropped 30 % in one week (Andersson and Wolff, 1996).

Government

Governments are strong and cooperating globally but the processes are time consuming. However, environmental costs, which have been regarded as external from the company view, will likely be internalised in the future. This development would be promoted by governmental regulation through environmental legislation and different control mechanisms as taxes and other incentive based regulation (Plogner, 2004).

Example of overall Environmental legislation

One example of overall environmental legislation deals with a principle of caution, "försiktighetsprincipen" in Swedish, and a principle of best technology, "principen om bästa möjliga teknik", that prescribe cautiousness and the choice of best possible technology in business operations in order to prevent harm to human health or the environment. (Miljödepartementet, 1998)

This is a crucial input for business strategy. If this legislation would be altered and extended to comprise also products in general, the need of refined business strategies would be obvious. Business companies apply accordingly strategies today with products that are more energy and material effective regarding production, use and reuse or recycling. The question is if such efforts generate good enough environmental performance to support sustainability since no one really knows what the threshold for environmental performance is or what environmental performance sustainable products should have.

Increasing pressure gives focus on the producer

Environmental problems have used to be viewed, in large extent, as external in the companies' view. But pressure is building up on companies to internalise costs for external effects through governmental control, consumers environmental awareness, environmental legislation but also from employees and investors etcetera (Plogner, 2004). The pressure is building up with increasing human knowledge, insights and awareness through means of communication and as the industrial world is expanding. Important and powerful forces are growing with customer insight, awareness and thereby demands of products and services with

better environmental performance, so called green consumerism. Pressures are also expressed through environmental pressure groups and green investments (Owen, 1992). The external view is actually becoming practically impossible.

Increasing pressure on the producer from government, consumers, investors and pressure groups etcetera, put a focus on companies which are the producers of products, waste and external effects through their and their suppliers combined processes, from the cradle to the grave or actually *from the cradle to the cradle*. Holistically viewed this include activities from excavation, refining and supplying of raw material and input products, production, and customers use of produced products including handling of products at the end of their lifecycles. The latter effectively means, for materials, to be reborn again, from the cradle to the cradle, to new use which gives very important opportunities for reducing material and energy flows through recycling of materials. This is also supported of tighter legislative control of waste disposal that also force up costs to the customer through higher prices on products that the responsible companies weigh up the increased costs with. Environmental legislation is likely to have an increasingly significant impact on industrial and commercial activity in the future (Owen, 1992).

Management accounting of resources, resource flows, in a business perspective is important and will not be of less importance, even strategic, in the future. Corporations' activities from procurement, purchase and production to distribution and customers' use of sold products have had a large impact on the globe for a long time which results in extensive local and global external effects of concern. The global distribution of corporations operations make the management controlling aspect not less complex, with both a growing need of intergovernmental control and corporate control, considering an intention to manage natural resources in a sustainable way.

1.3 The effect of conceived time perspectives

Time and timing is critical for accounting; to account for costs and benefits in the right fiscal period to get a true and fair view. Time is also important in relation to resource use. Even if products today increasingly get designed for reuse of at least the material that products consist of, products with shorter life-cycles results in more turn around of energy and material, and that more products get produced per time unit which keep the wheels spinning in an ever increasing speed.

The following statements (Andersson and Wolff, 1996) illustrates thoughts about how the human conceived time perspective influence decision-making:

“ups and downs of the economy are short-term phenomena compared to long-term effects in the ecological system, and since people in general and decision-makers in particular undoubtedly have to give priority to the most pressing problems, they tend to become rather short-sighted. Consequently economic problems, if and when they occur, tend to take precedence over ecological problems” “but it is important to remember that we depend on both systems and should not neglect problems in either of them” (p.224-5)

1.4 How can companies adapt to increasing external pressures

Two alternatives are discussed, from the literature; to fully disclose or not and to give management accounting an overhaul. Whereof the latter, eventual possibilities within management accounting, to develop decision making that support environmental performance are focused in this thesis.

1.4.1 Corporate self-interest

Because there exists a virtually universal reluctance to disclose bad news or what could be interpreted as bad news, the provision of information on environmental issues from companies can be highly selective and public relations driven. (Owen, 1992) The tendency to claim environmental friendliness carries with it a risk to get cynical response from any intended receiver. The best defence against corporate critics likely consists of rigorous disclosure one studied researcher claims (Owen, 1992). An alternative also exists in not claiming environmental performance that could be questioned in order to avoid *unintended consequences* due to particular expectations, from any intended or unintended audience, on a corporation's environmental performance.

As increasing environmental legislation imposes correspondingly higher financial costs on companies, as for the handling of waste, it would seem sensible and sensitive to fully disclose in order to justify incurred expenditures that can be very high for cleaning up operations. Certainly this, increasingly, will be in investors' interest for such information to be provided. Arguably, therefore, corporate self-interest would represent an immediate pressure to respond to a, since long time dawning, general environmental awareness. (Owen, 1992)

Disclosure and external reporting is not in focus in this thesis and will only be dealt with in association with discussions of eventual findings that need a discussion of that in association with management accounting or environmental management. Disclosure also could be considered inside the corporation, but that is only dealt with if such discussions are found in the reviewed articles.

1.4.2 Possible opportunity with the internal perspective

There are many reasons to, continuously, look inside the company to see if things still could be done in more efficient ways. To search after research within management accounting and financial accounting that include environmental management or environmental accounting possibly give an opportunity to review eventual recent findings about management accounting supporting decision making within companies for higher environmental performance of companies. This thesis focuses on: What knowledge exists today that aims to support decision making in companies towards better environmental performance? If found research results indicate inefficiencies in companies associated with accounting, management accounting and decision making, not only nature and society can benefit from management of that inefficiency but also the financial outcome.

Expected findings

What are expected to be found in an academic literature search are approaches within management accounting that promote improvements of companies' efficiency and financial performance through improvement of information for decision making and environmental performance of companies. Why this is expected is due to the complexity of allocating costs to products and services in an appropriate way for efficient decisions on products and services mixes and even for consideration of new business strategies (Ax, Kullve'n and Johansson,

2005, Samuelson, 2004). Also costs associated with environment, as for example for electricity, are likely to accumulate in overhead accounts, as with the recording and periodizing of the electricity bill, and therefore hard to manage.

Because of the complexity and the various possible focuses of management accounting functions in companies it could be expected that there are inefficiencies to be found at least in nature’s perspective. Strategic considerations concern expected future internalised cost structures, which not might be recognised today, with increasing prices for material and energy flows as the possible turn round per human activity is decreasing with the increase of human population and its activities.

Research in this direction is expected since structured accounting, accounting that don’t allow costs to sum up in overhead accounts or on accounts not associated with the cause of the cost; products and activities, should give opportunity to better cost management that can increase cost-efficiency which of some costs would be associated with turn around of energy, material and waste and if lessened resulting in better environmental performance. Also decisions and strategies on product mix and what to invest in, in the future, would be supported by a more structured accounting as the following simplified, but in principle in practice a most possible, example of correct respectively incorrect environmental cost allocation in a fictitious business operation with two production processes, one clean and one dirty, shows (Hamner and Stinson, 1993), see table 1.

Examples: 1) without, 2) with Environmental overhead cost	‘Clean’ process A	‘Dirty’ process B
<i>1) Correct environmental cost allocation</i>		
Revenues	\$200	\$200
Production costs	\$100	\$100
True Environmental costs	\$0	\$50
True profit	\$100	\$50
<i>2) Incorrect environmental cost allocation</i>		
Revenues	\$200	\$200
Production costs	\$100	\$100
If environmental costs are overhead	\$25	\$25
Illusory profit	\$75	\$75
The latter (2) is incorrect by	-25%	+50%

Table 1. Examples of correct (1) and incorrect (2) environmental cost allocation (Hamner and Stinson, 1993), p. 3.

If the environmental costs for process B, according to table 1, are allocated as equal overhead costs to both process A and B, both processes seem to generate the same profits and thereby, from this viewpoint, there are no incitements to alter product mix or decisions of future investments in favour of process A.

Cost allocation is an important example of a research field within which there are expected research results to find. Also to explore holistically what actual more environmental costs exists, within the corporation, the corporation’s responsibility today, which could be managed if made visible. In the introduction several factors of external pressure on the corporation and also external effects as results of inadequate accounting of resource use, have been discussed. The focus in this thesis, however, is not on external reporting, disclosure or inclusion of what

today are external costs but *given the accounting regulation framework today what can be done better within management accounting associated with environmental management.*

Chapter structure of thesis

The structure of the remaining parts of the thesis is according to the following division in, and description of, chapters:

Method

The method describes how literature search, literature review and analysis were performed.

Review

The review is structured according to a first analysis of the topics found in the articles. The topics were gathered under headings according to the main content, topics in the articles as the articles were read through. First an *Overall article review* is provided including table 4 that summarise: author, locations; topic described in abstracts; key terms; method, sources; and, main conclusions for reviewed articles.

Analysis and Discussion

The analysis and discussion is also structured according to the topic headings defined as the articles were read through and reviewed.

Conclusion

Conclusions are made from analysis and discussion including to what extent questions are answered and the purpose is fulfilled.

Further research

Under this heading a conclusion of existing knowledge gap for further research is made.

2 Method

The main part of the purpose of this thesis is described as to search for results from eventual research that include environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance. Eventual found research results will be reviewed to gain understanding of what has been done, how it has been done and what the key issues are including main criticisms (Hart, 1998).

2.1 Literature search method

The search, for articles to be reviewed, in Business Source Premier was performed with the following search phrases and selected search object, Abstracts in Academic Journals;

“Management Accounting” in AB Abstract or Author-Supplied Abstract
and “Environmental Management” in AB Abstract or Author-Supplied Abstract
or “Management Accounting” in AB Abstract or Author-Supplied Abstract
and “Environmental Accounting” in AB Abstract or Author-Supplied Abstract
or “Financial Accounting” in AB Abstract or Author-Supplied Abstract
and “Environmental Management” in AB Abstract or Author-Supplied Abstract
or “Financial Accounting” in AB Abstract or Author-Supplied Abstract
and “Environmental Accounting” in AB Abstract or Author-Supplied Abstract

This resulted in 21 literature sources, result entries whereof 16 academic articles are being reviewed. Also the following databases were searched, with the same method, but no additional articles were found within the topic: *Emerald Insight*, *JSTOR* and *Science Direct*. In *Emerald Insight* a total of three articles were found, one which was already included and two that were outside the purpose. In *JSTOR* no articles were found and in *Science Direct* three articles were found that were already included to be reviewed.

A survey on individual and linked search phrases, according to table 2, was performed to show total populations and also that the search method presumably gives a focus on a defined topic with “management accounting” and “environmental management” as main ingredients. Regarding focus see also under the following heading: Journals and publication years. As table 2 show, 19 of the entries were related to “management accounting” and “environmental management” or “management accounting and “environmental accounting” whereof the lion’s share, 18 entries were related to “management accounting” and “environmental management” and seven entries were related to “management accounting and “environmental accounting” in their abstracts. Some of these entries resulted of either of two search combinations; thereby the total sum can be less than the sum of the parts. Only two entries, article abstracts contained “financial accounting” and “environmental accounting” and only one entry, article abstract contained the phrases “financial accounting” and “environmental management”.

The thesis thus doesn’t just review any article that deals with “environmental management”, which search phrase was found in the abstracts of 1243 entries in academic journals in the database Business Source Premier or “environmental accounting” which numbered to 110 entries with the same search method. The focus in this thesis is to look in to “management accounting”, which totals 1220 entries, and “financial accounting”, which totals 3700 entries, in academic journals, after articles which abstracts include “environmental management” or “environmental accounting”. This refined search amounted to a total of 21 entries whereof

16 entries are academic articles being reviewed. Five of the 21 entries consisted of editorials and other announcements and hence not included in the review.

Search survey in abstracts in Business Source Premier 20071223	Entries
"financial accounting"	3700
"environmental management"	1243
"management accounting"	1220
"environmental accounting"	110
"management accounting" and "environmental management" or "management accounting" and "environmental accounting" or "financial accounting" and "environmental management" or "financial accounting" and "environmental accounting"	21
"management accounting" and "environmental management" or "management accounting" and "environmental accounting"	19
"management accounting" and "environmental management"	18
"management accounting" and "environmental accounting"	7
"financial accounting" and "environmental management" or "financial accounting" and "environmental accounting"	3
"financial accounting" and "environmental accounting"	2
"financial accounting" and "environmental management"	1

Table 2. Results, number of entries found, in a search survey in Business Source Premier, 20071223

After retrieving the given search result of articles, a first analysis revealed the contours of the reviewed topic. An additional search on other relevant phrases found in abstracts, according to the earlier used method described above, was made with the following search phrases; "management accounting" and "material flow" or "management accounting" and "materials account" or "management accounting" and "mass balance" or "management accounting" and "material efficiency". The same phrases combined with "financial accounting" instead of "management accounting" were also searched. Also the following phrases found in literature, used in the introduction, was combined and searched together with "management accounting" respectively "financial accounting" according to described method; "management accounting" and "green reporting", "management accounting" and "green accounting", "financial accounting" and "green reporting", "financial accounting" and "green accounting". No other search phrases were used since discussions of environmental management and environmental management, in relation to a management accounting and financial accounting and companies environmental, and eventual resulting financial, performance are in focus. No additional articles were found.

The idea to only search in abstracts was founded on the assumption that an article's main content is likely to be described in representative terms in the abstract. Searching in all text would have resulted in a larger amount of articles outside the subject with for example occurrences of a search phrase in a literature title in a reference list used as a reference in another topic. To search on subject was not considered efficient since this is depending on a classification that is existing, appropriate and consequent and because the search phrases consist of combinations of subjects. Because eventual keywords within an eventual knowledge or research area, that was the aim to look after according to the purpose were unknown to the author no search on keywords were done. Also after the described search was performed and articles were found it showed out that not all had associated keywords.

According to found topics and information in abstracts the purpose to find recent and relevant knowledge within management accounting or financial accounting that support decision making and development of environmental performance of companies today, is estimated to be fulfilled with this search.

2.1.1 Error sources

Possible inconsistency in information on articles and abstracts in the searched database could lead to that articles weren't found with the described search method and are missing in the review. Abstracts may be absent or not defined in the database.

2.1.2 Journals and publication years

Considering the concentrated amount of literature, 16 articles being reviewed, the distribution between different journals, accounting journals and management and environment associated journals are good and representing various research origins. However, six of the articles were published in a special issue on EMA, environmental management accounting, in one academic journal. The most recent article, from 2007, is published in an accounting journal, Accounting, Auditing & Accountability Journal. The oldest article, 1997, is also published in an accounting associated journal, Issues in Accounting Education. The distribution in time is relative narrow with half of the, eight, articles published during the last two years and all articles published within a time span of ten years including current year, which probably contribute to a good focus on the topic, see table 3.

Academic Journals that reviewed articles are published in	Year
Accounting, Auditing & Accountability Journal	2007
Journal of Cleaner Production	2006 (6), 2003
Greener Management International	2006
Environmental Quality Management	2004
Journal of Technology Management and & Sustainable Development	2004
Critical Perspectives on Accounting	2003
Journal of Environmental Assessment Policy & Management	2002
Accounting Forum	2000
Issues in Accounting Education	1997

Table 3. Academic Journals and years that reviewed articles are published in.

2.2 Review method

First a review of the abstracts in the articles was made, which was summarised in table 4, to get an overview of what the articles dealt with. From this the search method could be considered verified to be appropriate regarding the usefulness of the found information according to purpose and questions. After that the articles were sorted in ascending date order and the articles were read through in principle in date order starting with the oldest to get an apprehension of the development of the found research field as the articles were read through. Through this an understanding of fundamental problems and discussions and the development of these was gained.

As the articles were read through preliminary headings were formed according to important topics associated with the purpose that were common in found articles or in individual articles. Since the articles can be characterised to be data intensive and even perform hypothesis testing no special standpoints, other than interference from the author's *eventual dislocated centre of gravity* between, but yet from studies of equal extent of, natural science, environmental science and social science (business administration, economics and law) were considered for the review.

Under each heading in the review both, parts of the reviewed article authors' results, discussions and conclusions are gathered and reviewed rather straight forward in the purpose to catch a dynamic dimension of this fairly new topic so that the information not would be

influenced by the thesis author. However, at least the choice of what's included in the review is influenced by the same. In an effort to be scientific the author strives to be objective and mirror results and discussions. It's contradictions and discussions that make a thesis alive and interesting –otherwise there would be no problem to investigate and to try to contribute with a discussion on, in the afterward following analysis and discussion, which might clarify the stated issue some what. The review part therefore could seem to be stacked with literature references. If the reviewed authors discussions is not found interesting to a reader it is encouraged to proceed to the analysis were the thesis author analyse and discuss the same found tropics.

Only results and conclusions should be included in a review. Since the depending factors for the reviewed overall topic, environmental management accounting or not, is so complex and not clarified, understood, realised completely today and important aspects of these sometimes were found in earlier parts of the articles, than the results and conclusions, such discussions were included in the review. However conclusions in this thesis are only made built on verified results and conclusions in the articles together with the authors own overall system reflection in the thesis.

2.3 Analysis method

Delimitations, what is not explored or discussed, in this thesis are not gathered in one part of the thesis but rather were it is needed to be expressed in the text. The method is also to some extent self delimitating and explaining except for, among other aspects, the following use of generalising terms that could be confusing.

Delimitation

The terms “traditional role of accountants and accounting”, compared to the new environmental management accounting approach, is used and extensively discussed in the articles in association to the existing accounting regulation and practice. To use the label *traditional* could be very confusing for a “traditional accountant” since there are different perspectives in practice of corporations and so many different perspectives in theory building as *shareholder*, *agency-principal* and *theory of the firm* etcetera.

Environmental management accounting could be described as to try to apply accounting based more on logic and a natural science perspective within the ramifications of accounting regulations rather than a particular stakeholder or shareholder perspective for example. In other words, the perspective is neither left nor right just straight forward with the Earth and the environmental performance and sustainability of its inhabitant's activities in focus.

Analysis method

The analysis could according to the above delimitation be described as to be performed with a *neither left nor right just straight forward* perspective with the resource source, the Earth, in focus within the ramifications of accounting regulations. As the reviewed article content is (first reviewed and then) analysed, a consciousness regarding the discussed important system view and time perspective regarding resource turn around in the introduction, is in the authors mind to search for such discussions.

2.4 Transparency

The transparency of this described method fulfils both demands on validity and reliability.

3 Review

The used combinations of search phrases with management accounting respectively financial accounting and environmental accounting respectively environmental management resulted in 16 found articles which main content are being reviewed. Some topics are only discussed in individual articles but most topics are discussed in several articles. There is no ambition to completely review individual articles rather to strive to obtain, to some extent, breadth and depth on a research topic that can provide support for decision making and development of environmental performance for companies. The review is structured under headings according to the main content in the articles, described in the method. First an overall article review is given.

3.1 Overall article review

The main purpose of the thesis is to search after results from eventual research that include environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance.

With the described search method, with search phrases according to the purpose, a total of 16 articles were found. 14 of these articles can broadly be classified as related to management accounting and two related to financial accounting. One of the two articles associated with financial accounting discusses the use of learning cases that deal with comprehensive environmental accounting issues to help students understand the relation among the different areas of accounting. The other article associated with financial accounting plus several of the 14 articles associated with management accounting discuss and investigate the accountant's role in traditional accounting in relation to environmental management and Environmental Management Accounting. (See *Analysis method* for description on how the term *traditional accounting* is used in the articles and accordingly in this review and the following analysis and discussion of the articles in this thesis.)

Among the 14 articles associated with management accounting most deal with accounting and management of environmental costs and a methodology developed by a United Nations expert working group organised through the Division for Sustainable Development (UNSD) called Environmental Management Accounting (EMA). One of these 14 articles explores and discusses corporate environmental sensitivity in relation to adoption of environmental management accounting practice.

One of the articles associated with management accounting deals with potentials for environmental performance through management of defined *intangible assets* associated with management, human behaviour and human resources in environmental management systems (EMS).

The following table (4) summarises the reviewed articles in five columns; Author, Locations; Topic described in abstracts; Key terms; Method, Sources; and, Main Conclusion

Reviewed Articles

Authors, Locations	Topic described in abstract	Key terms	Method, Sources	Main Conclusion
(Pérez, Ruiz and Fenech, 2007) Spain	Environmental Management System (EMS), built on EMAS, with development of <i>Intangible Assets</i> as catalyst for environmental performance.	EMS and performance through <i>Intangible Assets</i>	Field research; interviews with environmental managers and accountants; 10 Spanish EMAS registered sites	Identification of advanced use of management accounting practices as key intangible asset for environmental embeddedness and improved environmental performance.
(Jasch, 2006) Austria	Environmental Accounting, Environmental Management Accounting (EMA) and importance of data consistency within different information systems like the list of accounts, stock management, production planning and process engineering.	Environmental management <i>cost assessment in one day</i>	Company workshops and Case studies	The importance of data consistency for effective use of EMA.
(Jasch and Lavicka, 2006) Austria, Austria	Sustainability Management Accounting in automobile cluster; two major cost drivers found: Purchase cost of non-product output and cost of lost working days because of sick leave, accidents and resulting overtime pay.	<i>Cost drivers, Cost Assessment</i>	Company workshops in six companies within the Styrian automobile cluster and selected member companies	Two major cost drivers: Purchase cost of non-product output; and, Cost related to lost working days because of sick leave and accidents and the overtime pay to make up for these lost working days.
(Gale, 2006a) Australia	Understanding of material purchase value of wastes and emissions and related processing costs through Environmental Management Accounting (EMA) methodology.	EMA as <i>modernisation strategy</i> for cleaner production	Research review of practical problems, including good examples, with adoption of EMA	Because environmental costs are hidden in overhead accounts or not recorded or required in conventional accounting systems; Opportunities for cost savings and performance are missed.
(Gale, 2006b) Australia	Environmental Management Accounting (EMA) framework applied on an annual financial report for a Canadian paper mill.	EMA framework <i>applied on an annual financial report</i>	Case study at a paper mill site	Environmental costs are generally higher than considered because costs and benefits often are hidden in other accounts. Environmental costs at least twice as high according to EMA methodology compared to conventional accounting.
(Burritt and Saka, 2006) Australia, Japan	Examination of links between Environmental Management Accounting (EMA) applications and with eco-efficiency measures in Japan.	EMA and <i>eco-efficiency</i> measures	Case studies	Practice of linking eco-efficiency measurement with EMA information is under-utilised, diverse and in need of further promotion to help Japanese business move production processes and consumption of its products towards sustainability.
(Scavone, 2006) Argentina	Internal environmental management reporting through Environmental Balance Score Card in Argentina. Improved information by Accountants.	<i>Environmental Balance Score Cards</i>	Study; of results from a governmental EMA promotion programme	Accountants important role in the development of quality information for management.
(Clarke and O'Neill, 2006) Australia, Australia	Is the Environmental Professional an Accountant?	<i>The role of the Accountant</i> for environmental sustainability	Literature study	Accountants have great potential in supporting and making contributions to managerial decision-making.
(Gibson and Martin, 2004) USA	Demonstration of value through Environmental Management Accounting.	<i>Cost control</i> and <i>value creation</i>	Literature study	Business entities and other organisations can improve financial environmental performance through EMA.

Authors, Locations	Topic described in abstract	Key terms	Method, Sources	Main Conclusion
(Li, 2004) UK (China)	Environmental Management Accounting (EMA) as response to environmental problems, for environmental decision-making; experiences of implementation in China.	EMA for environmental <i>decision-making</i>	Case Study with a governmental perspective on China	If environmental costs are properly traced back to product or service costs, governments can use this information to direct the market through taxation or other economic instruments instead of relying only on environmental legislation. This would prompt manufacturers to adjust manufacturing procedures or prices that would influence consumer behaviour.
(Lodhia, 2003) Australia	Accountants' responses to environmental agenda, preparedness of accountants to handle environmental accounting within conventional accounting framework in Fiji.	Environmental accounting <i>within conventional accounting framework</i>	Case studies	The responsibility of environmental accounting should not be left to a single party; a multi-disciplinary approach is needed with pooling of skills of environmental experts and accountants.
(Jasch, 2003) Austria	Environmental Management Accounting (EMA) provision for the transition of data from financial accounting, cost accounting and mass balance to increase Material efficiency, reduce environmental impacts and risks and cost of environmental protection.	<i>Identification of environmental costs through EMA</i>	Case study	Importance of consistent information systems. Separate information systems for financial and cost accounting and for process technicians better be one consistently following the material flows through the company. Material purchase value of non product output of 80,4 percent for a paper mill. Indicate that the main environmental costs might be plain in-efficiency in use of operating materials, raw materials and energy on non product output; waste.
(Gadenne and Zaman, 2002) Australia, Australia	Strategic Environmental Management Accounting, Current Corporate Practice/Strategic Intent; Current state of corporate Australia's Environmental Management Accounting practices and environmental management accountants perception of how Environmental Management Accounting information should be accounted for and reported in the annual report in environmentally sensitive corporations; as notes in the financial statement or in the profit and loss statement and the balance sheet.	<i>Strategic Environmental Management Accounting, Current Corporate Practice</i>	Survey and Hypotheses testing	Result indicates that many Australian corporations are motivated principally by legal compliance. Strategic intent to measure and disclose environmental costs indicate that firms will be more motivated by long-term strategies. Management accountants believe environmentally induced costs and expenses information should be reported as notes to financial statements rather than in the profit and loss statement in the annual report. Some support for that environmental management accountants believe that environmentally induced end-of-pipe and integrated technologies should be recognised as assets in the balance sheet. But inconclusive whether environmentally induced additional costs as/for fines, pollution prevention, R&D, regulatory compliance, taxes, tradeable pollution permits etcetera should be capitalised and amortised.

Authors, Locations	Topic described in abstract	Key terms	Method, Sources	Main Conclusion
(Frost and Wilmshurst, 2000) Australia	Environmental sensitivity of the industry as factor for adoption of Environment-related management accounting and control procedures, corporate environmental sensitivity.	<i>Corporate environmental sensitivity</i>	Survey and Hypothesis testing	Indication that environmental reporting is more likely to occur in environmentally sensitive firms but adoption of environment-related management accounting procedures appears not solely driven by environmental sensitivity.
(Bartolomeo, Bennett, Bouma, Heydkamp, James and Wolters, 2000) Italy, UK, The Netherlands, Germany, UK, The Netherlands	Report of investigation of links between environmental management and management accounting; current practice and future potential of Environmental Management Accounting in Europe.	<i>Management accounting and environmental management;</i> current practice and future potential	Trans-European project with interviews with accountants and environmental managers at 84 companies and detailed case studies of 15 companies	Opportunities exist for many companies, for both business and environmental reasons, to become more active in EMA, and that pressures on them to do so will increase. However actions need to be realistic and cost-effective and are likely to involve incremental changes to existing activities rather than introduction of completely new processes.
(Sefcik, Soderstrom and Stinson, 1997) USA	Describes how Environmental Accounting issues can be incorporated into existing courses to help students understand relation among the different areas of accounting ie. financial, managerial, information systems, auditing and tax.	Environmental accounting cases, to <i>help students understand</i> relation among different areas of <i>accounting</i>	Review and discussion	Incorporation of environmental accounting with its comprehensive nature is likely conducive to making learning to learn a primary objective and consistent with movement from a curriculum based on teaching accounting to one based upon an information development and distribution function for economic decision making.

Table 4. Reviewed articles with author, locations, topic, key terms, method, sources and main conclusions.

3.2 Review according to topics found in the academic articles

This section reviews contents in the found academic articles according to, of the author judged, important topics that are common in several articles or found in individual articles.

3.2.1 Environmental Management Accounting, conceptions

This part of the section reviews briefly a development of conceptions from early approaches to recent work within the main topic found in, 14 of the 16, articles reviewed associated with management accounting and a methodology developed by United Nations Division for Sustainable Development (UNSD) called Environmental Management Accounting (EMA).

Development of conceptions of Accounting including Environment

A brief background of a development, from early presumable to some degree diffused use of *environmental accounting* and later *environment-related management accounting conceptions* to more recently conceptions of environmental *management accounting* follows here.

Environmental Accounting

Environmental accounting can be defined as the understanding, recognition and incorporation of impacts of environmental issues on a firm's traditional accounting sub-systems (Sefcik et al., 1997). Environmental accounting flourished briefly in the academic accounting literature during the 1970s as a part of the more general area of *social accounting* (Bartolomeo et al., 2000, Sefcik et al., 1997). This aimed to broaden the scope of accounting from its traditional and legally defined concentration on financial stakeholders to a broader accountability to external stakeholders in general and society as a whole (Bartolomeo et al., 2000). Possibly because of few economic or legal consequences associated with it broad academic interest soon faded. However, corporate external environmental reporting, externally observed, presumably with basis on some kind of environmental accounting internally, started to occur with increasing frequency in the late 1980s as a consequence of environmental regulation on different levels (Bartolomeo et al., 2000, Gray, Owen and Adams, 1996, Sefcik et al., 1997).

Environment-related Management Accounting

Adoption of *environment-related management accounting* of companies is documented from the early 1990s with a number of studies having observed that such practices have resulted in cost savings (Frost and Wilmshurst, 2000). Such research has corresponded with discussion on development of appropriate accounting systems.

The objective has predominantly been to provide information for better management decision-making and Frost and Wilmshurst states that environment-related management accounting can be effective in improving management efficiency by:

- Identifying income statement and balance sheet impact
- Identifying cost reductions and improvements
- Prioritising environmental actions
- Guiding product pricing, mix and development decisions
- Enhancing customer value
- Future-proofing investment and other decisions with long-term consequences
- Assessing the eco-efficiency and/or sustainability of a company's activities

Environmental Management Accounting

Bartolomeo et al. (Bartolomeo et al., 2000) have investigated the links between environmental management and management accounting functions of a company or business. They identified four broad but distinct approaches to environmental accounting from the literature: External Financial Reporting; Social Accountability Reporting; Energy and Materials Accounting; and Environmental Management Accounting. They related these approaches in external and internal, financial and non-financial respectively perspectives according to Figure 2.

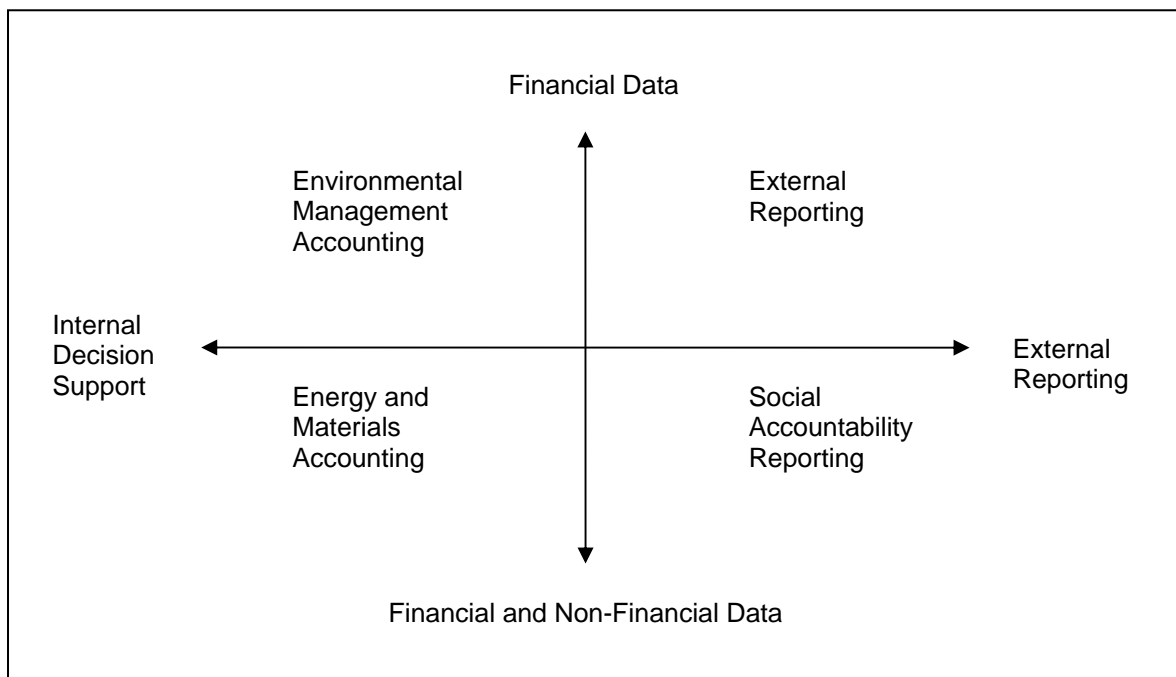


Figure 2. Environmental Management Accounting in relation to other approaches to environmental accounting in internal, external, financial and non-financial perspectives. (Bartolomeo et al., 2000).

Environmental Management Accounting (EMA) including Energy and Materials

Environmental Management Accounting (EMA) could be said to be a fusion between *management accounting, financial accounting and environmental information systems* (Jasch, 2003):

Management accounting constitutes a central tool for internal management decisions as for example cost accounting and product pricing. The main stakeholders are executive, site, product and product managers. In practice many companies calculate on the basis of the financial accounting data, without a separate cost accounting system.

Financial accounting, in contrast, is mainly designed to satisfy information needs of external stakeholders and financial authorities that have strong economic interests in standardized comparable data and true and fair information about the actual economic performance.

Core parts of *Environmental Information Systems* are material flow balances in physical units of material, water and energy flows within a defined system boundary.

EMA, *Environmental Management Accounting* represents a combined approach which provides for the transition of data from financial accounting, cost accounting and material

flow balances to increase material efficiency, reduce environmental impact and risk and reduce costs of environmental protection.

EMA promoted by UN

Environmental Management Accounting represents a new emerging area of management accounting research and practices, to an extent with governmental promotion through a UN work group that have developed and documented a formalised method for environmental cost assessment and control (Jasch, 2003).

The Expert Working Group on improving Governments' Role in the Promotion of Environmental Management Accounting was organised after informal discussions in 1998 administered of a commission within United Nations Division for Sustainable Development (UNSD) in the context of negotiations on environmentally sound technologies (Jasch, 2003). The discussions indicated that a number of governments were involved or interested in promoting EMA but there had been little or no communication between them. Participating in the Expert Working Group were representatives from:

- National environmental agencies and ministries,
- International organisations,
- Industry,
- Accounting firms,
- Academia, and
- United Nations agencies

With this method hidden environmental costs and benefits can be assessed and controlled that have a great potential to influence not only environmental performance but as a result also financial performance which this review show some examples of from research. EMA metrics for internal decision-making include both physical metrics for material and energy consumption, flows, and final disposal, and monetary metrics for costs, savings, and revenues related to activities with a potential environmental impact. Key application fields for EMA are (Jasch, 2003):

- Assessment of annual environmental costs / expenditures
- Product pricing
- Budgeting
- Investment appraisal, calculating investment options
- Calculating costs and savings of environmental projects
- Design and implementation of environmental management systems
- Environmental performance evaluation, indicators and benchmarking
- Setting quantified performance targets
- Cleaner production and Eco-design projects
- External disclosure of environmental expenditures, investment and liabilities
- External environmental or sustainability reporting
- Other reporting of environmental data to statistical agencies and local authorities.

The publication *Environmental Management Accounting: Procedures and Principles* published on UN-webpage: <http://www.un.org/esa/sustdev/sdissues/technology/estema1.htm> under "EMA Publications" is the first of a series of publications of the UN Expert Working Group. The publication is intended to minimize the cost of introducing EMA systems by a set

of principles and procedures for EMA based on commonly used and accepted financial accounting methods. This approach to EMA is not the only way but one that the Working Group after extensive consultation agreed to be sound and cost-effective. (Jasch, 2003)

Definition of costs a main problem

The main problem of Environmental Management Accounting is the lack of a standard for definition and accounting of environmental costs. In addition, most of these costs are usually not traced systematically and attributed to processes and products, but simply summed up in general overhead accounts. The fact that environmentally costs not fully are recorded, often leads to distorted calculations for improvement options and achieved savings. Therefore opportunities to prevent emissions and waste at the source by better utilising of raw and auxiliary materials and less harmful operating materials are not recognized and implemented. Also managers are often not aware that producing waste and emissions are usually more expensive than disposing of them. In conventional cost accounting aggregation of costs in overhead accounts results in costs being hidden from management. Therefore management tends to underestimate the extent and the growth of such costs. (Jasch, 2003)

Included costs in EMA

The present EMA method only deals with corporate environmental costs. External costs that result from corporate activities but not are internalised via regulations and prices are not considered. This is regarded the role of governments to apply political instruments as eco-taxes and emission control regulations to enforce the polluter pays principle and thus integrate external costs into corporate calculations. (Jasch, 2003)

The model support calculation of environmental costs for corporations that comprise all activities needed for legal compliance and compliance with community. This includes costs for prevention, disposal, control, shifting actions and damage repair that can occur in companies. Corporate environmental protection expenditure includes expenditures for measures for environmental protection of a company or what it is responsible for to prevent, reduce, control and document environmental aspects as impacts and hazards, as well as disposal, treatment, sanitation and clean-up expenditures, for principle see table 5. (Jasch, 2003)

Environmental Protection Expenditure (Waste Disposal and Emission Treatment, Environmental Management and Pollution Prevention)
+ Costs of wasted material
+ Costs of wasted capital and labour
= Total corporate environmental costs

Table 5. Total corporate environmental expenditure principle calculation (Jasch, 2003).

For internal calculation of environmental costs for a company, expenditures for environmental protection are only one side of the coin. The costs of waste and emissions include much more than the costs for pollution prevention or treatment. Waste in this framework has double meaning. Waste is a material that have been purchased and paid for but which has not been turned into a marketable product. Waste is indicative of production inefficiency. The costs of wasted materials, capital and labour have to be added to obtain the total corporate environmental costs and a relevant base for further calculations and decisions. Waste includes in this context solid waste, waste water, air emissions and comprises all non-product output. (Jasch, 2003)

Environmental Cost Assessment schemes

For assessment of corporate environmental expenditures, the environmental cost assessment scheme provided by the UN Expert Working Group, can be used, see table 6. Annual expenses are the best available data source to begin with. Further distinction into cost centres, processes, products and material flow balances can rather be done in an step by step procedure through which the information system gradually is improved (Jasch, 2003). The cost assessment scheme gather costs associated with environment in a structured way so they become visible and can be managed because it allocates them both to the effected environmental media and to what causes the costs, a responsibility or a cause, that become visible in a detailed environmental cost assessment. In this review just the overall headings of the cost categories, for practical reasons, is provided as a general template to get the idea of how the assessment could be performed.

Environmental Cost Assessment scheme

Environmental media	Air and climate	Waste water	Waste	Soil and ground water	Noise and vibration	Biodiversity, landscape	Radiation	Other
Environmental cost categories								
1. Waste and emission treatment								
1.1 Depreciation for related equipment								
1.2 Maintenance, operating materials and services								
1.3 Related personnel								
1.4 Fees, taxes, charges								
1.5 Fines and penalties								
1.6 Insurance for environmental liabilities								
1.7 Provisions for clean-up costs, remediation								
2. Prevention and environmental management								
2.1 External services for environmental management								
2.2 Personnel for general environmental management activities								
2.3 Research and development								
2.4 Extra expenditure for cleaner technologies								
2.5 Other environmental management costs								
3. Material purchase value of non product output								
3.1 Raw materials								
3.2 Packaging								
3.3 Auxiliary materials								
3.4 Operating materials								
3.5 Energy								
3.6 Water								
4. Processing costs of non product output								
Total Environmental Costs								
5. Environmental earnings								
5.1 Subsidies, awards								
5.2 Other earnings								
Total Environmental Earnings								
Balance costs/earnings								

Table 6. Environmental Cost Assessment scheme provided by UN (Jasch, 2003).

The costs that are included all exist today, but are scattered and hidden in different accounts. No new, extra external costs, but just existing costs, are included. It's just existing costs and expenditures, according to the existing accounting and environmental regulation today, that are made visible internal in the corporation, and if the corporation decide it could be included in the external reporting.

3.2.2 Environmental Management Accounting, depending factors

In this part of the section discussed factors, to influence engagement in corporate Environmental Management Accounting, in the articles are reviewed. The review part could, be viewed as, seemingly be stacked with literature references, for a motivation of how the review is done, see: *Review method*. If the reviewed authors' discussions are not found interesting please proceed to the analysis and discussion where the thesis author analyse and discuss the same found topics.

External pressures

Many of the articles discuss external pressure as a driving force for environmental activity in companies. Bartolomeo et al. reports that as environmental management in business has evolved interest has grown to develop a better understanding of environment-related costs and benefits as input to conventional management accounting. A main driving force is the effect environmental factors can have on the profitability and it's likely that these effects would increase in the future through both public policy and market forces. Some examples of this are increasing levels of capital and operating expenses for pollution control as regulation increase. Also costs are incurred as a result of public concern about environmental issues, for example Shell's disposal of the Brent Spar oil storage platform at a much higher cost than had been anticipated, also eco-taxes and other incentive-based regulation is anticipated. (Bartolomeo et al., 2000)

Gadenne and Zaman (Gadenne and Zaman, 2002) also claims that in response to increasing concerns by stakeholders there has been a trend for companies to provide more information on environmental matters both within management accounting systems and in annual reporting. They also mention that increased public awareness of environmental issues has put pressure on corporations to measure environmental costs and expenses and to develop and enhance disclosure of environmental information to stakeholders.

Gibson and Martin (Gibson and Martin, 2004) also states that business entities face increasing pressure to demonstrate value and performance from their environmental management systems. But also, by focusing on that managers realise the benefits for internal planning purposes. Environmental Management Accounting thus likely gives opportunities for business to better respond to increasing business and regulatory pressures by helping them to:

- more accurately track and manage raw materials, energy and wastes;
- more accurately identify, estimate and manage costs, particularly costs related to wasted raw material and management of waste streams;
- better identify and estimate the financial and other business benefits of environmental management activities; and
- better measure and report environmental and financial performance, thus improving the company's image with customers, investors, financial institutions, employees, communities, environmental organizations and governmental agencies.

Li (Li, 2004) states that environmental issues have emerged in recent decades as major aspects of economic growth and development. Such aspects are for example global warming; atmospheric, soil and water pollution caused by industrial activities; the quick decline of forest areas; noise pollution; and radioactive and chemical wastes. All these problems are associated with industrialisation and economic growth. Li further argues that if environmental costs are properly traced back to product or service costs, governments can use this information to direct the market through taxation or other economic instruments instead of relying only on environmental legislation. This would prompt manufacturers to adjust manufacturing procedures or prices that would influence consumer behaviour according to Li.

Clarke and O'Neill (Clarke and O'Neill, 2006) goes even further and claims that current social values and increasing awareness of the environmental impact of industry now means that corporations no longer can act as if there were endless natural resources and disposal options. Sustainable development, *the human need to exist on the Earth's income without eroding its natural capital*, have become central to both business and government. They also claim that increasing public awareness of the environmental impact of organisations and the need for sustainable development even has changed and promoted stakeholders' *expectations* on environmental performance.

Jash and Lavicka (Jasch and Lavicka, 2006) argues that the monetarised external impact of an organisation should influence its decision-making as well as allowed to give directions of future requirements since they tend to become internalised via legal frameworks if they are significant. Other reviewed authors (Clarke och O'Neill, 2005, Gadenne och Zaman, 2002, Gale, 2006a, Gale, 2006b, Gibson och Martin, 2004, Jasch, 2003, Li, 2004, Lodhia, 2003, Scavone, 2006) have similar argumentation.

Corporate Environmental sensitivity

Frost and Wilmshurst (Frost and Wilmshurst, 2000) examines environmental sensitivity of the industry as a factor associated with the adoption of environment-related management accounting and control procedures. Their results indicate that although environmental reporting is more likely in environmentally sensitive firms, the adoption of environment-related management accounting procedures does not appear to be driven exclusively by the environmental sensitivity of the industry. They conclude that further research is needed to identify what causes organisations to adopt environment-related management accounting procedures.

Traditional role of Accountants and Accounting

(See *Analysis method* for description on how the term *traditional accounting* is used in the articles and accordingly in this review and the following analysis and discussion of the articles in this thesis.)

Although management accounting could provide valuable information on environmental costs, such costs appear typically to have been neglected by traditional management accounting Frost and Wilmshurst states (Frost and Wilmshurst, 2000). Bartolomeo et al. express this in other words and claims that conventional management accounting – and conventional financial reporting – aims to report and analyse only costs incurred internally within the business. However, now more strategic and externally-oriented perspectives are needed they claim (Bartolomeo et al., 2000)

Frost and Wilmshurst (Frost and Wilmshurst, 2000) also claims that the evolving sustainability debate and reporting underlines the importance of a more holistic level of accountability and a recognition that “traditional accounting” practices are not able to provide this accountability. This also Lodhia reports (Lodhia, 2003) in research results which indicates that many Australian corporations are motivated principally by legal compliance, but also some visible strategic intents to measure and disclose environmental costs indicate that firms probably will be more motivated by long-term strategies in the future.

In research on environmental accounting practice and appraisal Lodhia further found that management accountants believe environmentally induced costs and expenses information should be reported as notes to financial statements rather than in the profit and loss statement in the annual report. Lodhia’s study also give some support for that environmental management accountants believe that environmentally induced end-of-pipe and integrated technologies should be recognised as assets in the balance sheet. But the results were inconclusive whether environmentally induced additional costs as/for fines, pollution prevention, R&D, regulatory compliance, taxes, trade able pollution permits etcetera should be capitalised and amortised.

Lodhia (Lodhia, 2003) further reports that interviewed accountants indicated that environmental issues are essential for their organisations but they had not considered the impact of environmental issues on their accounting practice. They perceived their roles as to work within a confined economic focus even though they have useful skills for environmental management and environmental management strategies. Lodhia further points out that the responsibility of environmental accounting should not be left to a single party; a multi-disciplinary approach is needed with pooling of skills of environmental experts and accountants.

Scavone (Scavone, 2006) claims that accountants play an important role in contributing to information quality in bookkeeping that better support decision making in environmental management issues and that the profession’s expertise is most relevant and helpful to make stakeholders aware of the importance of sustainability as a business strategy. Clarke and O’Neill (Clarke and O’Neill, 2006) also discuss if the environmental professional is likely to be an accountant. But they are a bit doubtful since although increasing social value of accounting knowledge has been evident and attributed to a variety of social changes including rapid industrialisation now it seems also environmental problems. Therefore it is maybe better that other, environmental professionals manage the environmental part given access to accounting information they claim.

Clarke and O’Neill further put forth that although some organisations in industries of environmental concern as mining and petrochemicals appear to have higher rates of adoption of performance measurement and reporting practices, widely moves to institutionalised environmental accounting have not yet occurred. Clarke and O’Neill further claims that accountants stand accused of a reluctance to move away from traditional attitudes and paradigms and of taking a ‘light green’ view of environmental accounting as modifying information systems without significantly altering their substance. The accounting profession therefore could lag behind and environmental accounting issues be taken over of other professions (Clarke and O’Neill, 2006). Other research results also suggests the accountants is likely to be left behind if they are not more proactive in responding to changing expectations (Frost and Wilmshurst, 2000).

Differences in ability of various disciplines of accounting in supporting sustainability

Clarke and O'Neill (Clarke and O'Neill, 2006) states that research results has highlighted fundamental differences in the ability of the various disciplines of accounting to engage in supporting environmental sustainability. Most evident could this be in comparison of *Management Accounting* practice and *Financial Accounting*.

Ability of management accounting systems to support sustainability

Within management accounting systems, which have purposes to provide performance information for internal decision-making, the choice to include environmental performance information is free. Management accountants would therefore be well positioned to make environmental performance 'visible' within an organisation. This could be done by incorporating financial and non-financial environmental information and key performance indicators into traditional management accounting control systems including use of *innovative balance score cards*. Further the expertise of accountants in the design and operation of information systems and the provision of quantitative analysis of financial and non-financial data actually give management accountants an important role in supporting environmental performance. (Clarke and O'Neill, 2006)

Ability of financial accounting systems to support sustainability

Unlike management accounting information, external financial reporting is highly regulated and the profession's conceptual framework could provide great challenges to accountants that seek to account for performance or impacts of an organisation holistically. The accounting profession's fundamental entity assumption requires that the performance of an entity is accounted for separately from its owners, other organisations and stakeholders. This is often criticised as if externalities were ignored in the reporting. But any transaction or event caused by an entity that does not have a direct measurable impact on the entity, even though it may on stakeholders, would be ignored for accounting purposes and in reported profits. Corporate financial statement disclosures would therefore be incomplete if there exist environmental impacts on external stakeholders that are not voluntary reported in notes or additional disclosure to financial statements. (Clarke and O'Neill, 2006)

The historically precise nature of accounting valuation with emphasis on validity and reliability of measurement contrasts with the nature of many environmental costs and liabilities which are difficult to quantify reliably. Financial accounting systems have thus limitations in effectiveness, resulting from current regulation and generally accepted accounting practice, in supporting environmental management. (Clarke and O'Neill, 2006)

Nevertheless, financial accountants can contribute by improving the information content by increasing the visibility of individual categories of costs, as cost of waste and non-renewable resource use, instead of letting them be aggregated in general expense and overhead accounts (Clarke and O'Neill, 2006) or be regarded as fixed costs. Other reviewed authors (Gadenne and Zaman, 2002, Gale, 2006a, Gale, 2006b, Gibson and Martin, 2004, Jasch, 2003, Jasch and Lavicka, 2006, Li, 2004, Scavone, 2006) have similar argumentation.

Lack of exchange of information and knowledge within the corporation

Experience shows that the *environmental manager* rarely has access to the actual cost accounting documents of the company and is probably only aware of a tiny fraction of the aggregated environmental costs. The *controller*, on the other hand, has most of the information but is likely unable to separate the environmental part without guidance. In

addition the controller could be limited to thinking within the framework of existing accounts. The two departments, thus, tend to have communications problems. (Jasch, 2003)

Importance of consistency in information systems

Jash (Jasch, 2003) points to the importance of consistent information systems. Commonly separated information systems in organisations for financial and cost accounting and for process technicians rather should be on common consistently following the material flows through the companies she claims.

Implementation aspects of EMA

Bartolomeo et al. claims that environmental management accounting often is complementary to other current trends in business and accounting. For example environmental cost accounting, as a subset of Environmental Management Accounting, can be seen in part as a specific application of *Activity Based Costing* (ABC) which focuses on the environment as a cost driver. In companies where environmental performance is identified as a significant strategic variable it can form one of the perspectives in a *Balance Score Card* (BSC) approach. (Bartolomeo et al., 2000)

Case studies (Bartolomeo et al., 2000) suggest that the financial benefits of introducing Environmental Management Accounting do not usually justify major changes and are therefore better achieved by integrating environment into existing change programmes, such as the introduction of *Activity Based Costing* (ABC) into a business. Realistically, therefore, for most companies, environmental management accounting would be an intermittent process in which periods of low-level, low-profile, activity are punctuated by bursts of considerable attention and innovation. These would often be triggered by changes such as the introduction of new internal accounting systems.

Environmental Management Systems (EMS) as catalysts

Pérez et al. (Pérez et al., 2007) explore how catalysts for change that stem from European Community Eco-Management and Audit Scheme (EMAS) could enable the embedding for environmental issues and values in organisations, through the creation of different *intangible assets*. They discuss: training and awareness building; continuous environmental improvement; integrating stakeholders' interests; and, organisational learning as catalysts. Further, their field research gives an illustration of the implication of management accounting in such processes of environmental embedding.

Two critical intangible assets are suggested from the exploration of training and awareness building: the awareness of employees, and the environmental knowledge, skills and expertise of employees. Two intangible assets have emerged from the analysis of continuous environmental improvement: the integration of environmental issues in the strategic planning process and the use of management accounting practices. Five key intangible assets are evidenced from the analysis of integrating stakeholders' interests and organisational learning: the commitment of managers; the cross-functional coordination and communication; the integration of environmental issues in the strategic planning process; the use of management accounting practices and the environmental knowledge, skills and expertise of employees. Pérez et al. classify these intangible assets in three defined levels of environmental embeddedness according to figure 1.

<i>Intangible Assets indicating environmental embeddedness</i>		Indicators of environmental embeddedness				
		Awareness of employees	Environemtal knowledge, skills and expertise of employees	Commit- ment of managers	Cross- functional coordination and communication	Integration of environ- mental issues in strategies
L e v e l s o f e m b e d d e n e s s	Primary					
	Visible					
	Advanced					

Figure 1. Levels of environmental embeddedness (Pérez et al., 2007).

The first, primary, level of embeddedness is based on the need to keep the Environmental Management System (EMS) alive, assuring a minimum level of continuous environmental performance improvement. A second, visible, level of embeddedness is characterised by further influence of environmental issues over organisational structures and strategies. The third, advanced, level of embeddedness is characterised by the existence of intangible assets that guarantee the integration of environmental issues over time. This level includes the use of management accounting practices as emerging costs systems, capital budgeting, scorecards and other advanced management accounting practices. This implies formal and informal interactions between different functions that enable the sharing of environmental information which stimulate the use of management accounting practices for further embeddedness. (Pérez et al., 2007)

3.2.3 Environmental Management Accounting, some corporate results

This part of the section reviews research results from environmental management accounting studies with researchers working together with members in corporations.

Environmental management cost assessment in one day

Jash (Jasch, 2006) shows that in just one day environmental management costs could be assessed for a company in a company workshop. This could be achieved with information from the annual report complemented with information extracted with the help of multidisciplinary functions from the firm as: production manager, environmental manager, material's management or storehouse department manager, controller and at least one member of financial accounting and cost accounting department.

Environmental Cost Assessment

Gale (Gale, 2006a) report results from a case study where he applied EMA framework to the 2000 year-end financial report for the Canadian Mackenzie Paper Division paper mill. A conventional reading of obvious environmental costs from the financial report was Cdn\$2.196.838.

With the UN supplied EMA methodology estimates resulted in total environmental costs of Cdn\$4.858.753, see table 7. Environmental costs according to EMA were thereby more than twice as high as those reported by the company. This supports a view that environmental costs are much higher than generally considered and shows that many important environmental costs are hidden in other accounts he concludes.

Only summarised costs per environmental cost categories and environmental media, in the environmental cost assessment scheme, are included in this thesis for practical reasons. In the complete detailed environmental cost assessment scheme costs are tracked down to responsibility or cause which facilitate management of every cost associated with environment that the company have expenditures for today.

The sums for the cost categories, according to the environmental cost assessment scheme, in this case study were as follows: (1) Waste and emission treatment: Cdn\$3.348.902; (2) Prevention and environmental management: Cdn\$270.109; (3) Material purchase value of non product output: Cdn\$946.799; and (4) Processing costs of non product output: Cdn\$292.943. No Environmental Revenues was reported.

The result led the participants from the company, the Canadian Mackenzie Paper Division paper mill, to question the EMA methodology rather than the performance of the company operation, even though they had participated in and supplied information on costs and material flow to the case study. Gale concludes that more research is needed on shortcomings of existing accounting practices.

Environmental media	air and climate	waste	waste water	soil and ground water	noise and vibration	biodiversity landscape	radiation	O E C	Curr. book value	Total	Total Category cost
Environmental cost categories											
1. Waste and emission treatment											
1.1 Depreciation for related equipment									15931		
Total current book value											
Costs by environmental media		103	774	0	0	0	0	0			
Sub-total										867	
1.2 Maintenance, operating materials and services											
Costs by environmental media		12	1832	0	0	0	0	12			
Sub-total										1855	
1.3 Related personnel											
Costs by environmental media	45	34	458	0	0	0	0	0			
Sub-total										538	
1.4 Fees, taxes, charges											
Costs by environmental media	7	28	44	0	0	0		0			
Sub-total										79	
1.5 Fines and penalties											
Costs by environmental media											
Sub-total	0	0	0		0	0	0	0		0	
1.6 Insurance for environmental liabilities											
Costs by environmental media	0	0	0	11	0	0	0	0			
Sub-total										11	
1.7 Provisions for clean-up costs, remediation											
Costs by environmental media											
Sub-total	0	0	0	0	0	0	0	0		0	
Total Waste and emission treatment											3349
2. Prevention and environmental management											
2.1 External services for environmental management											
2.2 Personnel for general environmental management activities											
2.3 Research and development											
2.4 Extra expenditure for cleaner technologies											
2.5 Other environmental management costs (oec)											
Costs by environmental media (not in detail)	196	44	12	19	0	0	0	0			
Total Prevention and environmental management										270	270
3. Material purchase value of non product output											
3.1 Raw materials											
3.2 Packaging											
3.3 Auxiliary materials											
3.4 Operating materials											
3.5 Energy											
3.6 Water											
Costs by environmental media (not in detail)	0	0	600	0	0	0	0	347			
Total										947	947
4. Processing costs of non product output											
Total			107					185		293	293
Total Environmental Costs											
Costs by environmental media (not in detail)											
Total											
5. Environmental earnings											
5.1 Subsidies, awards											
5.2 Other earnings											
Total Environmental Earnings	0	0	0	0	0	0	0	0		0	0
Balance costs/earnings	248	221	3827	30	0	0	0	544		4859	4859

Table 7. Environmental Cost Assessment for Mackenzie Paper Division paper mill in rounded Cdn\$-thousands.

In another example the environmental cost assessment scheme is used by Jash in the SCA pulp and paper company SCA Graphic Laakirchen in Austria for year 2000, see table 8. The table shows the distribution in percent for environmental costs for the company in year 2000. The total environmental costs assessed for year 2000 were 23.758.510 Euro. As can be seen in the table *material purchase value of non product output* had a lion share of 80,4 percent.

Environmental Cost Assessment scheme

Environmental media	Air and Climate	Waste Water	Waste	Soil and groundwater	Other	Total	Total per main cost category
Environmental cost categories							17,8
1. Waste and emission treatment							
1.1 Depreciation for related equipment	0,2	3,2	0,5			3,9	
1.2 Maintenance, operating materials and services		5,0		0,1		5,1	
1.3 Related personnel	0,8	1,6	0,7			3,1	
1.4 Fees, taxes, charges	0,7	1,3	3,6			5,7	
1.5 Fines and penalties							
1.6 Insurance for environmental liabilities							
1.7 Provisions for clean-up costs, remediation							
2. Prevention and environmental management							2,6
2.1 External services for environmental management					0,1	0,1	
2.2 Personnel for general environmental management activities	0,1				0,9	1,0	
2.3 Research and development		1,5				1,5	
2.4 Extra expenditure for cleaner technologies							
2.5 Other environmental management costs							
3. Material purchase value of non product output							80,4
3.1 Raw materials			23,0			23,0	
3.2 Packaging			0,1			0,1	
3.3 Auxiliary materials			2,1			2,1	
3.4 Operating materials	0,1	32,0	0,5			32,5	
3.5 Energy	22,6					22,6	
3.6 Water		0,1				0,1	
4. Processing costs of non product output		0,2	0,9			1,0	1,0
Total Environmental Costs	24,6	44,9	31,3	0,1	1,0	101,9	
5. Environmental earnings							-1,9
5.1 Subsidies, awards		-0,8				-0,8	
5.2 Other earnings		-0,2	-0,9			-1,1	
Total Environmental Earnings		-1,0	-0,9			-1,9	
Balance costs/earnings	24,6	44,0	30,3	0,1	1,0	100,0	

Table 8. Environmental Cost Assessment scheme for SCA Laakirchen with distribution of environmental costs in percent for year 2000 (Jasch, 2003).

Some more results reported

Bartolomeo et al. (Bartolomeo et al., 2000) reports that most companies, in a trans-European research project that comprised interviews with accountants and environmental managers at 84 companies in Germany, Italy, The Netherlands and the UK and detailed case studies of 15 companies in those four countries, had recognised the superiority in principle of pollution prevention at source compared to end-of-pipe solutions. The companies were also seeking to

prevent pollution by integrating environmental management into their normal decision-making. However, this was not evenly distributed across business functions: implementation was highest in production (74 %) and R&D (61 %), but there was still room for further improvement in, for example, product design, distribution, use/consumption or disposal stages where less than 50 % of companies had adopted this approach.

Gale (Gale, 2006b) report that some companies address their costs for waste and emission treatment in detailed tables on their websites and annual sustainable reports for example Canon and Fuji Xerox. Which of Fuji Xerox in radical departure from end of pipe approaches now have several zero emission factories. Canon identified 17.1 billion yen of environmental costs in year 2003 and 23 billion yen in environmental savings. The 5.9 billion yen differential is evidence of both positive financial as well as environmental effect.

Another example of the *material purchase value of non product output* is evident in Xerox's use of packaging for shipping of products to customers. The company had at one point 23 different packaging types and sizes. The purchase of the packaging was recognised to be accounted for as auxiliary materials not associated with the core business. This led to the conclusion that cost savings could be achieved if the number of packaging containers could be reduced. This resulted in that Xerox reduced the number of container types to just two adjustable and reusable sizes with packaging costs of US \$ 12.08 less per shipping unit than previously and overall savings estimated to be US \$ 1.2 million. (Gale, 2006b)

Burritt and Saka (Burritt and Saka, 2006) report that the Tanabe corporation identified large raw material loss and waste processing costs in the pharmaceutical production processes at one of their plants in fiscal year 2001. In fiscal year 2002, Tanabe made several improvements in the production process and as a result cost savings reached 60 million yen per year and hazardous waste drastically reduced.

Jash and Lavicka (Jasch and Lavicka, 2006) found two major cost drivers in their company workshop studies, these were: purchase cost of non-product output; and, cost related to lost working days because of sick leave and accidents and the overtime pay to make up for these lost working days.

3.2.4 Environmental Management Accounting, experiences

This part of the section reviews both some criticism of, and opportunities with, environmental management accounting.

Result in case study questioned by company

Gale reports (Gale, 2006a) that the research result led the company participants at the Canadian Mackenzie Paper Division paper mill, even though they had participated in the research project and supplied information on costs and material flow in the EMA case study, to question the EMA methodology rather than the performance of the company operation. A forum to discuss the results would have been very useful at this stage, Gale claimed, but the study was brought to a close without a full debriefing on points that could have helped EMA researchers make further improvements in methodologies. Therefore Gale concludes that more research is needed on shortcomings of existing accounting practices. He even considers that established accounting norms may intentionally or unintentionally support polluting technologies. Gale further states that it is essential for practitioners interested in this area to evaluate the strengths and weaknesses of EMA against established accounting practices. Case

study work with corporations and to delineate barriers and obstacles to adoption of a standard EMA methodology is important. (Gale, 2006a)

EMA practice opportunities and criticism

According to Gale a few progressive companies provide EMA data and many may not be informed of current trends in the EMA literature. He further states that it is hard to see how even the most well-meaning companies could progress towards sustainability without detailed cost information structured according to an internationally agreed framework. Although there is a shortage of high quality published environmental cost information from various industry sources analysis of case information provides evidence to support arguments that the UN EMA methodology cost categories provide environmental managers and accountants with a clearer picture of environmental costs of operations that far exceeds that available from conventional accounting. (Gale, 2006b)

Prime examples are savings by replacing toxic organic solvents by non-toxic substitutes thus eliminating high and growing costs of regulatory reporting, hazardous waste handling and other associated costs. Many other examples deal with more efficient material use. The use of EMA reveals that waste is expensive not because of disposal fees but because of the *wasted material purchase value*. Environmental Management Accounting would simply be, a better and more comprehensive management accounting that open up the eyes for hidden costs. (Jasch, 2003). But with a focus on business efficiency neither conventional management accounting nor Environmental Management Accounting are solely concerned with real notions of efficiency Burritt and Saka (Burritt and Saka, 2006) claims. The foundation for this claim is a more holistic approach taken into account a global natural system perspective with attempts to define business efficiency measures in terms of ecological sustainability

Use of EMA in investigations for Mergers and Acquisitions

Also for specialists in corporate mergers and acquisitions EMA could be useful in due diligence investigations. A better understanding of the full environmental costs and benefits for a company may have important ramifications for calculation of comparative metrics, costs and discounted cash flows upon which judgements are made. (Gale, 2006a)

Environmental accounting as a teaching tool and contribution

An argument for teaching environmental accounting could be, according to three researchers in USA, Sefcik et al. (Sefcik et al., 1997), that many firms find that some of their most costly and challenging accounting problems lay within the environmental area. The use of environmental accounting techniques could help firms move toward a preventative rather than a curative approach to environmental problems and thereby promoting environmental and financial performance, Sefcik et al. claims.

The characteristics of environmental accounting issues cover many, if not all, areas of accounting. Sefcik et al. claims that the use of environmental accounting cases can help students understand the relation among different areas of accounting as financial accounting, management accounting, information and management systems, auditing and tax. Incorporation of environmental accounting with its comprehensive nature is likely conducive to making learning to learn a primary objective and consistent with movement from a curriculum based on teaching accounting to one based upon an information development and distribution function for economic decision making, Sefcik et al. claims.

4 Analysis and Discussion

In this chapter found Environmental Management Accounting, conceptions, depending factors associated to the corporation, corporate results and experience and criticism are analysed. External reporting is not focused in the thesis rather cost allocation and cost management. But twice as high environmental costs estimated with help of EMA compared to in “traditional” reporting, as one example in this thesis show, probably generate extensive considerations about disclosure. Although this is not the main theme for this thesis, but since this example that consisted of a management accounting case study ended abruptly probably because of the studied company’s disclosure considerations, a discussion on the topic is included in an attempt to explain possible causes. The latter is discussed under the headings *Environmental Management Accounting, experience: Result in case study questioned by company*.

4.1 Environmental Management Accounting, conceptions

This section briefly discusses the reviewed UN provided Environmental Management Accounting conceptions. The way Environmental Management Accounting have been conceptualised in the reviewed articles is firstly as an management accounting tool that has focus on making order in cost accounting and allocation of costs. This firstly supports better management accounting but also secondly likely result in both better financial and environmental reporting and performance.

EMA promoted by UN

The promotion of EMA by the intergovernmental organ UN is an excellent initiative because intergovernmental cooperation is needed on this issue because of corporations’ global distribution of operations. It has a potential to at least give a little global contribution to management of, or house holding with, the globes resources.

Definition of costs a main problem

In lack of a regulated standard the UN promoted methodology and environmental cost assessment scheme can evidently be effective this review shows and can be applied in any company that wants to increase its efficiency. The reward is potentially high savings especially in business processes that turn around a lot of material. As long as there isn’t a common standard set, activities as benchmarking maybe are hard to perform. But since the environmental cost assessment according to the environmental cost assessment scheme is possible to achieve in only a one day work shop as a start, with preparations made before, the effort is small compared to eventual reward this review has showed.

The environmental cost assessment scheme

The environmental cost assessment scheme is a structured first approach that fast can be applied and used as template and if needed maybe the documents on EMA procedures and principles give some support, see the internet links under the heading: *To Practice; Environmental Management Accounting, Procedures and Principles*. This could be performed manually with out expensive IT-investments to start with.

The examples of environmental cost assessment schemes in this review just contain the overall headings, as templates. When performing an environmental cost assessment detailed information on costs and the activity or cause associated with every cost is made visible under each respectively heading so information for management accounting and controlling of the costs are provided. Also totals are calculated that give an aggregated view of what causes costs; reactive waste and emission treatment, proactive prevention and environmental

management or material purchase value of non product output and what the environmental cost per environmental media is today according to existing regulation today.

Included costs in EMA

EMA doesn't include external costs today that not are regulated. It just provides a systematic cost structure that makes environmental cost visible and thereby controllable. In companies with long term strategic intentions external costs also could be considered.

Insurance cost for *environmental liabilities* are included in the reviewed cost assessment scheme. Eventual costs for such *contingent liabilities* that are not covered of insurance, if such liabilities associated with potential environmental risk and damage should fall out, also should be considered as information that influence decision making when the environmental cost assessment data is used for tactical and strategic considerations.

4.2 Environmental Management Accounting, depending factors

Engagement in environmental performance work as environmental management accounting is depending on a number of found factors which are being analysed and discussed. In this first section the extracted factors, from the reviewed articles, that influence corporate environmental activity and performance are analysed and discussed. An attempt to make a covering model over different dependent factors for a corporation's environmental performance would result in an overwhelming complex model. The model, in figure 3, is associated with "traditional accounting" and found depending factors in the reviewed articles that is discussed to influence corporate environmental performance. The model includes examples of stakeholders that constitute external pressures, see figure 3. (See *Analysis method* for description on how the term *traditional accounting* is used in the articles and accordingly in the following review, analysis and discussion of the articles in this thesis.)

4.2.1 External pressures

Findings in the reviewed articles give support for the issues discussed in the introduction, concerning the future expected governmental, external, pressure on the company. External governmental pressure is in general expected to increase and force development towards internalisation of environmental costs in the future. Many of the articles discuss increasing concerns by stakeholders as important factors and that increased public awareness of environmental issues has put pressure on corporations to measure environmental costs and expenses and to develop and enhance disclosure of environmental information to stakeholders is stated in reviewed research result. (Clarke and O'Neill, 2006, Gadenne and Zaman, 2002, Gale, 2006a, Gale, 2006b, Gibson and Martin, 2004, Jasch, 2003, Li, 2004, Lodhia, 2003, Scavone, 2006).

4.2.2 Corporate Environmental sensitivity

What causes organisations to adopt environmental management accounting procedures is not clear research results show. Environmental reporting is more likely in environmentally sensitive firms but adoption of environmental management accounting procedures does not appear to be driven exclusively by the environmental sensitivity of the industry (Frost and Wilmshurst, 2000).

What probably drive companies to adopt environmental management accounting is just the simple insight that the way expenditures and costs are recorded and accounted for have implications for both financial and environmental performance. Whether the corporate environmental sensitivity is high or low doesn't influence the adoption of environmental

management accounting probably because it is not communication aspects of a more or less precarious environmental situation that are in focus but probably rather a strive for plain efficiency. If this efficiency work is reported or not is depending on corporate environmental sensitivity or maybe insensitivity certainly with extensive considerations of the risk for misinterpretations.

Corporate model with "traditional accounting"

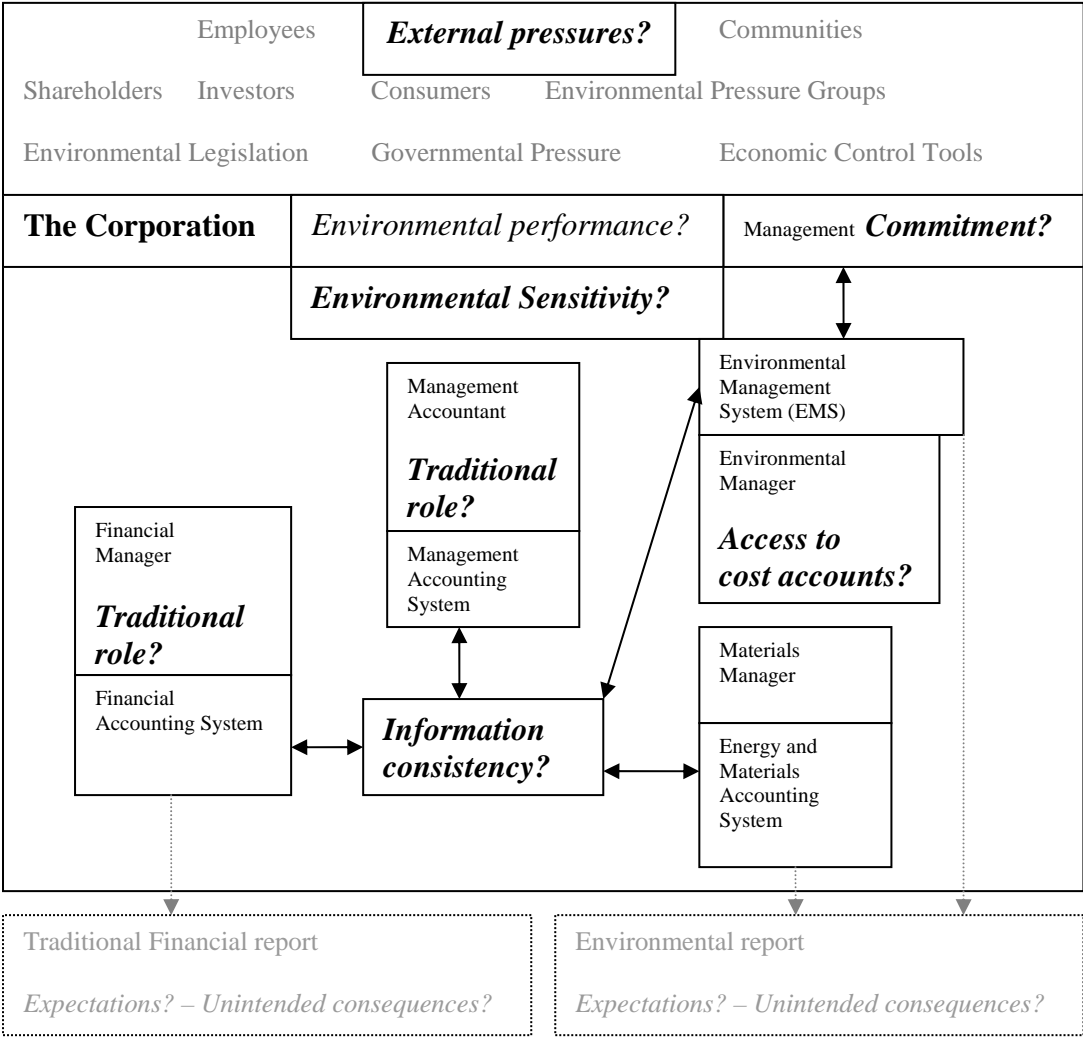


Figure 3. Model of corporate environmental performance dependent factors that are analysed.

4.2.3 Traditional role of Accountants and Accounting

The traditional role of accountants and accounting compared to the new proposed environmental management accounting approach is extensively discussed in the articles in association to the existing accounting regulation and practice. This indicates that current accounting regulation and practice constitutes hurdles for the development of standardised environmental accounting practices as well as an absent pressure for environmental management accounting.

To use the label *traditional* could be very confusing for a "traditional accountant" since there are different perspectives in practice of corporations and so many different perspectives in theory building as *shareholder*, *agency-principal* and *theory of the firm* etcetera, for an explanation of the used term *traditional accounting* see *analysis method*.

If environmentally induced costs and expenses information should be reported as notes to financial statements rather than in the profit and loss statement in the annual report, or, environmentally induced end-of-pipe and integrated technologies should be recognised as assets in the balance sheet, or, whether environmentally induced additional costs should be capitalised and amortised (Lodhia, 2003) is not discussed other than as follows; costs, periodized expenditures for investments and maintenance, should not be hidden but accounted for and disclosed in such appropriate way that the costs can be managed and information used for decision making and even strategy reconsiderations.

Differences in ability of various disciplines of accounting in supporting sustainability

Clarke and O'Neill (Clarke and O'Neill, 2006) states that research results has highlighted fundamental differences in the ability of the *Management Accounting* practitioners and *Financial Accounting* practitioners to engage in supporting environmental sustainability.

Ability of management accounting systems to support sustainability

Through the use of emerging management accounting practices like environmental management accounting procedures, principles and systems, companies have the ability to support real action and contribute with substance to environmental performance also with higher financial performance resulting. But if it will result in sustainable business performance no commonly used measures today can tell.

Ability of financial accounting systems to support sustainability

The ability of financial accounting systems to support sustainability is likely limited by current regulation and practice today. Therefore new regulation is an important and maybe even crucial factor for financial accounting systems to support sustainability. Financial accounting practice and content also influence management accounting. Therefore regulation is an important and maybe even crucial factor for management accounting systems to support sustainability. But even though a standard for environmental reporting is lacking, and because vivid communication of various businesses environmental friendliness might give a public reaction in which, companies might want to, or have to, proceed with some real substance in the environmental reporting backed up with real action through emerging management accounting practice like environmental management accounting. Evidently it has potential to facilitate cost savings and other benefits this review shows.

4.2.4 Lack of exchange of information and knowledge within the corporation

A lack of exchange of information and knowledge between working roles as the financial manager and the environmental manager is probably to a large extent due to the information inconsistency that occur with different used information systems with different specified purposes and with out a common holistically designed data model and objectives. This is exactly the problem UN has spotted and focused on in this first step, the development of the environmental cost assessment scheme, towards different more structured accounting system thinking.

4.2.5 Importance of consistency in information systems

One basis for management accounting is detailed information on costs. For Environmental Management Accounting also information on flows of material and energy is needed. These data on financial, material and energy flow commonly are, to the extent they are registered, separated and/or different represented in information systems which make data inconsistent

(Jasch, 2003). This represents an important development area for information and management systems.

Not the least for planning purposes, both operational and strategic, a continuous and systematic methodology for cost assessment and allocation would be desired. Information consistency, development of information system functionality and content to track and display information needed that even could improve the true and fair view of the company, is probably an effective issue to work with.

4.2.6 Implementation aspects of Environmental Management Accounting

In this part of the section some implementation aspects are analysed and discussed.

Considering potential cost savings with implementation of EMA

Results suggests that the financial benefits of introducing Environmental Management Accounting do not usually justify major changes and are therefore better achieved by integrating environment into existing change programmes, as with introduction of *Activity Based Costing* (ABC) into a business. Realistically for most companies, environmental management accounting would be an intermittent process in which periods of low-level, low-profile, activity are punctuated by bursts of considerable attention and innovation. (Bartolomeo et al., 2000)

After the above statement the UN promoted EMA methodology has been published and introduced to companies in case studies and work shops. This, EMA, methodology has showed evidence on revealing large environmental costs and thus large both potential and realised savings as reported corporate results shows that possibly might motivate IT-investments.

IT-system Implementation

IT-system development are expensive and how EMA should be incorporated and best implemented in companies accounting information systems is not considered in this thesis nor the cost effect of doing so. However as for the reviewed articles and common sense, information inconsistency constitutes the main problem. If a step by step process is possible to implement EMA and gradually build in EMA through considering EMA in development activities regarding a company's information and accounting systems is suitable. Or if a complete new approach with a new common data model that can keep track on additional types of flows and transactions as for material and energy, at least the cost of them, is the most effective approach has to be analysed within the corporation's domain and depending circumstances.

4.2.7 Environmental Management Systems as catalysts

Research on the topic of Environmental Management Systems (EMS) show that managers' commitment to environmental issues is very important; they have the opportunity to give support and legitimacy through their communications of priorities for practice and strategic intentions regarding environmental activity. But most important according to recent research is the use of advanced management accounting practices for development of environmental performance. That would include definition of and management of intangible assets associated with human and organisational parameters as knowledge and learning, skills, communication and management as well as use of emerging costs systems, capital budgeting, scorecards and other management accounting practices that promote environmental performance. (Pérez et al., 2007).

4.3 Environmental Management Accounting, some corporate results

So far the analysis has dealt with a company model with “traditional accounting” and the traditional role of the accountant as factors for corporate environmental performance. In this section results with new environmental management accounting applied are analysed. (See *Analysis method* for description on how the term *traditional accounting* is used in the articles and accordingly in the following review, analysis and discussion of the articles in this thesis.)

4.3.1 Environmental Management Accounting implemented

Some of the factors analysed in the preceding section, figure 3, probably are, or would be eliminated if a company and its management have decided to implement EMA, which is illustrated in figure 4, so that the following: eventual; lack of management commitment, information inconsistency, tendency to perform “traditional accounting” or that the environmental manager have no access to cost accounts, would constitute insuperable hurdles. EMA also likely promotes both financial reporting and environmental reporting, but that is not in focus in this thesis.

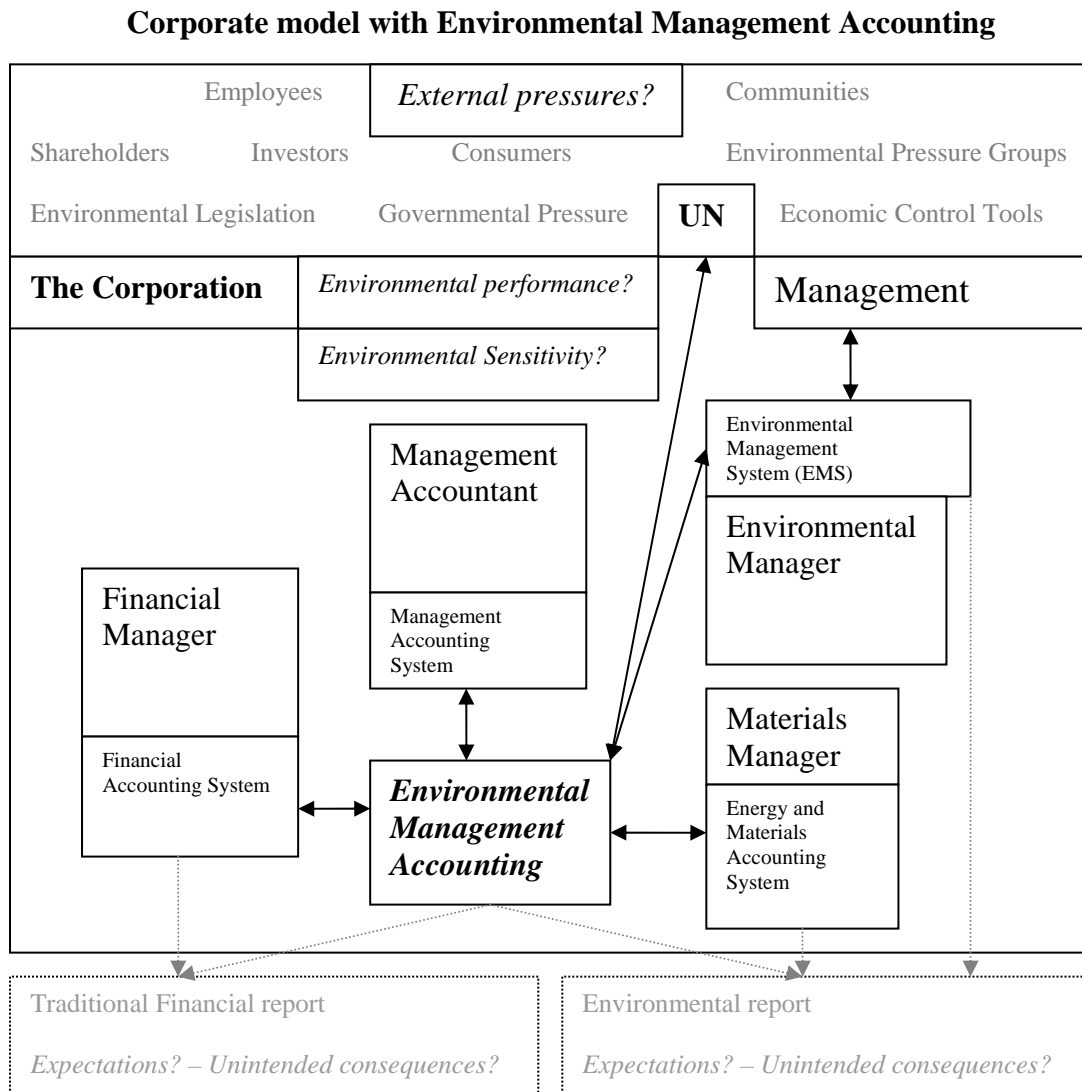


Figure 4. Model including the new corporate environmental performance factor, EMA.

EMA potential for elimination of hurdles for management, increased focus and efficiency

EMA has likely a significant potential of eliminating hurdles consisting of as already mentioned: management commitment, information inconsistency, traditional roles, no access to cost accounts and also considerations associated with environmental sensitivity at least from a common sense perspective.

Firstly, managers, financial managers, management accountants, material managers, purchase managers, environmental managers and all other employees likely all could become better aware of actual environmental costs that could be managed, after being made visible through environmental cost assessment and environmental management accounting.

Secondly, through this increased general awareness of the impact of such a holistic view of efficiency, “traditional” management in general and environmental management in specific would likely have a chance to become more focused and efficient. That could also result in better, not only financial results but also, environmental results, environmental performance.

Thirdly, this could also promote better quality. This since waste even more likely would be strived to be avoided. That would mean less un-saleable production output, that is, less products that are defect or partly defect. Also fewer products that seemingly not are defect, but eventually would show out defect when in use, could be lessened. This resulting from thus motivated more frequent activities with overhaul and rethought of production processes and aggregated quality controls. Like Toyota that would stop the production process if a fault is found to get it fixed immediately because not saleable or inferior quality production outputs, are and could very expensive in many ways.

Through the provision, and use in research, of the EMA methodology by UN, global experiences can be gathered from companies and used as inputs for refinement of methodology and theory which is made available to companies and governments globally.

4.3.2 Costs visible, savings possible

Jash (Jasch, 2003) report from a Case study, in the SCA pulp and paper company Graphic Laakirchen in Austria, distribution of environmental costs for the company in year 2000. The total environmental costs assessed for year 2000 were 23.758.510 Euro. The *Material purchase value of non product output* made up 80,4 percent of that cost, see table 8. This represent some very interesting result indicating that main environmental costs may not be what might be expected but plain inefficiency associated with use of operating materials, raw materials and energy on non product output, waste in other words.

A production process without inefficiency, no waste, might be hard to reach but companies are aiming at it for good reasons; waste is evidently costly as this case study shows an example of. Beside the cost category *Material purchase value of non product output*, the EMA method defines three more cost and expenditure categories: *Waste and emission treatment*; *Prevention and environmental management*; and, *Processing costs of non product output*, and one revenue category: *Environmental revenues*.

The review findings constitutes some recent and relevant basis of information, from research and practical experience, on management accounting practices that support decision making for development of environmental performance of companies. Evidences are found that there might be large potentials for cost savings for the UN EMA cost category *Material purchase value of non product output*. This is a theoretical calculus standpoint and to what extent waste practically can be lessened is a question. In a constant development of performance,

businesses increasingly are likely to strive for goals of zero errors in production that would, if reached, mean zero *Material purchase value of non product output* (excluding operating material, packing, auxiliary materials, energy and water).

Polluting companies actually pay three times for non-product output. First, the company pays the cost of purchasing raw materials of which a proportion ends up as wastes and emissions. Second, the company pays for the operational use of raw materials through labour and infrastructure investment costs of which a proportion ends up as wastes and emissions. Finally, the company also pays for the disposal costs of the wasted materials purchased or for licences, permits, for emissions of a proportion of the material purchase costs. (Gale, 2006b)

Looking at the amounts of the reported cost savings in the reported case studies, cost savings are likely in many businesses. Considering that purchased material, depending of industry area, often is a large cost, potential cost savings could be great. Just the fact that companies get there eyes more open for the real cost of waste would probably result in higher focus and material efficiency.

This thesis review some reported results that claim that environmental management accounting, EMA, can contribute to potentially large cost savings and benefits. Although it could be discussed companies could have achieved these savings anyway and that it's in the corporation's normal interest to effectively manage costs, the opportunities for cost savings are reported in association with environmental management accounting activity and environmental cost assessment.

The tool, environmental cost assessment scheme, that environmental management accounting provide, likely promote a good support for finding cost and environment savings because of its way to structure costs through system thinking rather than just what's right according to accounting regulation, the companies accounting practice, financial perspective and the extent to which materials flows are accounted for. Detailed results reported show that there are savings to make as the following examples show. For comprehension of amounts in foreign currency, see appendix for current exchange rates.

Gale reported that Fuji Xerox in radical departure from end of pipe approaches now have several zero emission factories. Xerox's reduction of packaging for shipping of products to customers from 23 different packaging types and sizes to just two adjustable and reusable sizes with packaging costs of US \$ 12.08 less per shipping unit than previously and overall savings estimated to be US \$ 1.2 million. (Gale, 2006b)

Gale also reported that Canon identified 17.1 billion yen of environmental costs in year 2003 and 23 billion yen in environmental savings. The 5.9 billion yen differential is evidence of both positive financial as well as environmental effect. (Gale, 2006b)

Gale (Gale, 2006a) has also estimated, through the use of EMA methodology, twice as high environmental costs, Cdn\$4.858.753, compared to the conventionally reported environmental costs, Cdn\$2.196.838, in the financial annual report for year 2000 for the Canadian Mackenzie Paper Division paper mill. But the EMA result rather than the company operation was questioned by the company participants, this will be further analysed and discussed under the following heading: *Environmental Management Accounting, experiences and criticism*.

Burrit et al. (Burritt and Saka, 2006) report that the Tanabe corporation made several improvements in the pharmaceutical production processes at one of their plants and as a result cost savings reached 60 million yen per year and hazardous waste drastically reduced.

4.4 Environmental Management Accounting, experiences

This part of the section discusses some experiences with and criticism on environmental management accounting.

4.4.1 Result in case study questioned by company

Gale reports (Gale, 2006a) that the research result led the company participants at the Canadian Mackenzie Paper Division paper mill, even though they had participated in the research project and supplied information on costs and material flow in the EMA case study, to question the EMA methodology rather than the performance of the company operation. A forum to discuss the results would have been useful but the study was brought to a close without a debriefing on points that could have helped EMA researchers make improvements in methodologies.

There was no forum to discuss the results when the study was brought to a close and there could have been many reasons why the company questioned the results as is discussed under the next main heading, discussion and conclusion.

In Gales case study on the paper mill site the company participants questioned the EMA result which had resulted in twice as high environmental costs as reported by the company itself for year 2000. From the company view these results may not have been interpreted as good and useful information, internally or externally, maybe the contrary, not.

Gale as a researcher points to that more research is needed on shortcomings of existing accounting practices and even considers that established accounting norms may intentionally or unintentionally support polluting technologies. But it might not be just a matter of rational accounting behaviour it could depend on other ingredients of human (company) behaviour.

There may be several different reasons for the company to question the results. The company might not have wanted or didn't know how to deal, internally or externally, with a disclosure of twice as high environmental costs. There exists a virtually universal reluctance to disclose bad news or what could be interpreted as bad news (Owen, 1992).

The *Prevention and environmental management costs* that amounted to Cdn\$270.109 through EMA methodology, might have been considered high and increasing with actions on the matter and estimated higher than the actual considered benefits.

Even if *Material purchase value of non product output* was the second largest cost category, that constituted about a quarter of the total EMA costs, with Cdn\$946.799 plus *Processing costs of non product output* of Cdn\$292.943 it might be hard in this particular production process type, but surely possible to do some, improvements at date with existing technology. Efficiency of production processes depends on what efficiency is possible to achieve with the best affordable technology. The best affordable nor the best available technology might not have close to 100 % efficiency in output in relation to the input. There is hardly any process without losses of energy and or material.

The cost of *Waste and emission treatment* of Cdn\$3.348.902 was by far the largest, constituting about three quarters of the estimated EMA costs. By accepting this high cost, the company must realise or admit that they have invested in and spend a lot on end-of pipe treatment rather than in preventing waste and emissions, *Prevention and environmental management*, that had a comparable low estimated cost of Cdn\$270.109. This, the company or rather decision makers might not want to disclose; to show out to be reactive in a proactive initiative. Linked to such a disclosure is also a content of extended communication with stakeholders including shareholders. On the other hand how much couldn't be spent on prevention for this considerable cost and what would the revenues for such investments be in the future.

This case shows that unintended consequences can occur when doing practical research in business organisations and might be considered as risks or be anticipated by companies which have thoughts of performing environmental accounting and disclosures. However, the reviewed results in this thesis reveal several examples that constitute evidence of both environmental and financial benefits of proactive approaches and prevention initiatives compared to camouflaged expensive, through hidden costs, business as usual reactive end-off pipe approaches.

The following is brought up in general from researchers in the review: More research is needed on shortcomings of existing accounting practices. It is essential to evaluate the strengths and weaknesses of EMA against established accounting practices, to perform case study work with corporations and to delineate barriers and obstacles to adoption of a standard EMA methodology is important.

4.4.2 Practice opportunities and criticism

According to Gale (Gale, 2006b) a few progressive companies provide EMA data and many may not be informed of current trends in the EMA literature. Analysis of case information provides evidence though, that support arguments that the UN EMA methodology cost categories provide a clearer picture of environmental costs of operations that far exceeds that available from conventional accounting. (Gale, 2006b)

There are opportunities for savings by replacing toxic organic solvents by non-toxic substitutes eliminating high and growing costs of regulatory reporting, hazardous waste handling and other associated costs. EMA reveals that waste is expensive not because of disposal fees but because of the *wasted material purchase value*. (Jasch, 2003) But with a focus on business efficiency neither conventional management accounting nor Environmental Management Accounting are solely concerned with real notions of efficiency Burritt et al. (Burritt and Saka, 2006) claims. The foundation for this claim is a more holistic approach taken into account a global natural system perspective.

Use of EMA in investigations for Mergers and Acquisitions

EMA is probably a most important tool when making investigations for mergers and acquisitions. Operations environmental burdens and associated current and future costs could be analysed and made visible through the EMA methodology and a structured analysis according to the environmental cost assessment scheme, if information is available. All investors need to know how environmental issues effect the bottom line (Owen, 1992).

Environmental accounting as a teaching tool and contribution

Providing students with environmental accounting skills and specifically environmental management accounting methodologies, in their tool box, is likely a good way for scholars to contribute to more sustainable business performances if prioritised by future managers, which will be recruited among these students.

4.5 How these approaches increase understanding and knowledge

From this approaches it is clearly showed the importance of information consistency, to account on accounts in a structured way to make potentially high hidden environmental costs, visible and possible to break down on responsibility centres, processes, activities, products and services and to track material and energy flows to make management accounting of these cost and material and energy flows possible. This give companies potential to increase efficiency as well to reconsider strategies and mixes of products and services. The fact that the companies cost structures become visible, through use of the EMA method, can give support for new sustainable long-term strategies. Through EMA methodology a tool to assess costs more holistically is available and it becomes more evident what future costs could be, when expected governmental regulation and consumer demands force external cost to be included, that today are recognised as external to the company. (Bartolomeo et al., 2000, Clarke and O'Neill, 2006, Gale, 2006a, Gale, 2006b, Gibson and Martin, 2004, Jasch, 2003, Jasch, 2006, Jasch and Lavicka, 2006, Lodhia, 2003, Pérez et al., 2007, Scavone, 2006)

From the standpoint, that the human population need to exist on the Earth's income without eroding its capital, a further discussion is concerned with the natural world, the globe system perspective introduced in the introduction, opposed to the cultural industrial reality being reviewed and analysed. These tools being reviewed, given the ramifications with demands from regulation and consumers, make opportunities for increased efficiency in operation visible. This might support development towards sustainability. Changes in mixes of products and services, materials and energy used and even strategies probably can be reconsidered that dramatically change business focus from the common focus today on selling products towards selling services and functions.

4.6 Issues discussed in the introduction

In this section issues discussed in the introduction, including questions and purpose, that is brought up again in a concluding discussion.

In the introduction the importance to apply a system view was underlined. A system view was considered to include knowledge of how the system work, its limitations and possibilities and how to maintain the system. There is definitely a need to know more about both how natural systems work and how cultural systems work and how, if, they can work together. Especially since one system is expanding and the other, which the first is completely depending on, is constant or rather in risk of being depleted of the first, the cultural industrial, system. Not much was found on applied system views in the reviewed literature except for a discussed

(Clarke and O'Neill, 2006) prerequisite for a sustainable society; *the human need to exist on the Earth's income without eroding its natural capital,*

4.6.1 Pressures for environmental performance and disclosure

Findings in the reviewed articles support the issues, discussed in the introduction, concerning the future expected governmental pressure and internalisations of external costs. There was some support also for that that consumers can exercise pressure. This support constituted of a catastrophe like event. Maybe some types of consumer pressures just arise, and are effective, over a certain threshold level or some kind of degree of environmental disaster to force companies to an extended internal perspective.

4.6.2 The effect of conceived time perspectives

Regarding, the discussion in the introduction about resource use and time perspectives, not much was found in the reviewed articles. As discussed in the introduction time has to be considered in association with resource flows since natural resource flows have limitations in the time dimension, namely limiting speeds in possible turn around of resources, recovering processes, and beforehand given limited sources which money potentially don't have.

4.6.3 How can companies adapt to increasing external pressures

Two alternatives were discussed in the introduction to disclose or not, and to take action within management accounting.

Corporate self-interest

The alternative, mentioned in the introduction, to not disclose environmental performance or environmental costs that could be questioned this review probably has showed one example of. It was reported that one company, in one of the reviewed articles, chose not to use the detailed and higher environmental cost structure revealed with the EMA methodology. This was probably in order to avoid expected *unintended consequences*. Expectations from the company, which had disclosed its environmental costs accompanying with the annual report, and the surrounding society, were probably for both, that the company had reached good or high environmental performances. The company though maybe not was sure that over twice as high environmental costs, revealed by the EMA environmental cost assessment scheme was a positive signal to the market. Decision makers in the company maybe considered the risk that it could be interpreted as the company had invested a lot in expensive end-of-pipe solutions rather than having been strategic proactive and developed processes and avoided waste that demanded end-of-pipe solutions.

Expenditures for cleaning up operations as to take care of eventual contaminations, liquidate end-of-pipe solutions and invest in new production processes can be very high. But to disclose such costs to justify the expenditures for better environmental performance and lower future costs would probably be wise and increasingly likely in investors' interests.

Possible opportunity with the internal perspective

The internal perspective, management accounting, obviously have opportunities but taking into account a steady increase in population, activities, material and energy use with only one globe and its associated resources available, conceptions on how large sustainable resource, material and energy, flows can be for business operations, is lacking.

How big can the Earth's yearly income, yield of natural resources, be without eroding its capital, divided on all the globes business operations and human activities?

4.6.4 Purpose of thesis

The purpose of this thesis is to search after results from eventual research that include environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance. If research results are found, according to the purpose, the aim is to review this. Possibly eventual found knowledge of depending factors for a corporation's environmental performance in relation to accounting can be summed up in an overview model. Also eventual knowledge gaps and needs of further research will be analysed (see Further Research).

The following questions were formulated:

What research exists today that includes environmental management or environmental accounting within management accounting or financial accounting that could support decision making in companies towards better environmental performance?

How could this eventual knowledge support decision making in companies towards better environmental performance today?

Answers found:

The described search method resulted in research results found from a small and focused research niche within management accounting labelled, Environmental Management Accounting (EMA). With the defined search method 16 articles, on this topic, were found and reviewed in this thesis. This dawning research field and knowledge area was unknown to the author. But research in this direction was expected since structured accounting, accounting that don't allow costs to sum up in overhead accounts or on accounts not associated with the cause of the cost; products and activities, should give opportunity to better cost management that increase cost-efficiency which of some costs would be associated with turn around of energy and material and if lessened resulting in better environmental performance.

The UN promoted Environmental Management Accounting (EMA) methodology found uses an environmental cost assessment scheme that map, even hidden, environmental costs in a structured way for decision making. The method reveals that environmental costs could be twice as high as the environmental costs that some companies disclose in their annual reports. This gives potentials for large cost savings for, and strategy reconsiderations in, companies. The largest cost category often turns out to be, according to the EMA method: *Material purchase value of non product output*.

The EMA methodology opens up for possibilities for both better environmental and financial performance for companies today with a modest work effort to start with, since a first environmental cost assessment can be managed in just about one day.

Future internalisation of external costs is anticipated of the reviewed authors in general. Those companies which start using the EMA methodology today would get ahead and would probably be better prepared to deal with increasing costs for environmental issues in the future. With better information for decision making not only more effective product and service mixes is possible but also completely new and different business strategies and investments can be anticipated that are future-proof.

Crucial for decision making is consistent information and consistent information systems. Not only monetary measures, costs, revenues and cash flows are important to monitor and manage

but also the corresponding flows of material and energy and their costs. For this, Environmental Management Accounting, EMA, can support decision making in companies today towards better environmental performance through the provision of effective structured cost assessment that support effective decision making for better environmental performance and possibly more effective and future-proofed product mixes, strategies and investments.

A model was possible to construct with input from the obtained and analysed factors in the articles. A valuation of which factors are most important for improvement of a company's environmental performance is not possible without empiric research studies. This varies with different situations, types of business etcetera and characteristics of ingredients in the business organisations.

However, from the analysis and from a common sense perspective it seems reasonable that information consistency is the most important factor behind the different symptoms of shortcomings of eventual existing "traditional accounting and management" to support environmental performance. Off course management's commitment is crucial but if it necessarily must come first, likely depends on the financial manager's and the chief management accountant's ability and willingness to develop the accounting practice.

Top managements engagement in Environmental Management and the corporations EMS, Environmental Management System is also crucial. Environmental activities according to objectives in the EMS may not have economic efficiency as a main driving force. Depending on how well the Environmental Manager succeed to link environmental issues to business strategies, potential revenues and cost savings and convince management including top-management of the benefits.

Speaking from the authors own experience and hopefully common sense, for the EMS to be efficient, it's almost completely depending on the top-managements commitment and communication of priorities. A person, or persons, with fiery spirit is not enough to succeed in making an EMS effective.

For an EMS to be effective it have to influence the business more than through stated commitments of continuous development of the environmental performance including to manage the company's use and recycling of paper and so forth. Including purchase demand processes, which certainly contain great opportunities to demand environmental performance from suppliers. Which have great potential to increase the company's own environmental performance. For an EMS to be effective it also must be able to exercise influence on business strategy and management accounting practice which also likely would influence financial accounting and financial performance.

A lot of thoughts, ideas, knowledge, experience and the UN promoted EMA methodology were found within the management accounting research field which all aim at supporting decision making for development of environmental performance of companies today. How this knowledge can support decision making and development of environmental performance for companies today is showed through this thesis, but not how long towards sustainability this would lead.

5 Conclusion

According to the review, analysis and discussion, crucial for decision making is consistent information and consistent information systems. Not only monetary measures, costs, revenues and cash flows are important to monitor and manage but also the corresponding flows of material and energy and their costs. For this, Environmental Management Accounting, EMA, likely can support decision making in companies today towards better environmental performance through the provision of effective structured cost assessment that support effective decision making for better environmental performance and possibly more effective and future-proofed product mixes, strategies and investments.

How this knowledge could support decision making and development of environmental performance for companies today has been showed through the thesis but not how long towards sustainability it would lead.

6 Further Research

One basis for management accounting is detailed information on costs. For Environmental Management Accounting also information on flows of material and energy is needed. These data on financial, material and energy flow are likely separated and/or different represented in information systems if the information is registered. This, the need of consistent, and for management in general accessible, accounting information represents an important development and research area. As a basis a data model for accounting and management accounting, which also facilitate resource accounting and management of resource flows, from a local individual level to a global common level, would be needed.

Actually even both an *Earth income statement* and an *Earth resource balance sheet* would be needed to keep track of the *Earth's income without eroding its natural capital*. This would be needed to be able to obtain a comprehension of how large sustainable resource, material and energy, flows can be for business operations.

Eventually the following questions have to be addressed and answered to actually make the continuity principle, going concern perspective, possible at all, which is fundamental for running a business on the whole and in relation to and to attract, necessary stakeholders: investors, employees and customers:

What characterise good environmental business performance?

What characterise sustainable business performance?

How large can sustainable resource, material and energy, flows be for business operations?

7 Literature

- Andersson, T. & Wolff, R. (1996) Ecology as a challenge for management research. *Scandinavian Journal of Management*, Vol. 12, pp. 223-231.
- Ax, C., Kullve'n, H. & Johansson, C. (2005) *Den nya ekonomistyrningen*, Malmö, Liber ekonomi.
- Bartolomeo, M., Bennett, M., Bouma, J. J., Heydkamp, P., James, P. & Wolters, T. (2000) Environmental management accounting in Europe: current practice and future potential. *European Accounting Review*, 9, 31-52.
- Burritt, R. L. & Saka, C. (2006) Environmental management accounting applications and eco-efficiency: case studies from Japan. *Journal of Cleaner Production*, 14, 1262-1275.
- Clarke, K. & O'Neill, S. (2006) Is the Environmental Professional an Accountant? *Greener Management International*, 111-124.
- Frost, G. R. & Wilmshurst, T. D. (2000) The Adoption of Environment-related management accounting: an analysis of corporate environmental sensitivity. *Accounting Forum*, 24, 344.
- Gadenne, D. & Zaman, M. (2002) Strategic Environmental Management Accounting: An Exploratory Study of Current Corporate Practice and Strategic Intent. *Journal of Environmental Assessment Policy & Management*, 4, 123.
- Gale, R. (2006a) Environmental costs at a Canadian paper mill: a case study of Environmental Management Accounting (EMA). *Journal of Cleaner Production*, 14, 1237-1251.
- Gale, R. (2006b) Environmental management accounting as a reflexive modernization strategy in cleaner production. *Journal of Cleaner Production*, 14, 1228-1236.
- Gibson, K. C. & Martin, B. A. (2004) Demonstrating Value through the Use of Environmental Management Accounting. *Environmental Quality Management*, 13, 45-52.
- Gray, R., Owen, D. & Adams, C. (1996) *Accounting & accountability*, London, Prentice Hall.
- Hamner, B. & Stinson, C. (1993) Managerial Accounting and Compliance Costs *University of Washington discussion paper*. Washington, DC, University of Washington.
- Hart, C. (1998) *Doing literature Review, Releasing the Social Science Research Imagination*, London, Sage.
- Jasch, C. (2003) The use of Environmental Management Accounting (EMA) for identifying environmental costs. *Journal of Cleaner Production*, 11, 667.
- Jasch, C. (2006) How to perform an environmental management cost assessment in one day. *Journal of Cleaner Production*, 14, 1194-1213.
- Jasch, C. & Lavicka, A. (2006) Pilot project on sustainability management accounting with the Styrian automobile cluster. *Journal of Cleaner Production*, 14, 1214-1227.
- Li, X. (2004) Theory and practice of environmental management accounting. *International Journal of Technology Management & Sustainable Development*, 3, 47-57.
- Lodhia, S. K. (2003) ACCOUNTANTS' RESPONSES TO THE ENVIRONMENTAL AGENDA IN A DEVELOPING NATION: AN INITIAL AND EXPLORATORY STUDY ON FIJI. *Critical Perspectives on Accounting*, 14, 715.
- Miljödepartementet (1998) Miljöbalk (1998:808). IN Miljödepartementet (Ed.), SFS
- Owen, D. (1992) *Green reporting : accountancy and the challenge of the nineties*, London, Chapman and Hall.
- Pérez, E. A., Ruiz, C. C. & Fenech, F. C. (2007) Environmental management systems as an embedding mechanism: a research note. *Accounting, Auditing & Accountability Journal*, 20, 403-422.

- Plogner, A.-C. (2004) Företaget och miljön. IN Samuelson, L. A. (Ed.) *Controllerhandboken*. 8., [rev.] utg. ed. Stockholm, Teknikföretagen : Industrilitteratur.
- Samuelson, L. A. (Ed.) (2004) *Controllerhandboken*, Stockholm, Teknikföretagen : Industrilitteratur.
- Scavone, G. M. A. (2006) Challenges in internal environmental management reporting in Argentina. *Journal of Cleaner Production*, 14, 1276-1285.
- Sefcik, S. E., Soderstrom, N. S. & Stinson, C. H. (1997) Accounting Through Green-Colored Glasses: Teaching Environmental Accounting. *Issues in Accounting Education*, 12, 129-140.
- Valor, C. (2005) Corporate Social Responsibility and Corporate Citizenship: Towards Corporate Accountability. *Business & Society Review (00453609)*, 110, 191-212.

8 Appendix

Current exchange rates to Swedish currency [Kronor] provided to give a comprehension of the amounts reported in different foreign currencies. Alternations in exchange rates between different occasions, date and year for reported data, are not considered, the exchange rates were obtained the 9:th of January 2008.

From Currency	Exchange rate to Swedish currency 2008-01-09
Canada 1 Dollar =	6,50 Kronor
Japan 100 Yen =	5,96 Kronor
USA 1 Dollar =	6,52 Kronor

Exchange rates to Swedish currency, rounded to two decimals. Source: Forex.

9 To Practice: Environmental Management Accounting, Procedures and Principles

The link to the publication *Environmental Management Accounting, Procedures and Principles (2002)* published on UN-webpage (webpage and pdf-document accessed 2008-01-07 10:00) is provided here from one of the reviewed article (Jasch, 2006). The document is not used in the thesis since it was not extracted through the described method used for search of information in this thesis.

<http://www.un.org/esa/sustdev/sdissues/technology/estema1.htm>

under “EMA Publications”. Direct link to the document:

<http://www.un.org/esa/sustdev/publications/proceduresandprinciples.pdf>