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Information Technology's CMMI and the Triple Bottom Line

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ABSTRACT

The present throughput "waste" economy, which requires more than 80 tons per person of non-renewable natural resources a year, is sacrificing Earth's ecosystems and future options to maintain the material wealth of Americans and Europeans. This cycle of massive consumption of non-renewable resources and the accompanying by-products of enormous waste and pollution are problematic for the long-term success and survival of most organizations and perhaps humanity itself. This destructive practice will gradually yield to custom-tailored services and products. Environmental accounting will help speed this transition, and will be made feasible through the use of information rich technologies, required to manage a sustainable economy. This paper presents a suggested model of implementation.

Introduction

Western style wealth, generated at present for less than 20% of the people of the world, consumes more than 80% of the natural resources harvested and damaged each year. The "rich of this world" will have to invent new ways to generate their comfort, security and wealth with consumption levels one tenth (or a factor of 10 times less) their current use (Schmidt-Bleek, 1999: Robèrt et al., 2000). This has long been recognized in Europe, but has been discussed much less in the United States. Starting with an initial discussion of the need for **Factor 4**, it was soon realized that would not be enough. In 1997, the European Environment Ministers supported **Factor 10** as a strategic goal. The Business Council for Sustainable Development has gone further, suggesting that **Factor 20** might be a better long term goal for sustainability.

As Ghandi observed, "it took half the world to make England rich," but it also led to their downfall as a world power. Our over-consumption and excessive ecological footprint (try an ecological footprint calculation for your life at **www.earthday.org/footprint/**) is likely to lead to the continuing decline of the United States and the global environment unless we begin to consider the Triple Bottom Line. The issues of equity, fairness, health, and environmental quality must become integral components of organizations' strategic considerations. Meeting the goal of dematerializing society will require changes in culture, institutional structure, and technology (Schmidt-Bleek, 1999; van der Ost, 2004). The present throughput "waste" economy will

gradually yield to an information oriented customized economy. High quality, custom-tailored services and durable products will replace mediocre, short-lived products and poor incompetent services. In this new economy, quality of life will be more important than ownership of goods.

Today more than **80 tons per person** (400+ lbs per day) of non-renewable natural resources a year are sacrificed to maintain the material wealth of Americans and Europeans. As more resources are put into the economy they lead to more emissions, effluents, and wastes. This cycle of massive consumption of non-renewable resources, and its accompanying by-products of enormous waste and pollution, is detrimental to the long-term success and survival of most organizations. A durable, long-lasting, continuously successful operation will ultimately depend on more sustainable management of finances, people and the environment.

Dematerialization will help consumers, producers, retailers, scientists, non-government organizations (NGOs), and governments to initiate and manage the change to a sustainable society. Comparing an I-pod to an old tube type record player and five hundred LPS suggests that dematerialization is not only possible, but already underway. The required radical improvement of resource productivity must span the whole spectrum of products and services that meet our needs.

The processes required to successfully infuse this philosophy of sustainability and to accelerate operational transformation are very information intensive. More informed decision-making by the executive and managerial ranks will be needed in every functional area. Improved environmental accounting plays a role in a range of new approaches that are being explored to improved product and service development including: the Natural Step, Industrial Ecology, Design for Environment, Cleaner Production, Cradle-to-Cradle, Leadership in Energy and Environmental Design (LEED), and Material Flow Accounting, (Gray et al., 1995; Baumann and Cowell, 1999; Robèrt et al., 2000; McDonough and Braungart, 2002; Gray and Collison, 2002; Howarth and Farber 2002: Robèrt et al 2002).

A definition:

Sustainability involves the ability to persist with **Stable or Improving Well Being and Natural Capital,** first clearly enunciated by the Brundlant Commission Report (WCED, 1987).

Sustainable management will demand customer-focused, high quality service and products. It requires frugal behavior, long term planning horizons (10, 20, 100 years) rather than simply the next month or quarter, and concern for the Triple Bottom Line. Products should be designed to last, or to be easily recycled, reused or returned to nature. Focus on wastes as resources – how can they be used? Wastes are usually very inexpensive, you may get paid to take them away! TREX has created a durable, water resistant lumber made with waste plastic bags and wood fiber. These issues are addressed in the emerging field of industrial ecology (is4ie.org).

The fundamental change from business as we know it today – to how we must know it in the future -- is the recognition that business must consider environmental and social impacts of operation with full accounting for costs, risks and benefits (UNCTAD, 2004). The focus must change from short term profit (cash only) to long term appreciation of economic, social and natural capital: the **Triple Bottom Line** (sometimes noted as 3BL or TBL).

This revolution will create many opportunities and challenges for information technologists, the people who must expand the domain of Management Information Systems to include the capture, processing, archiving, and dissemination of information related to a sustainable and profitable future. This will involve a wide ranging set of software applications and middleware, enabling companies to collect information about detailed use within company and to relate it to reference sites at utilities and regulators to turn use data into impact data. There is a need for a set of integrated information flows to produce a Triple Bottom Line accounting report, (see figure 1).

The Triple Bottom Line and Sustainability

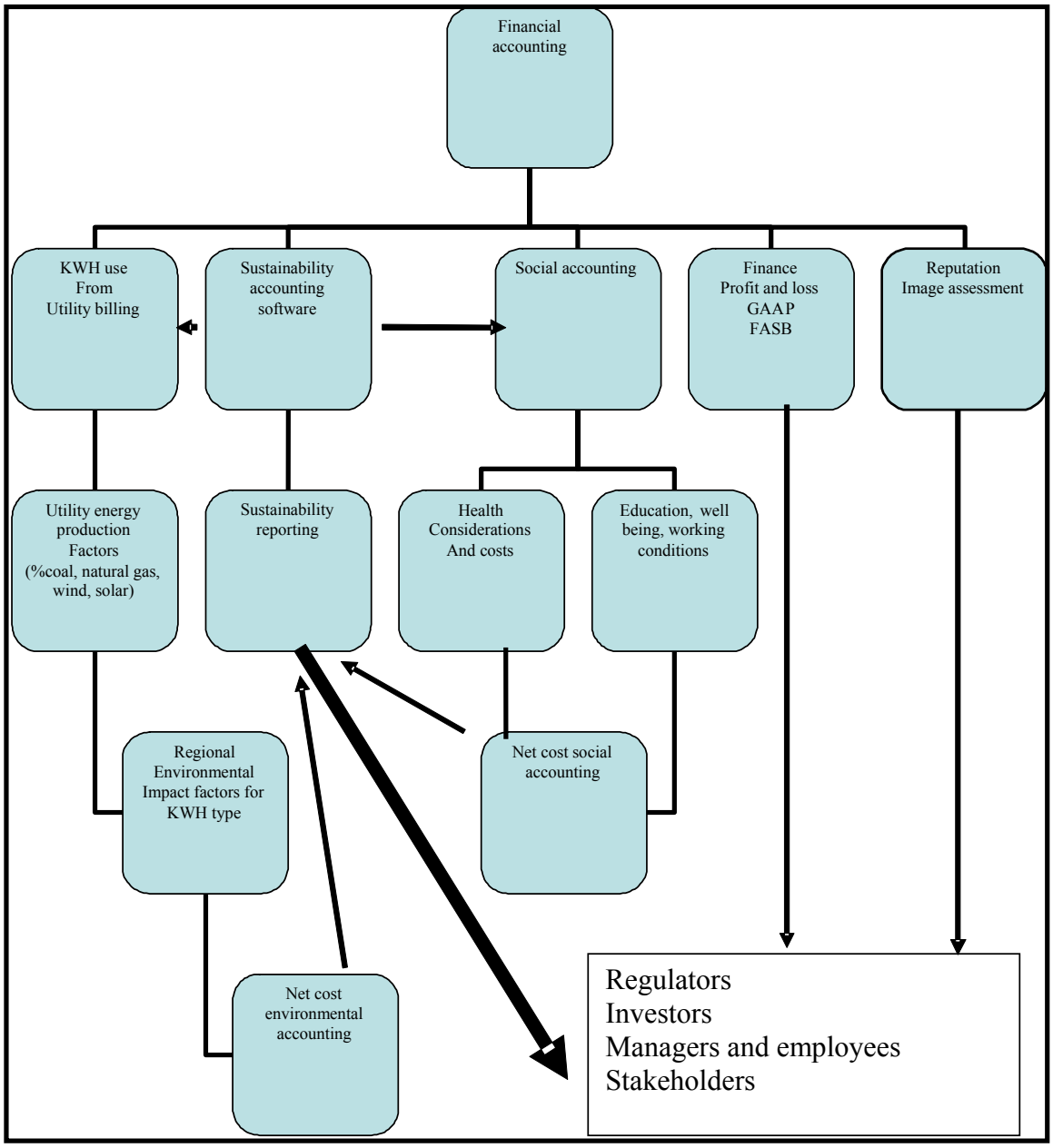
This rapidly evolving field of environmental accounting is wrestling with these challenging problems, but implementation will require significant changes in IT and accounting practices. A 3BL approach will commonly involve changes in management accounting, financial accounting and policy reporting. Although it may appear to be just another cost, environmental accounting can enable an organization and its stakeholders to evaluate and improve an organization's performance with economic, social and environmental measures (IFA, 2005).

If the market were complete, this would not be necessary and Milton Friedman's dictum, "A company's only responsibility is to increase profits for stockholders" would suffice. However, the flawed and incomplete market we have today, with enormous uncounted costs and incorrectly attributed costs, performs poorly. As British economist A.C. Pigou noted early in the last century the market will fail unless it includes all costs. Most markets today consider only a small fraction of the total transaction cost, leaving many "externalities" out of the picture (Antheaume, 2004; Bainbridge, 2004).

Environmental accounting can be used to more accurately determine financial performance, improve operations, reduce risk, drive innovation and compare alternative strategies for strategic planning. The companies, governments, NGOs, and professional organizations that deal with these issues have suggested a range of responses and approaches which remain in their formative stages (Rikhardsson et al., 2005; Chua, 2006). While a growing number of tools are available to facilitate environmental accounting, much remains to be done to make them more useful, inclusive, effective, accurate and user friendly (Beets and Souther, 1999; O'Dwyer et al., 2005).

Environmental accounting is increasingly being used in traditional financial and management accounting, policy accounting, and environmental management accounting (Schaltegger and Burritt, 2001; Sigma Project 2002; UN 2004; IFA, 2005). Although not common in the United States adoption and growth has been quite rapid in Europe, with more than 10,000 sustainability reports now prepared annually worldwide (Rikhardsson et al., 2002). Certified or Chartered Accountants do much of the financial accounting, which includes preparing financial and tax statements and auditing, often focused on investors, lenders, and regulators. GAAP and FSAB requirements are gradually adding more discussion or consideration of these issues.

Triple Bottom Line accounting, figure 1.



Activity-based and enterprise accounting can be used to improve allocation of overhead, costs, benefits and risk. Improved process flow mapping, integrated substance chain management, and material flow analysis better account for inputs/outputs and help identify costly non-product outputs. Environmental management accounting focuses on collecting and evaluating data on an organization's environmental performance, often using accounting over the full life cycle of products or policies, from inception to disposal, recycling, or closure. Environmental management tools include: eco-footprinting, material flow analysis, substance flow accounts, environmental accounting information systems, environmental audits, and required reports for regulators, such as the Eco-Management and Audit Scheme (EMAS) in Europe (Robèrt et al., 2002; GRI, 2002), Bringezu et al., 2003; Palm and Jonsson, 2003; EMAS, 2006;).

Governments and advocacy groups use environmental accounting to help develop and review the effectiveness of policies, incentives, and regulations on the performance of companies, industries and nations (Bainbridge, 2004). Environmental and social accounting may be included in preparation of company documents for the Global Reporting Initiative GRI, Dow Jones Sustainability Index, Corporate Social Responsibility rankings, Social Accountability 8000, the International Organization for Standards Environmental Management Systems 14001.

The potential benefits of improved management of information and environmental accounting include (Bainbridge 2006): Improved profitability; Better decision making; Discovered opportunities for cost saving; Discovered opportunities for new processes; Discovered opportunities for new products and services; Competitive advantage; Improved internal reports; Improved external reports; Improved employee morale and health; More accurate and complete costing and pricing; Reputation building; Societal benefits; Environmental benefits; Improved stakeholder relations; Reduced risk and liability.

The Challenges Ahead

The first challenge in developing environmental accounting systems capable of providing triple bottom line detail is deciding what approach to use, at what level, and how best to integrate environmental accounting into current accounting and management systems. Ideally the system would provide the types of information needed for all kinds of environmental account reporting. There is a wide range of alternatives, and a growing number of corporate financial reports and case studies provide some insight into what works, and what needs work (Wallage, 2000; O'Dwyer et al.; 2005). These studies, and others, suggest that proactive environmental reporting improves profitability and reduces risk, and creates a competitive advantage (Lorton, 2006).

The second challenge is more fundamental, reflecting our incomplete understanding of the complex environmental systems in which we live. IT Societies should develop linkages to the Ecological Society of America, the US Society for Ecological Economics, the International Society for Industrial Ecology, and other organizations involved in environmental research.

The third challenge is implementation. How do we collect, manage and analyze these new types of information. What kinds of quality assurance will be needed? New standards, procedures and processes will need to be devised to encourage corporate adoption of these inherently beneficial methods. Software development is underway, but no standard has yet emerged for this complex task. Ideally the software would be easily integrated with existing business management software

to provide data and reports useful for financial, management and policy purposes. These programs would be able to translate the gallons/liters of gasoline consumed into global warming gas cost contributions, the cost of local nitrogen pollution remediation, and the water and air pollution generated in the supply and disposal chain figure 1. This will take a concerted effort from IT developers, managers, accountants, managers, engineers, and environmental scientists.

IST's Expanding Leadership Role in Organizational Performance Enhancement

There is ample precedence in the recent history of Information Systems Technology's (IST) leadership role in the effectiveness of the diffusion of enterprise wide, information based, performance oriented change. The initial development of the Capability Maturity Model (CMM), developed by Carnegie Mellon's Software Engineering Institute (SEI), created a set of workable standards that can be used to manage complex projects. The dramatic impact on software improvement processes led to a wider organizational interest in modularizing other potentially measurable procedures (Kulpa and Johnson, 2003).

Information systems technology is an enabling force within an enterprise, and one that has a direct impact on the innovative operational results of an organization (Huang and Han, 2005). The evolved Capability Maturation Model Integration (CMMI) was a natural outgrowth of the ongoing quest for quality (Ahern et al., 2004). IST capability made it possible for an organization to capture the data required to monitor the appropriate metrics needed to assure the creation of quality products and services (Herbslep, 1997).

The Capability Maturity Model Integration (CMMI) has rapidly become a preferred means of improving organizational processes in industry and government. CMMI is a framework for guiding, integrating, and appraising improvement activities. CMMI provides a single, integrated framework for improving processes throughout an organization, enhancing the quality and efficiency of the organization as a whole (Ahern et al., 2004). The Capability Maturity Model Integration provides guidance for improving an organization's processes and their ability to develop, acquire, and maintain products and services. CMMI places proven practices into a structure that helps an organization assess its organizational maturity and process area capability, establish priorities for improvement, and guide the implementation of these improvements.

CMMI: A Prescribed Path to the Implementation of Planned Change—The "What to do"

The Capability Maturation Model Integration, as its name suggests, is a philosophy of sustainability. The CMMI is organized around Key Practice Areas (KPAs), and each KPA is associated with one or more goals and a list of key practices (Menezes, 2002). The key practices are considered representative of practices that organizations have typically put in place to meet the goals of the KPA. In the CMMI the KPAs are divided into 5 groups associated with what are called maturity levels. The most basic management practices are considered part of maturity level 2, while level 5 includes processes for process optimization and technology change management (Paulk et al., 1995).

Process Change Management is a key process area for level 5. The purpose of Process Change Management is to continually improve the processes used in the organization with the intention of improving quality, increasing productivity, and decreasing the cycle time for product development or other areas of interest, (i.e., the introduction of processes necessary for a

sustainable capability). Process Change Management involves defining process improvement goals and, with the top management sponsorship, proactively and systematically identifying, evaluating, and implementing improvements to the organization's standard processes on a continuous basis (Huang and Han, 2005).

"In the context of these models, processes refer to 'what to do' rather than 'how to do it.' A process area specifies goals that describe the result of successful application and practices that describe required (and expected) activities to achieve those goals. Some goals and practices are specific to the process area; others are generic and apply across all process areas. These generics describe essential ways in which a process can be institutionalized. Institutionalization refers to a process's degree of repeatability, standardization, and sophistication of control (www.sei.cmu.edu)."

The CMMI, by integrating the best-proven practices from a variety of disciplines, provides certain Key Process Areas to follow to improve the likelihood of achieving planned change. It encourages organizations to address the full product development life cycle, independent of the type of product or service involved (http://www.esi.es/en/Products&Service). The CMMI focus is on Process Areas (PAs), where each process area is a cluster of related practices that, when performed collectively, satisfy a set of goals considered important for making significant improvement in a particular area.

The Road Ahead

Modest investments in improved environmental accounting can lead to significant gains in Triple Bottom Line profitability, corporate image, and reduced liability. Environmental accounting demands new skills, tools, and more integrated accounting across department and division lines enterprise wide. A wide range of stakeholders can benefit from this information. Environmental accounting is also increasingly in demand for policy development by NGOs and at a range of levels of government. This work will demand innovation, creativity and investment in IT. It is an unmatched opportunity for information technology and technology developers.

Recommendations for Further Research

Much remains to be done to define the best or ideal IT application tools and processes needed to identify, capture, cleanse, process, and disseminate the integrated data required to implement the Triple Bottom Line. Data Mining (DM) operations, as an evolving focus within the discipline of IT, provides a rich domain of inquiry and development. Middleware developers will also face many challenging tasks. Researchers across a range of disciplines need to work together to examine the various process strategies, methodologies, and tools of DM for potential application in 3BL accounting and management. Testing DM's viability as a self-regulated, cybernetic tool, which can effectively sift through enterprise wide database repositories discovering knowledge, and providing automated structured trend analysis, may be of critical importance in speeding the transition to full cost accounting, a profitable 3BL , and a sustainable future.

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WEB RESOURCES:

CMMI
www.sei.cmu.edu

http://www.sei.es/en/Products&Service

EA
Environmental Management Accounting Research and Information Center
www.emawebsite.org

Environmental Management Accounting Network-EU, www.emanu-eu.net

International Federation of Accountants, www.ifac.org

Global Reporting Initiative, www.globalreporting.org

US Society for Ecological Economics, www.ussee.org

International Society for Industrial Ecology, www.is4ie.org