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PAPER

A Natural Resource-Based View of the Firm

Stuart L. Hart

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A Natural Resource-Based View of the Firm

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Abstract

Using resource-based theory as a point of departure, this paper proposes a *natural* resource-based view of the firm-- a new theory based upon the firm's relationship to the natural environment. It is composed of three interrelated strategies-- pollution prevention, product stewardship, and sustainable development. Propositions are advanced for each of these strategies regarding their connections to sustained competitive advantage, firm performance, and implementation.

Strategic management deals with the challenge of establishing and maintaining a match between changing external (environmental) factors and internal (organizational) resources and capabilities (Chandler, 1962, Andrews, 1971; Hofer and Schendel, 1978). There is an active debate among management scholars concerning the relative importance of internal firm resources (e.g. Wernerfelt, 1984; Barney, 1991) versus environmental factors (e.g. Hannan and Freeman, 1977; Porter, 1980, 1990) to sustained competitive advantage. However, most would agree that both internal and external factors are crucial to competitive success (Fiegenbaum, Hart, and Schendel, 1994). In fact, many recent contributions attempt an integration of the internal and

external perspectives (e.g. Womack et al, 1990; Prahalad and Hamel, 1990; Conner, 1991; Senge, 1991; Hammer and Champy, 1993).

This paper takes existing perspectives as the point of departure. While useful and important, I argue that received theory is inadequate and possibly even destructive: The external (environmental) perspective systematically ignores the biophysical environment while the internal (resource-based) view fails to take into account the critical natural resource constraints that provide the context for capability building. In short, a limited view of what constitutes a firm's "environment" makes traditional theories woefully inadequate as a basis for identifying future sources of competitive advantage.

The goal of this paper is therefore to propose a new theory of the firm, based upon its relationship to the natural environment. Accordingly, the first section of the paper orients the reader to the natural resource-based view of the firm. It discusses the driving forces for such a new conceptualization and presents the basic framework. Next, three interrelated environmental strategies-- pollution prevention, product stewardship, and sustainable development-- are presented including their environmental drivers and propositions concerning the key resources and capabilities, and strategic logic for each. Propositions are then developed connecting the strategies to competitive advantage and firm performance. Finally, some thoughts and propositions are advanced about how best to implement the natural resource-based view. The paper closes with suggestions for a future research agenda.

A Natural Resource-Based View

The world today faces a challenge unprecedented in human history: either alter the nature of economic activity or risk irreversible damage to the planet's basic ecological systems. The evidence is hard to ignore. If current consumption rates continue, all virgin tropical forests will be gone within 50 years, with a consequent loss of 50 percent or more of the world's species (Wilson, 1989). The composition of the atmosphere has already been altered more in the past 100 years-- through human activity-- than in the previous 18,000 (Graedel and Crutzen, 1989). Climate change, which might produce both rising ocean levels and further desertification, could threaten the very fabric of human civilization as we know it (Schneider, 1989).

Through errors of omission as well as commission, business bears much of the responsibility for this plight; air and water pollution, toxic emissions and spills, and industrial accidents have created regional environmental crises for thousands of communities around the world (Shrivastava, 1987). More significant, wasteful products and processes have led to exploitation of virgin materials, consumption of nonrenewable resources, and the contamination of air, land, and water on a global scale (Frosch and Gallopoulos, 1989).

Business in the developed world has been forced, over the past two decades, to comply with increasingly stringent environmental requirements and regulations. For example, expenditures for pollution control in the U.S. now represent over 2 percent of GNP (\$200 billion) and this percentage is expected to increase dramatically in the coming years (EPA, 1990). In some industries (e.g. chemicals), environmental and pollution control costs now account for as much as 20% of corporate capital expenditures (Buzzelli, 1994). Consumer research and public opinion polls suggest that a majority of people consider themselves environmentalists and have high expectations for corporate environmental behavior. In fact, a recent Roper Poll found that 84% of Americans believe that pollution and environmental damage are more serious crimes than insider trading or price fixing (Roper, 1992). Many Americans even believe that it is worth accepting a lower standard of living if it means protecting the environment (Research Alert, 1991).

In developing nations, conversely, there is a growing consensus that raising the standard of living of the world's poor through economic development will be essential to stabilizing population growth and curbing overuse of resources (e.g. Daly and Cobb, 1989; Ruckelshaus, 1989). The human population, which has doubled since World War II, is expected to double again over the next 40 years, to 10 billion, before levelling off sometime in the middle of the next century (Keyfitz, 1989). It may be necessary to increase economic activity five- to ten-fold just to provide basic amenities to this population (Graedel and Crutzen, 1989). This level of production will probably not be ecologically sustainable using existing technologies and production methods (Commoner, 1992; Gore, 1992).

Thus, it appears that few, if any, of our past economic practices can be continued into the future-- they are simply not sustainable. Over the next decade, businesses will be challenged to create a new approach to strategy and it seems quite likely that the basis for gaining competitive

advantage in the coming years will be rooted increasingly in the concept of environmental sustainability (Kleiner, 1991; Stead and Stead, 1992; Hart, 1994).

Unfortunately, there are few conceptual or theoretical guideposts for what constitutes appropriate business practice for the future. We need new conceptual and theoretical models that incorporate the natural environment as a central focus for business (Costanza, 1992). Received theory (e.g. industrial organization economics, population ecology, resource-based view) has used a narrow and parochial concept of environment that emphasizes political, social, technological, and economic aspects to the virtual exclusion of the natural environment (Shrivastava, 1991; Shrivastava and Hart, 1992). This conceptualization has failed to recognize that natural processes-- food production, ecological services, biological and cultural diversity-- are essential to sustaining human society and social organization.

For a meaningful *natural* resource-based view to emerge, managers and organizational theorists need to understand the nature of organization-environment relationships. Activities at every step of the value chain-- from access to raw materials through production processes, to disposition of used products-- have environmental impacts. Accordingly, there are three facets or strategies associated with the natural resource-based view of the firm: pollution prevention, product stewardship, and sustainable development.

Pollution Prevention

Environmental Drivers.

In 1986, the Superfund Amendments and Reauthorization Act (SARA) was passed in the U.S. Title III of that Act required for the first time that companies publically disclose their emission levels of some 300 toxic or hazardous chemicals through what has become known as the Toxic Release Inventory (TRI). The first year of the TRI (1988) revealed that the U.S. chemical industry alone emitted 539 million pounds of toxic materials to the environment (TRI, 1988). This sobering realization caused many companies in the most affected industries-- petrochemicals, pulp and paper, automotive, electronics-- to fundamentally rethink their approach to pollution control. For the first time, many managers came to understand the extent of their impact on the environment and recognized that polluting processes stem from inefficient use of material and human resources. In short, pollution was reconceptualized as a form of waste, and quality processes should not produce waste.

Key Resources and Capabilities.

Pollution prevention's major conceptual breakthrough was the realization that it is much cheaper to prevent pollution before it occurs than it is to clean it up at the "end of the pipe" (pollution control). This is analogous to the quality principle that preventing defects is superior to finding and fixing them after the fact (Imai, 1986). Reflecting the growth of this philosophy, two new journals, *Pollution Prevention Review* and *Total Quality Environmental Management* began in the early 1990s. Through the application of quality management principles to the environment, some companies have reduced their pollution levels dramatically. For example, McDonald's, in collaboration with the Environmental Defense Fund, reduced its solid waste stream by nearly 80% through source reduction, pollution prevention, and recycling (Waste Reduction Task Force, 1991).

Pollution can be prevented in production operations through four primary means: 1. Better Housekeeping; 2. Material Substitution; 3. Resource Recovery; and 4. Process Redesign (Cairncross, 1991; Schmidheiny, 1992). Better housekeeping means focusing worker attention on preventative practices, finding ways to stop leaks, and eliminating waste. Material substitution requires the identification of new, less toxic materials for use in production, such as converting from solvent-based to water-based cleaning agents. Resource recovery entails exploiting opportunities to reuse or recycle materials that were formerly treated as waste. Processes may need to be adjusted or redesigned so that the waste from one production step might serve as input to another (Frosch and Gallopoulos, 1989).

Through the use of employee involvement and teams (Lawler, 1986; Cole, 1989), significant reductions in pollution are possible using continuous improvement methodology focused on environmental improvement (Makower, 1993). Just as in TQM, critical aspects of TQEM include the proper bounding of the system or process to be improved, the involvement of key stakeholders in the process, and the establishment of clear goals or targets for improvement (Ishikawa and Lu, 1985; Imai, 1986).

Proposition 1: Pollution prevention requires the active participation of workers and employees. Empowered work teams focused around clearly-defined environmental goals produce the fastest reductions in emissions and effluents.

Strategic Logic.

By converting more raw material and energy inputs into saleable products or by-products (rather than waste), companies have realized significant savings from pollution prevention initiatives (Young, 1991). Programs like 3M's Pollution Prevention Pays (3P), and Dow's Waste Reduction Always Pays (WRAP) have produced hundreds of millions of dollars in cost savings over the past decade. At Dow, for example, it has been estimated that "end of the pipe" pollution control projects cost the company \$16 for every dollar invested. Conversely, the return on pollution prevention projects has averaged better than 50% for the past ten years (Buzzelli, 1994). Not only can pollution prevention lower costs by reducing waste and liability exposure, it can also reduce cycle times by simplifying or removing unnecessary steps in production processes (Stalk and Hout, 1990; Smart, 1992). A pollution prevention strategy thus appears to facilitate the simultaneous achievement of environmental improvement and lower costs.

Proposition 2: Through lower raw material, compliance, treatment, disposal, and liability costs, an aggressive pollution prevention strategy can lead to a cost advantage relative to competitors.

Pollution prevention holds the potential to minimize or even eliminate emissions and effluents from production processes. Indeed, firms such as 3M and Monsanto have publically committed themselves to "zero pollution" goals. Eventually, however, there are diminishing returns to pollution prevention investments, with larger and larger capital investments required to realize smaller and smaller reductions. At Ford Motor Company, for example, it required a substantial effort to begin recovering and recycling scrap polyethylene plastic. Involvement of the waste management firm, the plastics supplier, the procurement group, and the affected plants was necessary before scrap plastic could be recovered, returned to the supplier, and incorporated into components made of recyclate. In the end, however, the initiative lowered disposal costs by 25% (because the waste management firm no longer landfilled the waste, but instead delivered it to the plastics supplier) and reduced parts prices by 10%, since the supplier now acquired much of its raw material free-of-charge (Wood, 1994). Thus, the firm must eventually turn its attention to the inputs (raw materials) and outputs (products) of the production process. The next dimension of the natural resource-based view of the firm therefore has to do with the concept of product stewardship.

Product Stewardship

Environmental Drivers.

In 1978, the German government created the world's first environmental product certification program-- the Blue Angel Program. Since that time, virtually every major industrialized country in the world (except the U.S.) has adopted a similar government-sponsored program for certifying products as environmentally responsible (Abt Associates, 1993). In the U.S., there are several competing private initiatives to rate products on environmental criteria, including organizations such as Green Cross and Green Seal. A common feature of virtually every such program is the use of some form of "life cycle analysis" to evaluate products (Davis, 1993). Life Cycle Analysis (LCA) assesses the environmental burden created by a product system from "cradle to grave" (Keoleian and Menerey, 1993). For a product to achieve low life-cycle environmental costs, designers need to minimize the use of virgin and non-renewable inputs. Also, the product-in-use must have a low environmental burden and be easily composted, reused, or recycled (Kleiner, 1991; Shrivastava and Hart, 1992).

Life cycle thinking is now being pushed even a step further. In 1990, for example, the German government proposed the first product "take-back" law (Management Institute for Environment and Business, 1993). This law proposed that for selected consumer products (e.g. automobiles), customers have the right to give the product back to the manufacturer at no charge at the end of its useful life. In turn, manufacturers would be prevented from disposing of used or "junk" products. The spectre of this law has created tremendous incentive to design products that can be easily composted, reused, or recycled so as to avoid what would become astronomical disposal costs and penalties. Several similar laws have been introduced in the U.S. Congress over the past two years.

Key Resources and Capabilities.

It has been estimated that 80-85% of products' life cycle costs are fixed by the time the design phase is complete (Allenby and Fullerton, 1992). Therefore, developing capability in what has come to be known as Design for Environment (DFE) appears critical to competitive success in the era of the "take-back." Most firms have learned the importance of coordinating design with manufacturing and accessing the voice of the customer during the design process (Takeuchi and Nonaka, 1986; Clark and Fujimoto, 1991; Denison, Hart, and Kahn, 1994). Design for

Environment implies taking these efforts at cross-functional coordination a step further by deploying the "voice of the environment" into the selection and design of products. To realize DFE, environmental staff, for example, should be integrated into the firm's strategic planning and product development processes (Hunt and Auster, 1990). Close working relationships between environmental staff and marketing are also important if customers' environmental expectations are to be identified early (Post and Altman, 1991).

Perhaps even more important, product stewardship appears to require the early and constructive involvement of key external stakeholders-- environmentalists, community leaders, the media, regulators, etc.-- in the planning process (Freeman, 1984; Buzzelli, 1991). For example, Dow recently instituted a Corporate Advisory Council composed primarily of environmentalists and academics to provide direct input to the Board concerning issues of corporate strategy, investment, and policy. Similarly, the company has incorporated the use of Community Advisory Panels in most regions of the world where it has significant operations.

Proposition 3: Product stewardship requires capability in integrating multiple perspectives, including well-developed cross-functional processes, and ability to engage diverse stakeholders in constructive dialogue.

Strategic Logic.

Through product stewardship, companies can divest themselves of environmentally hazardous businesses and differentiate new products with lower life-cycle costs. Being an early-mover in product stewardship may also confer preferred or exclusive access to important resources (Ghemawat, 1986). As an example, BMW initiated a "design for disassembly" process in Germany that they hoped would avert the government-imposed "take-back" policy. By acting as the first mover, they were able to capture the best German dismantler firms as part of their new recycling infrastructure, thereby gaining a cost advantage over their competitors, who were left to fight over smaller, often unlicensed operations. Competitive advantage was assured when the German government adopted the BMW approach as national policy. As the BMW example suggests, product stewardship may appear costly or even counterintuitive (disassembly!?) in the short term, but eventually should deliver substantial growth prospects (through repositioning of existing offerings and first-mover advantages in new products).

Proposition 4: Through enhanced product positioning, an aggressive product stewardship strategy can serve to differentiate a firm's offerings from those of its competitors and provide sustained growth opportunities.

Taken together, pollution prevention and product stewardship comprise the operating requirements for "green production" (Hart, 1993; 1994). and can be summarized through three guiding principles (Figure 1):

1. Minimize emissions and effluents (produce only useful product or by-product);
2. Minimize use of virgin materials and nonrenewable inputs ("green" the supply base);
3. Minimize the waste legacy of spent products (close the product loop)

Insert Figure 1 About Here

Moving from waste to useful product is the fundamental aim of pollution prevention while product stewardship guides the selection of raw materials and disciplines product design with the need to minimize the toxic legacy of products in use. By taking control of the full product life cycle, the natural resource-based view moves toward closing the loop in operations. However, firms limiting their pollution prevention and product stewardship strategies to the developed markets, while still employing more traditional methods in the developing world may still contribute to significant environmental harm. The natural resource-based view thus requires a final step: sustainable development.

Sustainable Development

Environmental Drivers.

The Brundtland Report (World Commission on Environment and Development, 1987) was the first document to clearly link Third World development issues with environmental concerns:

population growth and poverty in the developing world were identified as major causes of environmental degradation. Indeed, 90% of future population growth is expected to come in lesser developed countries, increasing the already heavy strain on resources and natural systems in those regions (Keyfitz, 1989; Ehrich and Ehrich, 1991). This looming concern was the primary focus of the 1992 "Earth Summit" in Rio de Janeiro.

Business activities in developing nations or poor regions have historically been limited to extracting raw materials, selling overflow products, redeploying obsolete technology from developed markets for low-cost manufacturing, or exploiting cheap labor for low-skill assembly operations (Commoner, 1992). Too often, such economic activities have inflicted damage upon those least able to speak up-- the poor, the disenfranchised, and those yet unborn (Gore, 1992; Mohai and Bryant, 1992). It does not appear feasible for such practices to be expanded to the extent necessary to achieve reasonable levels of social and economic development (MacNeill, 1989). With world GNP currently at about \$20 trillion, many believe it will be necessary to increase economic activity at least five- to ten-fold just to provide basic amenities to the burgeoning population in the developing world (Graedel and Crutzen, 1989). This level of economic production is probably ecologically unsustainable with current business and manufacturing practices: the attendant five- to ten-fold increase in fossil fuel use, resource depletion, and waste generation would almost certainly stress the Earth's natural systems beyond recovery (Meadows and Meadows, 1993).

Sustainable development thus implies fulfilling not only the wants of the existing market (developed world), but also to the needs of the emerging market (developing world): Business must adopt technologies and products within the planet's ecological means if poor nations are to develop their economies through environmentally sound infrastructure and technology (Schmidheiny, 1992; Figure 2).

Insert Figure 2 About Here

Key Resources and Capabilities.

The pressure for sustainable development has significant implications for firms, particularly

large multinational corporations. With free trade on the rise, long-term opportunities exist for those firms able to identify, develop, and deploy products and services that contribute to sustainable economies in the developing world. Sustainable development implies working over an extended period to change the minds of customers, suppliers, government officials, or managers in developing nations who would rather take the "easier" (but environmentally destructive) route to development (Schmidheiny, 1992). Taking such a bold stance requires strong moral leadership (Selznick, 1957), and a shared vision of the future (Senge, 1990). A dedication to long-range goals-- strategic intent-- also generates pressure and enthusiasm for innovation and change (Hamel and Prahalad, 1989).

For example, Dow decided in 1990 to exit its lucrative 1,1,1-trichloroethane (TCE) solvent business well ahead of government regulations because of its high life-cycle environmental costs (TCE is an ozone depleter and was due to be phased out under the Montreal Protocol later in the decade). Resources were moved from this business to research and development into substitute materials. In less than three years, a new business group-- Advanced Cleaning Systems Division-- was formed with four new (non-chlorinated) solvent products on the market. This decision may not seem significant until it is realized that the company exited the business *worldwide*. This included a rapidly growing TCE business in China, which (like most developing nations) was exempted from the Montreal Protocol until well into the next century. Dow recognized that rapid increases in the use of ozone depleting substances in countries like China could have disastrous environmental consequences. The company has been working closely with Chinese business and government leaders to implement substitute materials (Buzzelli, 1994).

Achieving organizational commitment to such a long-term undertaking is no easy task, since there is little reason to believe that investments in the developing world will have near-term financial payoff. However, a shared vision dedicated to sustainable development might provide the context required for managers to make day-to-day decisions consistent with the long-term direction (Senge, 1990; Campbell and Yeung, 1991). Such an implicit control system is evident in environmentally-oriented companies such as the Body Shop or Ben and Jerry's. The Body Shop credo of "trade not aid", for example, helps guide and focus product development, procurement, and production decisions within the company (Roddick, 1991).

Proposition 5: Sustainable development requires a corporate vision aimed at assuring the environmentally sound development of emerging markets.

Strategic Logic.

Conventional strategic wisdom suggests that corporations direct their attention to the most advanced markets with the most sophisticated customers since this is the best way to expedite technology development and innovation (Porter, 1990). Competing primarily in the developed markets of the U.S., Western Europe, and Japan, however, means focusing on a distinct minority of the world's future markets. General Electric's highly publicized shift in strategic focus from the U.S. and Europe to China, India, and Mexico reflects this growing realization (Smart et al., 1993).

Achieving sustainable development in these regions, however, is an ambitious (some would say utopian) dream. Hamel and Prahalad (1989) noted that companies that have risen to global leadership invariably began with ambitions that were out of all proportion to their initial resources or capabilities. Somehow, they created an "obsession" with achieving a mission over a long time frame. At Mazda, for example, CEO Yamamoto characterized the company's 20-year investment in rotary engine technology as a "sacred quest" (Denison, Hart, and Ichijo, 1994). While it has yet to prove a commercial success, Mazda has steadfastly refused to give up on rotary technology. As a result of this commitment, Mazda is now only a few years away from introducing a *hydrogen* rotary engine which emits water vapor as a combustion waste rather than the long list of serious pollutants associated with the conventional gas-powered engine.

A sustainable development strategy thus dictates that corporations apply new criteria in examining their business portfolio and long-term direction (Figure 3). To approach sustainable development, a company would transform or exit environmentally destructive businesses in developed markets. Similar businesses in the developing world would be reexamined and repositioned (Ilinitich and Schaltegger, 1993). Only businesses based upon green production principles would be nurtured and grown. A company's portfolio would thus evolve over time as market growth shifts increasingly toward the developing world.

Proposition 6: Through commitment to a vision, an aggressive sustainable development strategy can serve to position the firm for the long-term markets of tomorrow.

Insert Figure 3 About Here

Environment, Competitive Advantage, and Performance

In developing the natural resource-based view of the firm in the previous section, propositions were articulated regarding the capabilities and strategic logic for pollution prevention, product stewardship, and sustainable development. In this section, I explore the three strategies' potential for conferring sustained competitive advantage, both singly and in combination. I then propose how the natural resource-based view might relate to three key dimensions of firm performance.

Sustained Competitive Advantage

The resource-based view stresses the importance of tacit (causally ambiguous and socially complex) skills to sustained competitive advantage (Polanyi, 1962; Reed and DeFillippi, 1990; Barney, 1991). Advantages based upon highly codified factors or a few individuals are presumably subject to more rapid imitation or appropriation (Teece, 1987; Winter, 1987). Tacit skills thus serve as isolating mechanisms or "barriers to imitation," facilitating a sustained stream of economic rent (Rumelt, 1984). Furthermore, as Dierickx and Cool (1989) suggest, the imitability of a resource or capability is related to the process through which it is acquired. For example, path dependency (the need to develop capability "a" before developing capability "b") might enhance the sustainability of any given source of competitive advantage. Accordingly, Figure 4 presents the expected relationships among the environmental strategies and three sources of sustained competitive advantage: causal ambiguity, social complexity, and path dependency.

Insert Figure 4 About Here

A *pollution prevention* strategy requires the cooperation of all employees through many, small continuous improvement efforts (Makower, 1993). The decentralized nature of this process makes it difficult to observe in practice and hard to duplicate quickly. However, while deeply embedded and causally ambiguous, pollution prevention processes do not appear to be especially complex. Most efforts involve small teams of employees and stakeholders in solving problems within their operating domains. For those firms with less well-developed management processes, however, there could be barriers to implementing pollution prevention since the strategy requires the voluntary involvement of large numbers of people, especially line employees. Thus, pollution prevention appears to afford opportunity for a sustained competitive advantage for early-moving firms with strong management processes relative to competitors.

The skills needed for *product stewardship* appear to be substantially more socially complex than those needed for pollution prevention: The former requires fluid, informal communication across functions, departments, and organizational boundaries whereas the latter lends itself to more systematized processes for continuous improvement within natural work groups (Buzzelli, 1994). However, it appears that without having first made significant progress on the pollution prevention front, it may be difficult, if not impossible, to successfully adopt a product stewardship strategy: Differentiating products as environmentally responsible while continuing to produce high levels of waste and emissions in production is risky since outside observers (e.g. environmental groups) can easily expose this anomaly, destroying firm credibility and reputation. It has been said that "if you green your operations, the products will follow." This adage suggests a strong path dependency of product stewardship upon pollution prevention.

Adopting a *sustainable development* strategy implies reorienting the vision of the entire organization. To be effective, a vision must be unambiguous, public, and widely understood, making it highly codified in nature (Hamel and Prahalad, 1989; Fiegenbaum, Hart, and Schendel, 1994). However, "saying it" and "doing it" are two different things: Developing a shared vision of sustainable development would seem to require skilful leadership and an empowering social process, reaching deep into the management ranks (Senge, 1990). Perhaps most significantly, the successful implementation of this strategy appears to be heavily dependent upon having first mastered the skills implicit in pollution prevention and product stewardship. Thus, those firms moving most rapidly toward "green production" would seem to be in the best position to adopt a sustainable development strategy in the emerging markets of

the developing world. The ability to point to a track record of environmental achievement might be key to establishing the relationships required to stake out the markets of the future (Daly and Cobb, 1989; Schmidheiny, 1992). Thus, successful execution of a sustainable development strategy may require companies to "get on the escalator" of pollution prevention and product stewardship as first movers or risk being relegated to a semi-permanent follower status.

Figure 5 postulates how the three strategies might unfold over time. The y axis represents the relative importance of each as a basis for competitive advantage while the x axis defines time. The figure suggests that by 1994, the pollution prevention strategy has been widely implemented by firms in many industries and will soon become an expected practice rather than a source of competitive advantage. Indeed, between 1988 and 1991, releases reported by all firms through the Toxic Release Inventory declined over 30% (TRI, 1991). Product stewardship, however, is still comparatively uncommon (Davis, 1993). Consequently, there is opportunity for first mover advantage since no accepted standard has yet been established (Ghemawat, 1986). The concept of sustainable development is still being debated at a conceptual level and it is the rare company that has embraced this idea as a long-term vision (Schmidheiny, 1992). However, there is reason to believe that dedication to such a vision might help both focus and speed the development of pollution prevention and product stewardship capabilities. This will be discussed further in the final section of this paper.

Insert Figure 5 About Here

Firm Performance

It has been long recognized that firm performance is a multi-dimensional construct (e.g. Quinn and Rohrbaugh, 1983; Cameron and Whetton, 1983). Venkatraman and Ramanujam (1986) conceived of three fundamental dimensions: financial performance (profitability), business performance (growth and diversification), and organizational effectiveness (stakeholder satisfaction). What also seems clear is that to be successful, firms must "perform" both in the short- and the long-term (Hart and Banbury, 1994). Thus, to sustain success over time, firms must be profitable today (short-term), while simultaneously investing for growth tomorrow--

in new products (medium-term), and new markets (long-term). Figure 6 shows the hypothesized relationships among the environmental strategies and these three dimensions of firm performance.

Insert Figure 6 About Here

Pollution prevention is expected to produce cost savings in the near-term. Through reduced liability, cycle time, and raw material, compliance, and disposal requirements, a pollution prevention strategy should provide for enhanced cash flow and profitability. With the gains from pollution prevention dropping to the bottom line quickly, additional resources are available for other investments such as product stewardship.

A *product stewardship* strategy is not expected to produce immediate results. Since product stewardship entails altering the firm's product and technology portfolio, the strategy should have pay-off in the medium-term (2-5 years, depending upon the investment intensity and product development time in a given industry). Product stewardship should aid in achieving growth by 1. positioning the firm to gain share within established product-markets; and 2. establishing the firm as the first-mover and market leader in new product-markets.

Taken together, the pollution prevention and product stewardship strategies hold the potential to enhance profitability and growth by lowering costs, differentiating products, and raising entry barriers through first-mover reputation building (Ghemawat, 1986). While substantial resources appear to be required to achieve product stewardship, this commitment seems small when compared to the level of investment and risk required to pursue *sustainable development*-- a massive undertaking requiring a decade or more to accomplish. There is no reason to believe that commitment to sustainable development will result in enhanced short-term profitability or even medium-term growth. Rather, a vision of sustainable development should serve to position the firm for the long-term markets of the future.

Implementing the Natural Resource-Based View

In the preceding section, I argued that there is a sequential aspect to the natural resource-based view of the firm-- that a pollution prevention strategy should produce the cash to push toward growth through product stewardship which, in turn, should position the firm to embark on a sustainable development mission in emerging markets. The sequential nature of strategy *content*, however, tells us little about the *process* of achieving environmental sustainability (Pettigrew, 1992). As I noted above, "knowing" it and "doing" it are two different things. The key implementation question is thus: How does one most effectively lead an organization toward the natural resource-based view?

Figure 7 presents the theory of implementation (Galbraith and Kazanjian, 1986). As Hamel and Prahalad (1989), Campbell and Yeung (1991), Hart (1992) and others have noted, there is an important distinction between strategic ends and means. The former (vision, mission, strategic intent, goals, etc.) define what the firm is trying to accomplish whereas the latter specify how the firm will get there (structure, systems, processes, etc.). This distinction is noted on the vertical axis of the figure. I have already developed the important theoretical difference between tacit and codified capabilities (Teece, 1987; Barney, 1991). The former are hard to identify and duplicate whereas the latter are easily observed and copied. Thus vision and processes tend to be tacit, since they are embedded in the minds of people and teams whereas goals and structures (including formal systems) are more codified, since they are easily observed, often written, and quickly duplicated. This distinction is noted on the horizontal axis of the figure.

Insert Figure 7 About Here

Sustained competitive advantage is enhanced to the extent that important firm capabilities are tacit in character (Ghemawat, 1986; Teece, 1987; Barney, 1991). Thus, vision- or process-centered initiatives will be harder to duplicate than goal- or structure-based initiatives. Furthermore, shared vision might provide the essential context within which process-based initiatives can be embedded (Hamel and Prahalad, 1989). Efforts to develop new process skills without a sense of purpose or direction would thus seem to be less effective than process development driven

by a shared vision (Senge, 1990; Fiegenbaum, Hart, and Schendel, 1994).

It is therefore proposed that the natural resource-based view of the firm could be most effectively implemented through the following managerial sequence:

1. *Develop a shared vision of sustainable development for the firm.* This involves reorienting the firm's long-term purpose around the social-environmental vision of sustainable development. For new firms, this may not represent a significant organizational effort, but for existing, large firms, gaining consensus about such a vision will require a substantial organizational and cultural change.
2. *Identify the key goals to be achieved along the way.* Once a shared vision has been achieved to guide organizational change and development, then specific goals or targets can be set to move the organization in the desired direction. Initially, these goals will relate to pollution prevention, gradually giving way to product stewardship targets.
3. *Focus on developing new process skills.* Identification and involvement of the necessary stakeholders is prerequisite to effective process development. As a first step, process development will focus on employee involvement to realize pollution prevention goals followed by interventions to develop the cross-functional and cross-boundary skills needed to achieve product stewardship.
4. *Change the formal structure.* Rather than restructuring first, it may make sense to redesign formal structure and systems only after a clear sense of vision, goals, and needed processes has been achieved. Premature commitment to information, planning, or reward systems may become an expensive mistake if the necessary stakeholders have not been involved in their development. While a few "symbolic" structural changes may help (e.g. establishing a board-level position for the environment) wholesale changes in structure and systems may actually slow the move toward sustainable development, if people do not share a common vision and sense of direction.

Conclusions and Future Research

This paper has argued that a limited view of what constitutes a firm's "environment" renders traditional theory inadequate as a basis for identifying future sources of competitive advantage.

Using the resource-based view as the point of departure, the paper proposed a *natural* resource-based view of the firm, based upon the organization's relationship to the natural environment. Three interrelated strategies-- pollution prevention, product stewardship, and sustainable development-- were presented in detail along with accompanying propositions concerning the key capabilities and strategic logic for each. Propositions were also developed connecting the strategies to sources of sustained competitive advantage, firm performance, and an implementation framework.

Designing research to test the many propositions suggested as a part of the natural resource--based view will require both methodological flexibility and patience, since much of the theory is prospective in nature (e.g. as of this writing, there were no examples, to the author's knowledge, of large manufacturing firms committed to a vision of sustainable development). Research on sustainable development strategies must thus necessarily take a developmental, case-comparative approach. An interesting research project in this regard would be a comparative field study of two firms in a given industry-- one moving toward sustainable development and the other resisting change. How do these two organizations differ? What is it that predisposes some firms to make the bold move ahead of others? Does internalizing such a vision really speed the adoption of pollution prevention and product stewardship practices?

Research on product stewardship can take a somewhat more structured approach, given that some firms have begun to pursue actively this strategy. Here the ideal unit of analysis might be the product or product development team rather than the firm (e.g. Russo and Fouts, 1993). Using life-cycle analysis and environmental certification data (e.g. Council on Economic Priorities, 1991) a number of important questions are possible to examine: Which firms and industries are first movers in implementing a product stewardship strategy? Does this strategy result in improved market position? Is life-cycle methodology adopted company-wide or do pockets of innovation occur first, followed by the adoption by other product groups or business units? In moving to product stewardship, do firms make a radical leap to internalizing the full life-cycle costs into the design of products or is the process accomplished more gradually? A comparative study of several new product development projects across firms with strongly differing levels of cross-functional capability might help to shed light on which corporate practices foster successful product stewardship.

Finally, hypothesis-testing work on pollution prevention can be started immediately, given the wide adoption of this strategy by existing firms. Environmental performance data on the S&P 500 is now readily available through such sources as the Toxic Release Inventory (TRI, 1988; 1991) and the Investor Responsibility Research Center's (IRRC) Corporate Environmental Profiles. Similar data bases are also emerging in Europe and Japan. By merging these sources with more conventional data on firm performance (e.g. Compustat) it should be possible to test directly the propositions relating pollution prevention practices to cost reduction, profitability, and path dependency. Such analyses should also facilitate a more detailed understanding of industry differences with regard to the natural resource-based view (e.g. manufacturing versus service firms, or consumer versus industrial products).

Thus, there is much work to be done examining the relationship among environmental management practices and indicators of financial and market performance. In this author's view, the natural resource-based view of the firm opens a whole new area of inquiry and suggests many productive avenues for research over the next decade.

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FIGURE 1
Green Production

FIGURE 2
A Natural Resource-Based View of the Firm

FIGURE 3

Sustainable Business Portfolio

FIGURE 4
Environment and Competitive Advantage

<u>Source of Advantage</u>	<u>Strategy</u>		
	Pollution Prevention	Product Stewardship	Sustainable Development
Causal Ambiguity	+++	++	+
Social Complexity	+	+++	++
Path Dependency	+	++	+++

+++= high ++= medium += low

FIGURE 5
Stages of Competitive Advantage

FIGURE 6
Environment and Performance

FIGURE 7
Implementing the Natural Resource-Based View

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