

External factors influencing the environmental performance of South African firms

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THIS ARTICLE REVIEWS THE EXTERNAL factors that influence environmental performance of companies in South Africa, drawing on international and local literature. After considering factors within the natural, social, economic and institutional environments, the article develops a typology for predicting the environmental performance of the business sector. This model is then applied to the South African context to identify positive and negative influences on environmental behaviour. The analysis indicates that, of the 18 factors identified, only five are currently promoting good performance. A further seven factors, however, are likely to show gradual improvement as a result of government policies in the economic, social and environmental arenas. Issues raised for consideration by policy makers include: the integration of financial, industrial and education policies with environmental initiatives; the pricing of minerals, electricity, and disposal of waste into the air and sea; and improved enforcement of environmental legislation.

Although no empirical study has been carried out to determine the effect on the environment of South Africa's business sector, commentators generally agree that its performance is poor and its consequences undesirable. For example, Bethlehem and Goldblatt¹ noted that levels of waste production were very high, that there was no widespread use of clean technology, and that there were few facilities for waste exchange and recycling. These concerns have yet to be substantively addressed. Furthermore, the minister of environmental affairs and tourism recently commented on the poor environmental track record of industry in his budget speech, stating: 'It is simply unacceptable to allow the air that we breathe to become more and more polluted and our streets and countryside to become filthier. There is rampant lawlessness among industrial polluters and a "don't care" attitude amongst many citizens. The rot must stop'.

Government policies to reduce industrial pollution have historically empha-

sized a regulatory approach with, for example, permits being required for the discharge of waste into the air or water. This approach has often proved ineffective due to inadequate laws and poor enforcement capacity.² More recent pollution policy, as encapsulated in the white paper on integrated pollution and waste management, includes proposals for revised legislation, economic incentives, education and capacity building, public participation and increased availability of information.² The policy, which has yet to be implemented, provides a broader context for addressing pollution and waste production. Effectively implementing the policy requires understanding the effect companies have on the environment.

Many factors potentially influence the environmental performance of firms, both positively and negatively. These may be located within a firm, related to how a company is structured and operates, or within its external environment. Public policy usually focuses on the external environment because it is more amenable to policy intervention. This article seeks to identify the external factors that currently influence the environmental performance of firms operating in South Africa, drawing from international and local literature (see Table 1 for a list of local surveys). Such external influences have been conceptually grouped into four categories for the purpose of the review: natural, social, economic, and institutional. After considering each factor in turn, I propose a typology for predicting the environmental performance of a business sector in a specific locality in a South African context. The article concludes with policy implications of the analysis.

Natural environment

Surprisingly, no literature has been identified that explicitly addresses the natural environment as a factor that potentially influences the environmental performance of firms. Yet one would expect scarcity of natural resources and environmental services, if reflected in market price, to promote their efficient use.

South Africa is well endowed with min-

erals, with the largest known deposits in the world of gold, chromium, manganese, vanadium, andalusite and the platinum-group metals and considerable reserves of other metals.³ The country also has large coal deposits, which rank fourth in the world and provide over 80% of South Africa's commercial primary energy needs.^{3,4} There is currently a surplus of electricity generating capacity, which is primarily coal-based, with demand projected to exceed supply by only 2007.⁵

By contrast, South Africa is a water-scarce country and it is anticipated that, if current water usage patterns continue, remaining surface water resources available to meet national needs in the most important catchments will be adequate only until 2030.⁶ This shortage of fresh water means that, as well as limited water supply for firms, there is reduced capacity for the disposal of liquid waste and its assimilation by rivers. In terms of solid waste disposal, all nine provinces are predicted to have an overall shortfall in waste disposal capacity in the next five years.⁶

Social environment

Society can influence the environmental performance of firms through the imposition of social norms, the development of consumer preferences, the pressure organized communities place on firms to clean up, and the level of education and skill of workers, which conditions their ability to contribute to environmental management initiatives.

Social norms

Social norms define what is generally considered by society to be acceptable behaviour by a company. Through helping to define the attitudes to the environment that people take into the workplace, social pressures also help to define a firm's 'corporate culture'. South Africans appear to place considerable importance on the natural environment, which would suggest that they should have high expectations of environmental performance. For example, a 1995 survey of 678 people in KwaZulu-Natal, of whom 96% were black, asked respondents to prioritize development goals. A 'healthy environment' was ranked 'very important' by 68% of those surveyed and came fifth in order of importance, behind only education and training, security, clean water, and basic health care. 'Protect environment for future generations' was identified as 'very important' by 59% of the respondents and came eleventh in order of importance, ahead of such issues as reducing corruption, sanitation, quality

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Table 1. South African surveys relevant to the environmental performance of companies.

| Author | Date | Sample | Subject matter |
|--|-----------|---|-------------------------------|
| Jeppeson ⁴⁴ | 1999 | 202 small, medium and micro firms | Environmental performance |
| Hatch and Hounsom ⁴³ | 1997/1998 | 140 firms | Environmental competitiveness |
| De Villiers and Visser ⁴⁵ | 1997/1998 | 514 listed companies and 10 public entities | Environmental reporting |
| KPMG and Industrial Environmental Forum ⁶ | 1997 | 200 top companies | Environmental performance |
| Craffert, Fourie and Hoogervorst ¹⁵ | 1997 | 116 large companies | Environmental training |
| Foundation for Research Development and Industrial Strategy Project ⁹ | 1997 | 244 manufacturing firms | Innovation |
| De Villiers ³⁰ | 1996 | 517 auditors, managers and users | Environmental reporting |

of housing and literacy.⁷

A study of thirty firms in the United Kingdom (U.K. survey) found that, in some companies, the strong personal commitment of the chief executive officer and other senior managers to environmental 'stewardship' was a significant factor in the environmental orientation of the firm. The increasing environmental awareness and concern for the company's reputation by employees was also a significant factor, in some cases, in the 'greening' of firms.⁸ A 1997 study of 200 top companies in South Africa (KPMG-IEF survey) found that environmental awareness was high among senior management, who can provide leadership for the 'greening' of a company (92% of respondents reported either a high or medium awareness). However, this awareness decreased at middle management level and was least amongst non-managerial staff, among whom just over half (56%) had low awareness.⁹

Consumer preferences

Consumer preferences influence the marketability of different kinds of goods. In many developed countries, there is a growing number of 'green consumers' who are willing to pay a premium for 'environmentally friendly' products. A range of eco-labelling schemes, that verify environmental claims for products and services, have supported this trend.¹⁰

Green consumerism has implications for all stages of the supply chain, with a product's environmental impact often being evaluated through its entire life cycle. As a result, firms particularly conscious of their environmental reputation may be unwilling to deal with environmentally unfriendly firms. Just over half of the respondents in the U.K. study identified pressure from suppliers and customers as an important reason for investment in cleaner production.⁸

No studies have been conducted which describe South African consumer preferences for environmentally friendly goods. Given the low incomes of the

majority of the population, it seems unlikely that there is a large body of 'green consumers'. However, South African exporters are subject to the demands of consumers in other countries. Such companies are likely to be subjected, at least indirectly, to consumer pressure through requests from customers for reports on environmental performance.

Community pressure

Community pressure has been identified as a significant force motivating firms to improve their environmental performance.¹¹ This is particularly the case where firms require permission from public bodies for expansion or new developments, and where its granting can be significantly delayed or obstructed by hostile residents.⁸ The level of community pressure appears to increase with community income and education.^{12,13} To be effective, however, community pressure may need to be supported by formal regulation.¹⁴

The potential impact of community pressure on firms in South Africa is lessened by the low income and educational levels of many people living adjacent to industrial areas as a result of apartheid planning. The educational levels of these communities may gradually improve, however, as a result of the post-apartheid government's attempts to widen educational opportunities.

From the perspective of industry, in the KPMG-IEF survey public opinion was identified by almost two-thirds of respondents as a significant inducement for greater environmental responsibility by firms, second only to government policy. However, only 7% of respondents in the survey admitted that the public perception of their firm's environmental performance was generally negative.⁹ In a 1997 study of 116 large South African companies (HSRC survey), the community was identified by just under half (46%) of the respondents as providing the main pressure to increase environmental training in the future.¹⁵

Workers' educational and skill levels

Workers' educational and skill levels also appear to have an effect on the environmental performance of companies.¹⁴ This may be partly because the level of technical skills within a firm determines how quickly new and cleaner technologies can be adopted.¹⁶ In addition, effective environmental management requires process workers, engineers and front-line managers to be able to apply their knowledge to environmental management issues.⁸

South Africa has a poorly trained workforce with a mean educational level of only 7.1 years. This can be compared to the 60% or more of the working-age population with more than upper secondary education or a vocational qualification in many OECD countries. In addition, firms in South Africa spend on average only 1% of their payroll on training, compared with between 4% and 7% for OECD countries.¹⁷ In the HSRC survey, however, over half the respondents (56%) reported providing environmental training.¹⁶

Government is endeavouring to redress the lack of worker training with the implementation of the Skills Development Levies Act (No. 9 of 1999), which requires employers to pay for additional on-the-job training.

Labour relations in South Africa are generally adversarial, with lack of trust on the shop floor and little evidence of management and labour working together in a cooperative or innovative manner, especially at the plant or enterprise level. This reflects the rigid and hierarchical manner in which many firms are organized,¹⁷ and is unlikely to support employees taking responsibility for improving their firm's environmental performance. Recent research has indicated that the 'Fordist' forms of management entrenched in South Africa have created a 'silo' mentality, where there is poor understanding of how one function (such as quality or environmental management) affects another.¹⁸

Economic environment

The economic climate can affect a firm's environmental performance by the extent to which the costs of environmental impacts are internalized by the company, through the responsiveness of capital markets to environmental performance, as a result of the structure of markets themselves and the competition this generates, and through the influence of the economy on the firm's profitability and investment patterns.

Internalization of environmental costs

Neo-classical economics has traditionally explained environmental degradation as evidence of a negative externality, where the market system fails to take into account the cost of the pollution.¹⁹ It is expected, therefore, that the environmental performance of a firm improves when its environmental costs are 'internalized' and met by the company itself.

Many environmental costs in South Africa are external to the market system, thus encouraging poor environmental performance. In respect of minerals, it is estimated that about 90% is in private ownership²⁰ with no royalties for their extraction payable to the state.⁵ In addition, the environmental management of mines has often been poor, resulting in severe environmental consequences including significant water and air pollution.²⁰

Eskom, South Africa's principal electricity generator, supplies the world's cheapest electricity to high-load users.²¹ Its prices do not take into account the substantial environmental costs of producing electricity. A recent calculation of the estimated value of class one externalities of electricity production – that is, those that are potentially serious and for which sufficient information is available – totalled in 1994 between 19.5 and 105.3% of Eskom's average tariffs.⁴

The pricing of water in South Africa also does not take into account the full financial costs of water supply, environmental management or environmental degradation. Government policy proposes to increase water tariffs to cover the full financial cost of supplying water, including the cost of capital, and to charge water users for the expense of ecological management of catchments. In addition, a charge may be adopted to promote equitable and efficient allocation in water-stressed areas.²²

Waste disposal facilities in South Africa are generally of a low standard, treatment facilities are the exception rather than the rule, and very few sites are contained or have leachate systems. This has resulted

in 'under-priced' waste disposal services and high environmental costs.²³ Government is aiming to have all landfill sites registered and operated in agreement with minimum requirements by 2005.²⁴ Waste disposal costs to firms are likely to increase as more expensive landfill management systems are put in place.

There is no 'environmental' charge for waste disposal into fresh water, although industries discharging into municipal treatment works must bear the cost of treatment. The Department of Water Affairs and Forestry is developing a pricing policy for the discharge of waste into water. This will adopt a 'polluter pays' philosophy and include an 'environmental' charge.²⁴ There is no 'environmental' charge for dumping waste into the air or into the marine environment, and there does not appear to be any government proposal to introduce such charges.^{25,26}

Capital markets

A less well-researched aspect of economic theory is the impact of capital markets on the environmental performance of firms. These markets affect the availability of capital and also the way in which a firm's current performance and future potential are implicitly measured. 'Capital markets may be one of the most important factors conditioning corporate behaviour...' (ref. 10, p. 54). The literature in this area focuses on two factors: the impact of capital markets on a firm's priorities, and the response of capital markets to the environmental performance of firms.

The market value of a company's stock is largely determined by its short-term earnings and dividend prospects.¹⁰ Management, therefore, concentrates on short-term profitability rather than on long-term potential,²⁷ making it difficult to obtain funding for investment in environmental improvements.⁸ Capital markets appear also to place a value on a firm's environmental performance, with its market value generally declining when adverse news about the firm is announced,²⁸ and management's environmental effort being linked to the public trading of the company's shares.¹⁴

The University of Cape Town-based Industrial Strategy Project investigated the six large business conglomerates that dominate the South African capital markets and which together controlled 86% of the shares on the Johannesburg Stock Exchange in 1992.¹⁷ The project's findings, which have environmental implications, are set out below:

- Industrial expansion has been funded through internal earnings and share

capital rather than by significant debt financing, so that banks have not played a major role in their financing and therefore in scrutinizing environmental risks.

- Through extensive use of a pyramid of holding companies, a small group of shareholders has been able to raise share capital for expansion without relinquishing control. South African firms are, therefore, not subjected to market accountability, including environmental accountability, through the influence of a broad range of shareholders.
 - Shareholders are 'strong and patient' in the sense that, because of their large shareholdings, they are unable to relinquish their holdings without impacting significantly on share values. As a result, a firm's share price is less likely to be influenced by environmental performance or bad environmental news (such as a prosecution or disaster).
 - The performance of subsidiaries is evaluated in relation to narrow financial criteria. This makes it difficult for subsidiaries to justify large environmental expenditures, where benefits such as improving the firm's image and developing good public relations, may be more intangible in the short term.
 - The conglomerate controls the access by subsidiaries to capital. This means that subsidiaries are unable to obtain direct access to capital markets and other independent sources of finance. In addition, the conglomerate determines the proportion of earnings that a subsidiary can retain for reinvestment. Subsidiaries are required to 'compete for funds in an 'internal' capital market, dominated by 'opaque logic' (ref. 17, p.162). These factors make it difficult for a subsidiary to obtain capital for significant environmental investments. It also means that the subsidiary is not accountable to external capital markets that may take environmental performance into account when determining share value.
 - The investment behaviour of conglomerates is extremely risk-averse. This also makes it less likely that a subsidiary will obtain finance for environmental investments, such as cleaner production technologies, which may require substantive changes to production processes and be relatively untested.
- The above conclusions suggest that many firms in South Africa are relatively immune to pressures that capital markets may place on environmental performance. They also help to explain the reluctance of many South African firms to make substantial investments that are to

the benefit of the environment.

In a 1997 study of innovation patterns within the South African manufacturing sector, lack of appropriate sources of finance was identified as the main barrier to innovation, followed by the pay-back period of the innovation being too long.²⁹

A 1996 South African study on users of company reports found low awareness among auditors, accountants and users of financial statements of the potential financial impact of environmental issues on firms. However, almost two-thirds of the respondents indicated that environmental information would influence their decisions about companies, even if the information did not indicate financial implications.³⁰ This implies that the influence of capital markets on the environmental performance of firms, particularly those outside the conglomerate network, may increase in the future.

Market structure

It has been argued that a highly competitive market will discourage good environmental performance. This is because competition encourages firms to cut costs and to embark on unethical behaviour in order to stay ahead of rivals. In addition, high levels of competition can encourage firms to embark on isolationist and independent strategies which fail to realize the benefits of collaboration on environmental issues, such as information and cost sharing.^{31,32}

It is also argued that competitive markets may provide a greater incentive for firms to differentiate products on the basis of environmental quality.³² In addition, it is thought that innovation and the adoption of new technologies are often driven by competition. Firms innovate early to gain a competitive edge or else do so later in order to survive.³³ Although the evidence for the effect of market competitiveness on environmental performance is uncertain, for the purposes of this analysis it is assumed to have a positive impact.

South African industry has historically been highly concentrated with poor levels of competition, particularly in the chemicals, non-metallic minerals, iron and steel, and motor vehicle sectors.³⁴ During the 1990s, however, government reduced tariff protection, with the average import tariff dropping from more than 30% in 1990 to just over 14% in 1998. This has increased the level of competition from imports and stimulated some increase in the levels of productivity in manufacturing, which may have environmental benefits.

Economic climate

The general economic climate is thought to have an effect on innovation, the adoption of new technologies and the environmental performance of firms. For example, slow economic growth provides few opportunities for expansion and investment in new and cleaner technologies, depressed profits make new investment difficult, and high rates of inflation can create uncertainty about paybacks of investments and increase risk.^{8,35,36}

A poor economic climate can also lead to significant restructuring in firms as they struggle to survive in the more competitive environment, with management attention being diverted away from long-term strategic issues such as environmental management towards short-term survival. The restructuring of companies can lead to the installation of new managers who are not abreast of environmental initiatives. Leaner structures can also result in less staff time to devote to complex environmental assessments.⁸

Although there has been a recent downturn in South Africa's economic climate, it has been generally positive for environmental investment. After a recession in the early 1990s, the economic climate improved, with an annual growth in GDP of about 3% for the years 1995 to 1997. In response to the 'Asian Crisis', however, the economy went into recession in the second half of 1998. Real GDP growth for 1999 was only 1% but, according to the Department of Finance, was expected to rise to 3.5% for 2000 and to remain at this level for several years.

This recession has been accompanied by a decline in exports, which had increased at an average real rate of 7.4% from 1994 to 1999. Exports are expected to recover only gradually over the next few years. Therefore, the effect of environmental demands of international markets on South African firms is likely to increase only slowly.

Institutional environment

The institutional setting strongly affects the environmental performance of firms, particularly through the promulgation and enforcement of environmental regulations and the availability of information on company performance.

Environmental regulation

The literature identifies environmental regulation as a strong motivating force behind the improved environmental performance of firms.^{8,16,37,39} The U.K. survey reported the often critical role that regulation can play in providing environmental

managers with leverage to persuade others within the firm to make environmental investments, especially in a recession or when there are other priorities. In addition, the introduction of regulatory requirements often prompted firms to carry out an environmental audit. This gave the company a better understanding of the environmental impacts of their manufacturing processes and of potential cost savings that could be achieved while improving performance. This information, in turn, engendered support from top management for environmental investments.

The regular enforcement of environmental regulation also appears to be important in the promotion of cleaner production. For example, a Mexican study found that plants that experienced regulatory inspections and enforcement were significantly cleaner than their counterparts that did not.¹⁴

Environmental regulation in South Africa has been characterized by a multiplicity of fragmented and uncoordinated laws, poorly resourced environmental management institutions and weak enforcement, particularly in regard to industrial pollution. For example, since the Atmospheric Pollution Prevention Act 45 of 1965 was introduced, air pollution control staff have never numbered more than six, whereas the number of industries to be controlled rose from 700 in 1970 to 2000 in 1995.⁴¹

In an endeavour to address some of these problems, there have been reviews of environmental policy since the transition to democratic government in 1994. New national policies have been developed in the areas of agriculture, forestry, land, water, marine fisheries, environmental management, biological diversity, minerals and mining, energy, coastal management, and integrated pollution and waste management.⁴² New legislation in the form of the National Environmental Management Act 107 of 1998, the National Water Act 36 of 1998 and the National Forests Act 84 of 1998 have been passed by Parliament, and regulations under the Environment Conservation Act 73 of 1989 now require an environmental impact assessment procedure for specified activities. These policies are currently in the process of being implemented. Firms will soon be faced with tougher environmental regulation, although it is not clear whether levels of enforcement will be significantly improved. A notable gap in recent legislative reforms is the control of air pollution, which is still regulated under a law over 30 years old.

Table 2. Typology for the environmental performance of the business sector in a specific locality.

| Environment | Clean-dirty continuum | |
|---------------|---|---|
| | Clean | Dirty |
| Natural | Shortage of key natural resources Limited assimilative capacity relative to size of business sector | Abundant natural resources Ample assimilative capacity relative to size of business sector |
| Social | High environmental consumer awareness and willingness to pay High income and education levels of surrounding communities | Poor environmental consumer awareness and willingness to pay Low income and education levels of surrounding communities |
| Economic | Internalization of firms' environmental costs Highly competitive market Positive economic climate | Externalization of firms' environmental costs Concentrated market Negative economic climate |
| Institutional | Strict environmental regulation High levels of enforcement Publicly available information on firms' environmental performance | Lax environmental regulation Poor levels of enforcement No publicly available information on firms' environmental performance |

In the KPMG-IEF survey government policy and legislation was identified by 83% of respondents as the most significant pressure for greater environmental responsibility.⁹ However, in a 1998 survey of 140 South African firms (CSIR survey), only just over a quarter of respondents reported that environmental legislation had influenced their business practices, suggesting that actual changes caused by legislation may have been minor. Respondents reported that the major effect of legislation was the reduction in emissions and effluent (35%), followed by a decline in the use of hazardous and toxic substances (17%), increased control over the use of waste (14%) and decrease in raw material use through recycling (7%).⁴³

Legislation's low impact may have been a result of ignorance. A 1999 survey of 202 South African small, medium and micro-size firms revealed that respondents had a poor awareness of environmental laws (between 30 and 50% for specific pieces of legislation), with the exception of the Occupational Health and Safety Act (No. 85 of 1993), which had an 84% awareness level.⁴⁴

The CSIR survey also found that, if future environmental legislation was introduced, the majority of respondents (71%) indicated that they would reduce impacts to meet requirements, just under a third would comply beyond legislated requirements, and a small proportion (5%) would ignore them because government is unable to enforce environmental legislation.⁴³

Availability of information

An important role for government, in addition to regulation, is to mobilize the economic (market) and social (community) forces that put pressure on firms to clean up. Government can achieve this through a range of actions including making accurate information about firms' environmental performance publicly available.³

In the past, information on the environmental performance of local firms was withheld from the public on the basis of commercial confidentiality. This situation appears likely to change in light of the recently promulgated Promotion of Access to Information Act (No. 2 of 2000), which provides people with the right to public records as well as to private records when required for exercising legal access such as provided for by section 24 of the Constitution of South Africa Act (No. 108 of 1996). However, information may still be withheld under this Act on the grounds that it may do harm to commercial or financial interests [s36(1) and s64(1)], and this may be used to argue for denying information on waste discharges.

In a separate initiative, the recently promulgated National Waste Management Strategy proposes to make information more readily available through the establishment of a waste information system. All generators, transporters and disposers of waste will be required to register with a waste information system management agency and report waste-specific information on an annual basis. It is intended that the information collected will be made available to stakeholders.²⁴

Another way of making information on environmental performance available to the public is through corporate environmental reporting. Such reporting is not mandatory in South Africa, but a growing number of firms are making some disclosure on environmental issues. A study of the 1997 annual reports of 514 listed companies (being 97% of those listed on the Johannesburg Stock Exchange), and 10 public entities, found that just over a third made some disclosure of information regarding the natural environment, up from 23% the previous year.⁴⁵ Environmental reporting is increasing slowly; a similar study of 1998 annual reports identified 38% of companies making some en-

vironmental disclosure, an increase of only 4% from the previous year and with no increase found for the top 50 companies.⁴⁶

Although many South African firms refer to environmental performance in their annual reports, they appear reluctant to provide specifics about their actual impacts or compliance. For example, in 1997 only 6% mentioned any negative aspects of environmental activities, 10% set measurable targets, 11% disclosed environmental objectives concerning emissions and only 12% mentioned compliance with a legal standard.⁴⁷

Typology of factors for the environmental performance of the business sector

It is possible to identify a range of factors in the natural, social, economic and institutional environments that may typify a relatively 'clean' or 'dirty' business sector in a particular locality as shown in Table 2. By mapping the location of external factors along the 'clean-dirty' continuum, it should be possible to predict the overall environmental performance of the firms operating in a locality. Such mapping could also help to identify factors on the 'dirty' end of the scale, which could be the focus of public policy initiatives to improve environmental quality.

The positive or negative influences of these factors on the environmental performance of South African firms have been captured in Table 3. This analysis indicates that of the 18 factors identified, only five have a positive impact and are currently promoting good environmental performance. These include three factors in the natural environment, which are essentially given, and the positive influence of export markets and the economic climate. Although this analysis is not able to identify the relative strength of each factor, it does predict that, overall, the environmental performance of firms in South Africa is likely to be poor.

Table 3. Typology of factors influencing the environmental performance of firms in South Africa.

| Environment | Predictive factors | Direction of influence | | |
|---------------|--|------------------------|------------------------|-----------------------|
| | | Positive | Negative but improving | Negative |
| Natural | Availability of key natural resources | | | X X |
| | Assimilative capacity relative to size of business sector | X X X | | |
| Social | Environmental consumer awareness and willingness to pay | X | | X |
| | Income and education of surrounding communities Worker education and skills | | X X | |
| Economic | Internalization of environmental costs | | | X X X X X |
| | Competitiveness of markets Economic climate | X | | |
| Institutional | Environmental regulation Enforcement | | X | X |
| | Public availability of information on firms' environmental performance | | X | |

The analysis nevertheless indicates that a number of negative factors are likely to show gradual improvement (identified in Table 3 as 'negative but improving') as a result of a wide range of government policies in the economic, social and environmental arenas. Improvements are probable in the income and education of communities, the level of education and skills of workers, internalization of some water and solid waste disposal environmental costs, increase in the competitiveness of markets, greater environmental regulation and more publicly available information on environmental performance. Although the environmental impact of firms may therefore improve in the coming decade, the pricing of minerals, energy and waste disposal into the air and sea, and the enforcement of legislation, are areas which are not adequately addressed by current policy.

Conclusions

The above analysis has identified three areas of relevance to policy makers. First, policies potentially having a positive impact on companies' environmental performance are being developed by several government departments with no direct environmental mandate, including the Ministry of Finance, and the departments of Trade and Industry, Education and Labour. Environmental policymakers should consider ensuring that their economic, industrial and education policies include aspects that are likely to improve the environmental performance of companies and that these are integrated with policy initiatives.

Second, the pricing of the extraction of

minerals, supply of electricity and disposal of waste into the air and sea needs to be reviewed to ensure that environmental costs are internalized to promote the desired environmental performance of firms, or that other compensatory mechanisms are put in place.

Lastly, consideration should be given to greater enforcement of existing and proposed environmental regulation as this has been identified as a significant factor in their effect on the environment.

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National Science, Engineering and Technology Week 2001 message

R.M. Adam

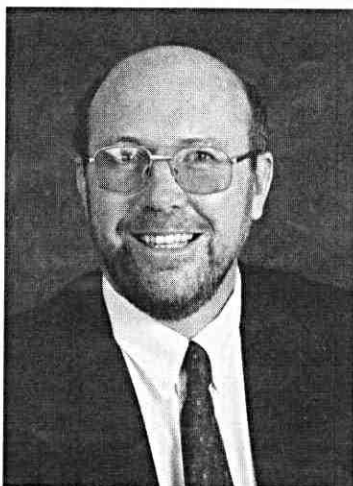
THE MANDATE OF THE DEPARTMENT OF Arts, Culture, Science and Technology includes the promotion of science, engineering and technology in our country. It is therefore a great pleasure to announce the National SET Week as one of our many activities to engage society as a whole in our science and technology endeavours.

The preparation of this message coincides with the release of the report of the Third International Mathematics and Science Study-Repeat (TIMSS-R), which is one of the most extensive and detailed studies on the performance of grade 8 students in mathematics and science in 38 countries. South Africa's performance in this study says volumes about the work that lies ahead of us in terms of reversing the legacy of an inferior education system, especially in maths and science.

We are committed to improving the performance of our country to international level in science and technology. The financial investments and the re-engineering endeavours that we have made

within our department bear testimony to this commitment. In the field of research, investments are now at the level where the average funding per researcher in South Africa is comparable with the equivalent figure for many developed countries. In fact, at approximately \$104 000, all-inclusive, it is higher than Australia's figure of \$98 000. Our problem is that we have too few researchers (only 0.72 per 1000 members of the labour force as compared with Australia's 6.4 and an OECD average of 5.5). Among the causes of this small proportion are low pass rates at matric level and low enrolments at universities and technikons in maths and science.

The South African White Paper on Science and Technology, *Preparing for the*



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21st Century, provides the policy framework that guides our operations, and it highlights the public understanding of science, engineering and technology (PUSET) as a necessary step towards social and economic development. The department therefore established the Directorate of Science and Society, mandated to implement programmes on PUSET.

Cabinet declared 1998 as the Year of Science and Technology, which provided a platform for celebrating science, engineering and technology by staging a variety of activities nationwide to generate public interest. The initiative had the broader perspective of launching the programme for the public understanding of science, engineering and technology. This project generated tremendous excitement throughout South Africa.

To sustain public awareness and appreciation of SET, we subsequently introduced the National Science, Engineering and Technology (SET) Week, which this year runs from 5–10 March. It is our fervent wish that, through National SET Week, we will see scientists interacting more with the public, thereby eradicating some of the myths about science, influencing the public's perception of what scientists do, and opening up the wonderful world of science and technology to millions of our people.

See inside front cover for details of SET Week 2001.

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