THE CORPORATE ROLE IN PROTECTING HEALTH SAFETY AND THE ENVIRONMENT

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As we approach the year 2000, we are at an important cross-roads with both the world's economy and environmental concerns becoming truly global in nature. The United Nations Conference on Environment and Development (UNCED) in Brazil concluded that the goals of development and environmental protection were not necessarily at odds, providing that institutions and people were committed to sustainable development. Industry, government, trade unions, environmental organisations and individual citizens are all important in fostering a transition to sustainability, but no one can deny the very central role that must be played by the commercial firm that creates economic wealth and has the ability to minimise, eliminate, and mitigate adverse effects of technology on health, safety and the environment. This is not to minimise the parallel importance of government in providing an appropriate political environment and regulatory system to guide sustainable development, but the focus of this paper is on the role of the commercial enterprise.

The concept of sustainability must necessarily be viewed broadly. Since the firm or enterprise is connected to or affects the whole of society, discussion of the sustainable enterprise must include issues related to sustainable production, consumption, employment, jobs which create purchasing power and culture. To put it another way, health, safety and environmental concerns must be construed expansively to include both physical and economic security. Further, while discussion about the sustainable enterprise tends to be centred on manufacturing, energy and services, it is important to note that sustainability also refers to extraction industries, agriculture, transportation, and information systems. Finally, the socio-economic impact of "industrial" activity, here broadly defined to involve all the activities that are undertaken to satisfy human needs, should also be viewed expansively to include ecological systems, biodiversity and environmental justice.

In a sense, formulating the solution as making the enterprise greener trivialises the enormity of the task before us. An industrial transformation may require the displacement of old technologies, industries and institutions by new ones, because in order to change, organisations must not only have the willingness and opportunity to change, but they must also have the capacity to change. Small and medium-size enterprises (SME's) may be especially important as the source of new sustainable technologies. Sustainability, in its broadest sense, may require increasing rather than further decreasing the labour intensiveness of industrial and agricultural systems and it may require reversing the trend towards large "mega-firms."

Opening up the existing enterprises to participation by labour and by the community may be one way of factoring societal "demands" into corporate consciousness, but the fundamental forces of competition and short-term or immediate need for cutting costs are powerful determinants of what direction the enterprise takes. It remains to be seen whether the enterprise can transform itself enough, and in time, to avoid future environmental disasters, socially disruptive displacement of labour and economic disparities. Does clean production designed by the firm necessarily mean lean production, displacing of labour? The rise of an underclass within the developed countries raises real concerns. The concept of North and South as existing in distinct national boundaries no longer holds. The increasing globalisation of the world economy paints a different picture. Sustainability and the sustainable enterprise have to be examined in an entirely different context than a decade ago. Identifying future, rather than just present needs (what some call "backcasting"), and facilitating an industrial transformation to satisfy those future needs is a different challenge than one focused on making the existing system more efficient or green. The remainder of this paper addresses:

- Incorporating Health, Safety and Environmental Concerns in Corporate Accounting
- Networks, Dialogue with Stakeholders, and the Greening of Learning
- Cleaner Production, Design for the Environment, and Facility-wide Planning
- Industrial Capacity for Undertaking Long-term Futures Studies, and
- Encouraging the Transition to Sustainability

Incorporating Health, Safety and Environmental Concerns in Corporate Accounting

Central to the issue of sustainability are the definition, measurement, and reporting of environmentally-relevant data pertinent to the operations of the corporation. In view of the task of designing and implementing a sustainable enterprise, it is necessary to answer such questions as: how is a firm not sustainable, at what rate and in what direction is it moving, and what changes must it make to become sustainable? Both the environmental consequences of a firm's activities, which include worker health and safety, public health and environmental impact, and its

environmental performance, i.e., the extent and effectiveness of actions taken, which mitigate its environmental consequences, must be considered.

A beginning point for the environmentally-conscious corporation is the use of tools for decision analysis that can influence the choice of alternative product designs and capital budgeting. Life-Cycle Analysis (LCA), which evaluates the impacts of technological activity from "cradle to grave," is a typical tool for product and process assessment. However, critics have argued that this instrument is often highly susceptible to diverging interpretations and exploitation for political goals. A lack of standard "envirometrics," a discontinuity between the social and the business-relevant measures, and opposing social interests have lead, on the one hand, to the widespread use of LCA in the public debate, and on the other hand, to assessments of highly questionable accuracy and value. LCA is a hostage of its fragmented creators. They suggest that LCA is currently most useful within a company context (i.e., within an intra-organisational network), and best integrated into a broader environmental management system.

Many have criticised traditional accounting and capital budgeting techniques for chronically and systematically undervaluing future versus present consequences and non-monetary and natural versus monetary and human effects. A consensus is emerging that such tools and systems must at the very least incorporate the Total Cost Accounting (TCA) or Full Cost Accounting (FCA) approaches, which basically means that they must include not only conventional financial accounts but also all relevant consequence and performance envirometrics.

Aside from tools for use for specific decision-support, eco-auditing can be used for assessment of the business organisation as a whole that may be of interest to investors or regulators. The basic idea of the eco-audit is to conduct a comprehensive review of selected envirometrics at regular intervals, and to compare current to prior, budgeted, and future expected envirometrics, and preferably also to industry or internal "benchmarks." Eco-audits can be conducted by internal or external, certified auditors. They can be mandatory or voluntary. Results can be kept confidential or publicly disclosed. Results can be comparable among firms and industries, or unique to one firm and only internally-comparable. Various methodologies exist.

The development of standard measurement and reporting practices of both environmental consequences and performance can contribute to the identification of strategic options for environmental management, and to making the competitive sustainable enterprise become much more a reality.

Networks, Dialogue with Stakeholders, and the Greening of Learning

The ability of organisations to learn from networks, influences the management and development of "environmentally sensitive technology." Networks can exist within the organisation (planning, production, and innovation functions), between organisations in the supply chain (suppliers, contractors, consumers/customers), and with other organisations (public interest/community based groups, compe-titors and regulators). These are termed intra-, trans-, and supra-organisational networks respectively. Networks can serve a number of purposes:

1. provide internal sources of technical ideas and information
2. provide technical ideas and information from sources external to the firm
3. create performance requirements/constraints or provide information about market demand and opportunities
4. provide a means to advance shared decision making with those external to the firm

The first purpose is served by intra-organisational networks. The second and third purpose are served by both trans- and supra-organisational networks, while the fourth purpose is served more specifically by customers, workers, and community-based groups. The latter have been termed "non-business stake-holders," although, in a sense, workers could also be conceived of as being in this category to the extent they do not share with management the production decisions or decisions about the choices of technology in the firm.

One additional kind of network is community-worker networks, such as environmental-labour coalitions pressing for better and more co-ordinated environmental and occupational health and safety programs, policies and laws, and the right-to-know coalitions who co-ordinate toxics information in the workplace and in the environment. These networks can influence not only better job health and safety, but better environmental management systems through community pressure with information supplied by labour as a silent partner.

An important factor, not discussed in the context of networks per se but nonetheless of importance within the intra-organisational network, is the role of the champion of new ideas and vision within the corporation. A number of researchers have chosen to highlight the important role of key actors. They appear to often be the Chief Executive Officers (CEO's) or owners, or managers with a secure and salient position within the firm. They have been called "champions" in the management literature, and in the R&D context, "gatekeepers." Business leaders whose understanding of the relationship between humanity and nature change, and who arrive at new beliefs about how their business should manage environmental strategy, figure rather prominently in the current environmental management literature. Management champions find new ways of looking at the challenges, adopt new personal values, and become the sponsors of voluntary change within the organisations, overcoming many barriers and sources of inertia. We must at times remind ourselves that, despite the compelling and highly relevant discussions of stakeholders, networks, institutions, and social (collective) actors in the environmental context, individuals play a central role and are

ultimately the "real" actors in society.

"Corporate greening" can be viewed as a paradigm shift. Evidence of this shift should be noticeable in company cultures, especially at the level of underlying assumptions. It is in cases where environmental concerns have become a "core strategic factor" in the management process that this shift may be most apparent. Artefacts like policies, changes in products and processes, and public disclosure of environmental information can indicate deeper changes in core assumptions.

Firms can collaboratively learn important new knowledge and skills through working with stakeholders. Learning from stakeholders is essential in developing core competence for discovering environmentally-focused solution-oriented strategies because it changes the corporation's value structure since it requires that they develop different skills and attitudes. The firm will need to shift from a deal-oriented, transactional, mechanistic approach to a more relational, open, learning orientation. A profound revision of the current understanding and practice of stakeholder dialogue is necessary. Stakeholder dialogue should be viewed as an open-ended learning process rather than a growth and profit outcome-focused "negotiations" process. Reciprocal trust is seen as essential in engaging the non-business stakeholders in a collaborative effort. Co-option and manipulation of those stakeholders is an antithetical activity.

Learning involves not only fact and technique acquisition, but "learning to learn." It is within this framework that new technical and organisational solutions can be found to ensure the future sustainable operation of the corporation. Solution-oriented strategies can provide three types of competitive advantage:

- play the game better by going green and thus enhancing growth
- change the rules of the game to the firm's advantage thus leading to growth and strategic influence
- create an entirely new game (re-invent the corporation) leading to a renewal of the core business

Three different mindsets characterise companies' responses to environmental challenges: compliance, pollution prevention and market-based business development. Firms with the latter focus tend to be more innovative, solution-oriented, and stakeholder based. They also learn how to predict and lead the market.

Unlike consumers, members of communities (part of the supra-organisational network) are non-business stakeholders. Yet community-based public interest groups are potentially important partners in transforming the firm into a sustainable enterprise, even though the experience to date has not been particularly encouraging. This experience includes:

- company communication about plant-based risk to the surrounding community
- industry- or government-created citizen advisory panels
- government-mandated emergency planning committees
- the negotiation of "good neighbour agreements" between plants and the community

Unlike a business, which tends to speak with one voice, there are important differences and sometimes conflicts between various constituencies within the community. Not only are there likely to be different community interests, but workers who both live and work in a industrial facility may have unique concerns.

Consumers are important stakeholders to companies and comprise a part of the trans-organisational networks discussed earlier. Green consumers may be concerned with a number of attributes of the products made by a particular company including whether:

- the product is manufactured in an environmentally sustainable way
- its use is energy conserving
- its disposal is environmentally acceptable
- the manufacturing (or disposal) is safe for workers

Directly assessing or verifying claims of being environmentally friendly or being a green product, however defined, is difficult for consumers. Either government or consumers' organisations might have a role to play here by collecting and analysing appropriate information.

Finally, networks, dialogue with stakeholders and learning can all be facilitated by the fashioning of appropriate educational initiatives. Clearly, educational efforts targeted at all stakeholders are needed and are currently receiving inadequate support.

Cleaner Production, Design for the Environment, and Facility Planning

The responses of industrial economies in the last thirty years to pollution and environmental degradation has evolved from:

- a lack of concern resulting in uncontrolled effluents/emissions and an absence of waste treatment, proceeding on to
- the control of pollution, waste treatment and the remediation of waste through "end-of-pipe" approaches, to
- the prevention of pollution and waste at the source of production using existing pollution prevention technologies, to
- innovation in pollution prevention and novel approaches like cradle-to-grave planning and integrated chain management

Both developed and developing countries have introduced technologies without a full appreciation of the economic costs of pollution control. As the costs of pollution control and waste treatment have become fully recognised, it has been argued that a trade-off or balance must be made between concerns for growth and concerns for the environment. However, this need not be the case. Cleaner production can minimise or eliminate the necessity to make trade-offs between economic growth and environment, or between worker safety and productivity, or between consumer product safety and competition in international markets. The co-optimisation of environmental, economic and energy goals creates win-win outcomes in the management of national economies.

Future industrial development faces an opportunity to "leap frog" to cost-effective preventative approaches in this evolutionary sequence by adopting and developing cleaner production. Cleaner production (CP) means the continuous application of an integrated preventive environmental strategy directed to both processes and products in order to reduce risks to humans and the environment, while promoting increases in productivity and competitiveness. For production processes, cleaner production includes conserving raw materials, water and energy, eliminating toxic raw materials and inputs, and reducing the quantity and toxicity of all emissions, effluents and wastes before they leave a process. For products, the strategy focuses on reducing impacts along the entire life cycle of the product, from raw material extraction, through manufacturing and use, to the ultimate disposal of the product. Thus, cleaner production is achieved by applying know-how to improving existing production technology, developing new technologies, changing products and creating new products, as well as by changing policies, procedures and institutions to ensure that individuals perceive positive incentives and receive rewards for taking preventive actions. Cleaner production approaches can be applied to raw material extraction, manufacturing, agriculture, transportation, energy, information systems and the organisation of work.

Facility-wide planning for pollution prevention is especially important and can have more than direct environmental, cost, and compliance benefits. It can also stimulate creativity, increase internal communication, and "open up systems" to the possibility of new solutions. An important component of doing facility-wide planning is to undertake technology options analysis (TOA), that is, identifying changes in production technology, such as inputs, final products and process, that could be adopted or developed to address environmental concerns. TOA goes far beyond an eco-audit or a technology assessment of existing production technology. Getting the firm to explore the adoption or development of superior technology could initiate a cultural shift.

Industrial Capacity for Undertaking Long-Term Futures Studies

One of the most distinctive features of environmental concerns from a corporation's strategic perspective is that constraints such as effluent and emissions standards, waste-disposal costs and energy costs, keep getting tighter and tighter, with no certain limits in sight. In the case of most social issues which have challenged businesses, such as child-labour laws and worker health and safety regulations, changes have come rapidly, borne by movements, but have then become accepted and integrated as new norms, and the pace of change has slowed to marginal, incremental improvement. Such issues are socially negotiated, and when the side which makes demands receives some satisfaction, the negotiation is settled, for the time being, at least. Moreover, the firm is a participant in this negotiation, and has access to information about the other side's demands, expectations, and intentions.

Environmentally-related social change is not negotiable in the same way. Although a firm's management may bargain with union representatives, it is the workers they represent whose needs must be met, and, assuming that the needs are well above the level of strict survival and subsistence, this is a social negotiation. In strong contrast to this, while much that goes on around environmentally-related business issues is social in nature, the entity which environmentalists and regulators represent is Nature, whose requirements (ecosystem health, biodiversity, tolerable toxics levels, regenerative capacity, etc.) are not social at all in the strict sense of the word. There can be no anthropocentric negotiation with the biological/ecological fundamentals. And since we do not yet know what levels of industrial activity are sustainable, nor how far short of or beyond the tolerances we currently are, about the only basis we have for forecasting future constraints is a rough rule-of-thumb that the ramp will continue up at least at its present angle of incline for some time, and that we will not become unambiguously aware when we have done enough.

This combined social-environmental context presents great difficulties for business forecasting, separating it from other less problematic economic and social variables like sales growth and changing product technology. But, added to its inherent conceptual difficulty is the fact that environmental demands on corporations are increasing significantly. The need to adequately plan future environmentally-related investments in new product, process, distribution, and facilities technologies is becoming an urgent competitive issue in many industries.

In the Netherlands, Karel Mulder and Philip Vergragt, noting how few companies have as yet integrated environmental practices into their innovative activities, have termed a more advanced, anticipatory form of strategic environmental technology management Business Technology Assessment (BTA). The corporate analogue of the more systematic technology assessment (TA) as performed by government

agencies, BTA is an unstructured, informal process of scanning the firm's business environment, forecasting future trends, and comparing these to the firm's own capabilities and options. The Dutch researchers point to various well-established government technology assessment programs, and argue that, although the abbreviation TA is relatively unknown in the corporate world, many TA-like activities can nonetheless be identified in practice. Backcasting (as opposed to forecasting), a technique recently employed to assess the implications of the Netherlands' 20-year NMP (National Environmental Policy Plan) for the use of plastics in construction and packaging, presents a novel approach to futures planning. Starting with a description of environmental and product safety demands that will need to be satisfied in the future, the analysts identify alternative technology routes which could be initiated now and followed to satisfy the requirements. This is to be distinguished from forecasting the likely future environmental effects of planned technology and making mid-course corrections to minimise their consequences.

Encouraging the Transition to Sustainability

In fashioning policies to encourage a transition to sustainability that focuses on technology, there are five essential questions to work through, remembering that technology is more than hardware and sustainability is more than pollution prevention:

- What are the technologies of extraction, manufacturing, services, transportation, agriculture, energy, waste management etc. that present significant sustainability problems (i.e., what are the targets)?
- What are the features and characteristics of the technologies we would like to have that would replace those technologies in the future?
- Do the technologies exist, do existing technologies need be to adapted in a minor or major way, or does new technology need to be developed?
- What sector or firm is in the best position to develop or deploy the desired technology?
- What governmental, corporate, labour and community/consumer-based policies need to be put into place to encourage the development or diffusion/transfer of the desired technology?

The answers to these questions depend on our definition of sustainability, the specific industry and the kind of corporations involved with the target problem, the technological potential of different potential responders, and our conceptual or behavioural model of how technological change takes place. But there is more to consider. Are we to design policies for the short-, medium- or long-term? Do we prefer an evolutionary or more radical response? Do we believe in directive intervention, targeted policies or policies that simply remove barriers and create a nurturing environment for investment and technology innovation/diffusion without giving competitive advantages to one technology over another? Are we willing to provide a dose of "shock therapy" to the economy and encourage the emergence of new industries and technologies and the displacement of the old?

A transition to sustainability will necessarily involve changes to the technological basis of corporate activities. The management of technology involves much more than the management of R&D. It includes not only the incorporation of clean technologies into business processes, but structural and cultural changes and changes in relations with different industrial actors. The management of technological change should be an enterprise-level activity. Moreover, the activity should be explicitly fashioned. Technical competency is not enough; a linkage with entrepreneurial competency is required to enable the organisation to have a learning capability. The corporate mission of "production" must be transformed into a mission that fulfils societal needs. Firms must learn to think and operate within a product life-cycle concept.

There are at least four types of corporations, each with different competencies and with a different learning trajectory:

- small technology-intensive
- small technology-contingent
- large science-based
- large mass-production

Examples of each are, respectively, speciality suppliers of engineering materials or devices; supplier-dominated manufactures of lower-tech products like clothing and furniture; chemicals and electronics; and steel and automobiles.

External competencies are also important. Only some SME's have the capacity for major innovation; incremental changes are more likely to be the norm without external programmatic support from outside the firm, such as clean technology centres. Venture capital investors will require the same technical soundness and return from sustainable technologies as they do from the technologies they have always been investing in. Finally, it is not clear that it is always technology that will be the source of the road to sustainability. Technological "fixes" have caused us problems in the past, so caution is advised. There may be no "natural trajectory" to sustainability independent of the actors. Businesses require appropriate organisational structures and cultures to look for and create market opportunities and co-ordinate them with technological possibilities.

It is important to encourage shifts between technological regimes, elsewhere called technological paradigms or guideposts, as opposed to shifts within a technological regime. A technological regime is a technology-specific trajectory involving design configurations, research

activities, and a development agenda. A parallel distinction is made between evolutionary change and radical or discontinuous change.

Once established, a technological regime creates a "selection environment" that tends to expand learning inside and excludes excursions outside, at least as long as incremental improvements in technology are rewarded in the market. When there are increasing returns with adoption, at some point society may become locked into a suboptimal technology. Established networks between firms, suppliers, customers and unions may perpetuate a technology.

New, paradigm-breaking, scientific insights; the failure or expense of old approaches to solve existing or anticipated problems, reflecting technical, theoretical or economic limits and constraints; and risk-taking entrepreneurial activity contribute to initiating a shift between technological regimes. Unlike evolutionary advances which tend to preserve the players in established networks, radical shifts are likely to be disruptive and create new winners and losers. Since governments are influenced predominantly by existing stakeholders and players, disruptive advances are resisted and dominant technologies remain entrenched.

The idea that government should be a trustee for, and therefore actively promote, new technology, industry, firms and resulting new networks is a difficult concept to put into practice. When there is sufficient societal support for dramatic changes that existing technologies can not deliver, government may be willing to place constraints on established technologies creating a market niche which may spur innovation.

Views of regulation on industry are conflicting. New regulations are resisted by regulated firms, arguing "unproductive" diversion of financial and human resources, while new and competing entrants silently seize the opportunity to penetrate markets with products and processes that design the environmental, health and safety performance requirements into their technologies, viewing them as opportunities rather than constraints. Sometimes, of course collaboration between traditional firms and those with a different technological basis occurs, or established firms merge with or buy up new firms, as witnessed by the absorption of biotechnology firms by established chemical and pharmaceutical companies.

Whether government is willing to directly aid and accelerate new development through R&D subsidies, support of needed infrastructure, tax instruments and procurement practices is another matter and requires that government think in terms of an industrial policy. Apart from government, sufficient, individual and industrial, consumer/customer demand can accelerate shifts between technological regimes with the entrepreneurial firms engaging in "strategic niche management." Rather than wait for consumer demand to mature, government can accelerate that demand by experimenting with policies that encourage consumers to use the new technology and provide feedback to developers to facilitate design changes and foster market acceptance reflecting evolving consumer tastes. Creating consumer pressure in this way is probably most effective in combination with government regulation of the undesirable aspects of the competing dominant technology, but ultimately it is the industrial or commercial corporation that must meet the challenge and respond.

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