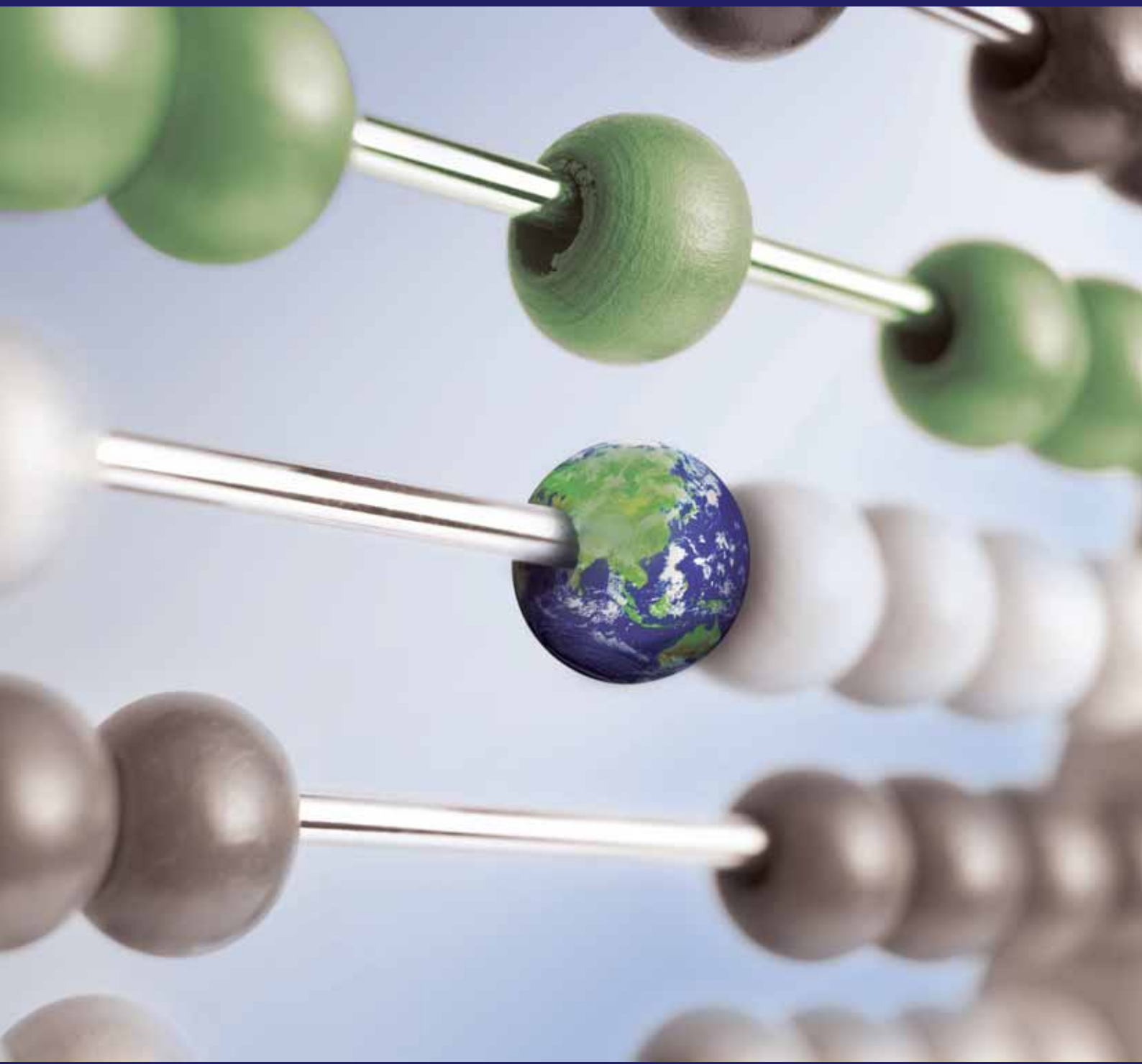
Universal Ownership

Why environmental externalities matter to institutional investors



UNEP Finance Initiative
Innovative financing for sustainability

PRI

The PRI is an investor initiative in partnership with UNEP Finance Initiative and the UN Global Compact

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Message from the Chairs of PRI and UNEP Finance Initiative

Many indicators regarding the health of the world's environment remain firmly in the red. Trends such as climate change, water scarcity, air pollution, biodiversity loss and ecosystem degradation all continue to threaten our finite stock of natural capital and the ability of our economy to provide sustainable growth and prosperity for all.

A great deal of this environmental damage is caused by the way we do business. If we are to create a truly sustainable global economy, then we must change our economic models so that business can become part of the solution, not part of the problem.

An increasing number of investors have begun to factor environmental, social and governance issues into their decision-making. This report helps investors measure the unaccounted costs of business activities by putting a price on natural resources that power business but rarely show up on corporate balance sheets.

This study provides an important rationale for action by large institutional investors that have a financial interest in the wellbeing of the economy as a whole. By exercising ownership rights and through constructive dialogue with companies and public policy makers, these "Universal Owners" can encourage the protection of natural capital needed to maintain the economy and investment returns over the long term. Many Universal Owners are signatories to the Principles for Responsible Investment (PRI), and we hope they continue to exercise leadership and responsible ownership by acting on the ideas and recommendations in this report.

This research also brings a responsible investor perspective to United Nations Environment Programme's (UNEP's) Green Economy Initiative, particularly en route to the 2012 UN Conference on Sustainable Development – also known as "Rio+20". Indeed this work represents an opportunity to take another step in the transformational process to develop a sustainable global economy.

Our thanks go to the team of authors led by Trucost who have put together this analysis. We hope this report can contribute to making economics part of the solution, for it is our shared responsibility to safeguard our natural assets for the benefit of our generation and future generations.

Yours faithfully

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Findings and recommendations

Large institutional investors are, in effect, "Universal Owners", as they often have highly-diversified and long-term portfolios that are representative of global capital markets. Their portfolios are inevitably exposed to growing and widespread costs from environmental damage caused by companies. They can positively influence the way business is conducted in order to reduce externalities and minimise their overall exposure to these costs. Long-term economic wellbeing and the interests of beneficiaries are at stake. Institutional investors can, and should, act collectively to reduce financial risk from environmental impacts.

US$ 6.6 trillion

The estimated annual environmental costs from global human activity equating to 11% of global GDP in 2008.

US$ 2.15 trillion

The cost of environmental damage caused by the world's 3,000 largest publicly-listed companies in 2008.

>50%

The proportion of company earnings that could be at risk from environmental costs in an equity portfolio weighted according to the MSCI All Country World Index.

Business use of environmental goods and services generates environmental damage that carries significant costs. These are largely external to financial accounts. Without adequate information about environmental externalities, markets have failed to account accurately for the dependence of businesses on ecosystem services such as a stable climate and access to freshwater. See page 6.

Environmental costs are becoming increasingly financially material. Annual environmental costs from global human activity amounted to US$ 6.6 trillion in 2008, equivalent to 11% of GDP. Under a "business-as-usual" scenario, annual global environmental costs are projected to reach US$ 28.6 trillion, equivalent to 18% of GDP in 2050.[1] See page 17.

Reducing greenhouse gas (GHG) emissions, water use and air pollution would have the greatest effect on reducing environmental costs. GHG emissions and resulting climate change impacts account for a large and growing share of environmental costs – rising from 69% (US$ 4.5 trillion) to 73% of externalities between 2008 and 2050.[2] The expected rise in costs for escalating GHG emissions and climate change impacts results in projected external costs of US$ 21 trillion in 2050. Water abstraction and air pollution are the other main contributors to environmental costs. See page 21.

Medium- to large-sized publicly listed companies cause over one-third (35%) of global externalities annually. The largest 3,000 public companies caused over US$ 2.15 trillion of global environmental costs in 2008, which equates to nearly 7% of their combined revenues. Other actors in the global economy, such as small and private companies, governments, other organisations and individuals contribute the remaining US$ 4.45 trillion of external costs. See page 24.

Five sectors account for around 60% of all externalities from the largest 3,000 listed companies. Reducing GHG emissions in the Electricity, Oil & Gas Producers, Industrial Metals & Mining and Construction & Materials sectors would have the greatest effect on reducing carbon costs. Reducing water use from the Food Producers and Electricity sectors could also lower environmental costs significantly. See page 27.

Most large, diversified equity funds invest in many companies with significant environmental impacts that undermine the environment's ability to support the economy. In a hypothetical equity portfolio weighted according to the MSCI All Country World Index, externalities could equate to more than half of the companies' combined earnings before interest, taxation, depreciation and amortisation (EBITDA), weighted according to Index constituents. See page 28.

External costs caused by companies can reduce returns to investors. Environmental costs can affect portfolio values by reducing future cash flows for companies held in portfolios and lowering future dividends. For a diversified investor, environmental costs are unavoidable as they come back into the portfolio as insurance premiums, taxes, inflated input prices and the physical cost associated with disasters. One company's externalities can damage the profitability of other portfolio companies, adversely affecting other investments, and hence overall market return. See page 29.

The costs of addressing environmental damage after it has occurred are usually higher than the costs of preventing pollution or using resources in a more sustainable way.[3,4] It is in the interests of Universal Owners such as large institutional investors – with stakes in an economy-wide cross-section of publicly traded securities as well as property and other non-listed asset classes – to reduce externalities. It is in the financial interest of fund beneficiaries that Universal Owners address the environmental impacts of investments to reduce exposure to externalities and protect long-term returns. See page 34.

1.Trucost applied rising external costs to projected "flows" of resource use, waste and pollutants to estimate the size of future annual externalities, if business continues as usual with regionally oriented low per-capita economic growth, rising population levels and slow, fragmented technological development (Intergovernmental Panel on Climate Change Scenario A2).

2. Trucost applied a carbon price of US$ 85 to each tonne of GHGs emitted in 2008 to calculate global annual external costs as US$ 4.5 trillion. This is based on the social cost of carbon from the Stern Review on the Economics of Climate Change (2006), HM Treasury UK.

3. Jaffe, A.B., Newell, R.G., Stavins, R.N. (2005) A tale of two market failures: Technology and environmental policy, *Ecological Economics*, Vol. 54, Issues 2-3: pp. 164-174.

4. Rayment M. et al. (2009) *The economic benefits of environmental policy*, GHK, Sustainable Europe Research Institute (SERI), Transport & Mobility Leuven, VU University Amsterdam, Institute for Environmental Studies (IVM).

Recommendations and next steps

Institutional investors can collaborate to encourage policymakers and companies to reduce environmental impacts.

Investors can exercise ownership rights and encourage the protection of natural capital needed to maintain the economy and investment returns over the long term. Universal Owners and other investors can take a number of measures to help mitigate externalities:

1. **Evaluate impacts and dependence of investee companies on natural resources.**
2. **Incorporate information on environmental costs and risks into engagement and voting initiatives and seek to reduce environmental impacts of portfolio companies.**
3. **Join other investors and engage collaboratively with companies through platforms such as the PRI Engagement Clearinghouse to address key issues.**
4. **Engage individually or collaboratively with public policymakers and regulators to encourage policies that promote the internalisation of costs and establish clear regulatory frameworks.**
5. **Ask for regular monitoring and reporting from investment managers on how they are addressing fund exposure to risks from environmental costs and engaging with portfolio companies and regulators.**
6. **Encourage rating agencies, sell-side analysts and fund managers to incorporate environmental costs into their analysis.**
7. **Support further research to build capacity and improve understanding of the relationship between corporate externalities, ecosystem goods and services, company financial risk and portfolio returns.**

Introduction

Environmental degradation that damages natural and human capital harms economic productivity. One way to measure business damage to the environment is to price natural resource use, waste and pollution. Damage costs from production are usually not paid in full by the companies generating them and are therefore known as "external costs" or "externalities".

PRI and UNEP FI commissioned Trucost to calculate the current and future estimated monetary value of environmental degradation to provide a basis for large institutional investors, otherwise known as Universal Owners, to address externalities that have the greatest financial implications.

Human activities degrade ecosystems that are vital to economic productivity.[5] Society and the economy are dependent on functioning ecosystem services. Plants, animals, microbes and the physical environment provide "free" inputs such as food and raw materials, pollination and genetic resources. Forests, grasslands, wetlands and marine areas provide life-supporting services such as nutrient cycling, freshwater and climate regulation (see Table 1 on page 5). These ecosystem services have delivered a relatively stable environment over 10,000 years, providing conditions for people to develop organised societies and economies.[6]

Despite the importance of functioning ecosystem services, environmental degradation is an increasing trend. Approximately 60% of recognised ecosystem services have been degraded over the past 50 years.[7] The UN Millennium Ecosystem Assessment highlights climate change and water scarcity as major negative drivers of ecosystem change in the next 40 years,[8] and the impacts of climate change – such as changes in precipitation, temperature, coastal flooding and biodiversity loss – will affect access to water, food and land. Economic growth and an expected increase in the global population by 2050[9] will also add growing pressure to finite, over-exploited resources such as water, fossil fuels, fisheries, timber and minerals in many regions. Over time, these trends could undermine economic output by disrupting the flow of energy, raw materials and ecosystem services that sustain the economy and provide essential goods and services.[10] The scale of human intervention in nature has raised the probability of reaching thresholds and causing irreversible damage to local or global life support systems.[11]

Businesses impose costs on the environment. Businesses contribute to much of this environmental harm. Production that transforms energy and matter (inputs) into products (outputs) causes waste and pollution that can damage ecosystems.[12] As shown in Diagram 1 on page 5, extraction, processing, manufacturing, distribution and disposal of goods are among the activities that can erode natural resources and undermine the ability of ecosystems to absorb waste and pollutants and provide goods and services.[13]

Current economic and business models fail to recognise the value of ecosystem services and the cost of environmental harm. Where the costs of environmental damage, such as pollution, are excluded from the transaction between a buyer and seller, they are largely "external" to a company causing damage and are borne by third parties.[14]

5. World Business Council for Sustainable Development, Meridian Institute and World Resources Institute (2008) The Corporate Ecosystem Services Review: Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change, Version 1.0.

6. Röckstrom, J. et al. (2009) Planetary Boundaries: Exploring the Safe Operating Space for Humanity, Ecology and Society, Vol 14, No. 2, Article 32.

7. World Economic Forum (2010) Global Risks 2010, A Global Risk Network Report.

8. World Resources Institute (2005) Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry.

9. www.un.org/esa/population/publications/wpp2008/pressrelease.pdf, 2 February 2011.

10. OECD (2001) Environmental Strategy for the First Decade of the 21st Century.

11. UN World Commission on Environment and Development (1987) Our Common Future.

12. World Resources Institute (2005) Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry.

13. OECD (2001) Environmental Strategy for the First Decade of the 21st Century.

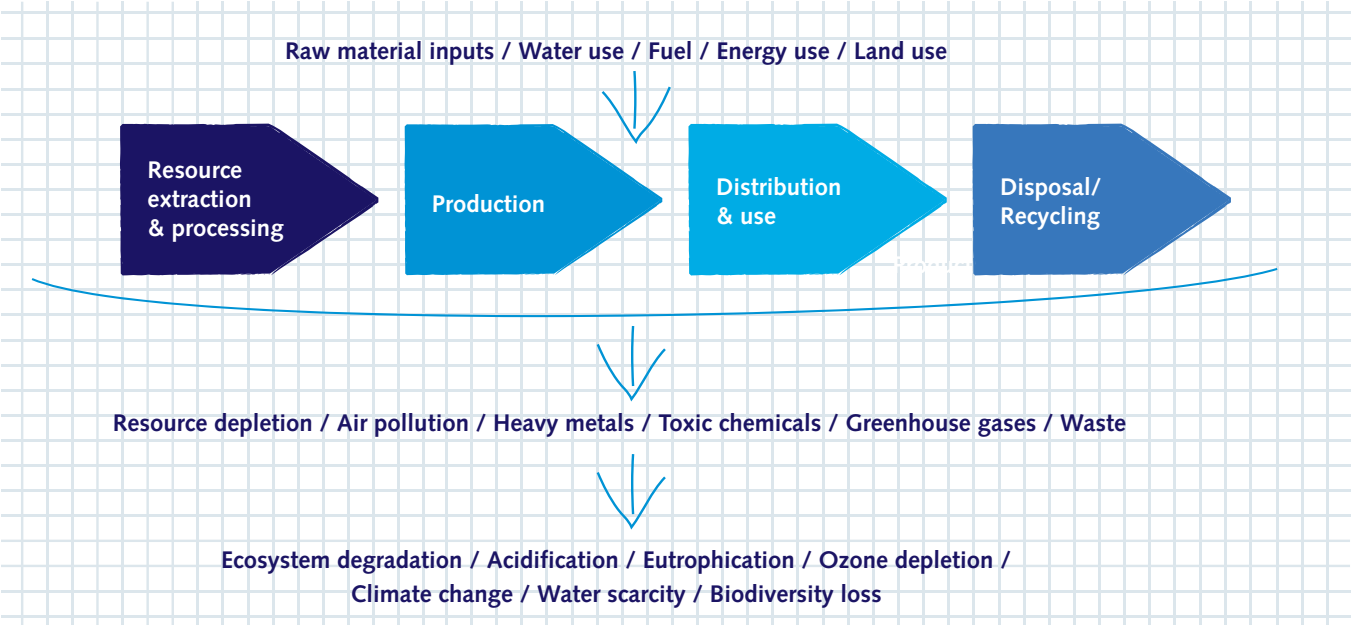
14. Pigou, A.C. (1960) The Economics of Welfare, Fourth edition.

TABLE 1:
Ecosystem services at risk from environmental damages

Ecosystem services include:

- **Provisioning**
  – water, food, fibre, timber, fuel.
- **Regulating**
  – climate, flood protection, erosion, waste processing, air and water quality, pollution control.
- **Cultural**
  – recreational, aesthetic.
- **Supporting**
  – soil formation, photosynthesis, nutrient cycling, carbon sequestration, pollination.

DIAGRAM 1:
Value chain analysis



These "externalities" are not reflected in market prices, which results in the prices of goods and services being too low. For example, burning fossil fuels to produce power increases emissions of greenhouse gases, and changes the climate system's energy balance. However, in most countries the environmental harm caused by greenhouse gas emissions is not factored into electricity prices, and is therefore external. Positive externalities, such as the provision of carbon storage through soil, peatland and forest preservation are also largely excluded from markets. Unless markets start to accurately reflect the economic costs of degradation, future generations will reap fewer benefits from ecosystems.[15]

Universal Owners and externalities

Large institutional investors are the permanent and Universal Owners of private enterprise. Universal Owners typically have diversified investments across asset classes, sectors and geographies with long time horizons.[16] Based on this definition, any large institutional investor with a well-diversified portfolio can be viewed as a Universal Owner.

The Universal Owner hypothesis is based on the idea that there are clear links between the performance of large, diversified investment portfolios and the economy overall. It states, "a portfolio investor benefiting from a company externalising costs might experience a reduction in overall returns due to these externalities adversely affecting other investments in the portfolio, and hence overall market return. For a diversified investor, there is no place to hide from these costs: they come back into the portfolio as taxes, insurance premiums, inflated input prices and the physical cost of disasters." Seitchik (2007)[17]

In theory, Universal Owners recognise that they own a share of the economy and therefore adapt their actions to promote a prosperous, sustainable future.[18]

15. World Resources Institute (2005) Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry.

16. This concept of a Universal Owner differs from the definition by Hawley and Williams (2000), as it does not limit Universal Owners to institutional investors with a passive investment strategy.

17. Seitchik, A. (2007) Climate Change from the Investor's Perspective.

18. Ibid.

CASE STUDY:

BP OIL SPILL HIGHLIGHTS EXPOSURE TO ENVIRONMENTAL RISKS AMONG UNIVERSAL OWNER PORTFOLIOS

The BP oil spill in the Gulf of Mexico in April 2010 shows the importance of Universal Ownership principles.[19] BP has reported liabilities of over US$ 39.9 billion for compensation claims and clean-up. Repercussions include the company's share price falling, a suspension of dividend payments and investors demanding extra yield to hold the company's bonds, driving up borrowing costs.[20] The BP oil spill is an example of the risks of investment concentration: BP typically accounts for around 8% of UK equity holdings by pensions.[21] BP's performance following the disaster would have caused a net portfolio loss of about 2.5% by June 2010.[22] The Norwegian Government Pension Fund Global lost more than € 1 billion (US$ 1.4 billion) on its 1.75% stake in BP.[23] The firm faces claims from stakeholders including US pension funds and more than 400 lawsuits.

The discrepancy between environmental costs on company balance sheets and those paid by others in the economy represents a market failure. Because companies do not measure and deduct off-balance-sheet environmental liabilities from their revenues, profits inaccurately portray the company's actions as positive. The lack of international accounting standards to identify the full financial costs of environmental impacts presents a barrier to managing related financial risks for companies and investors. To correct this market failure, the price mechanism should take into account the full external costs and benefits of production and consumption.

19. MSCI Research Bulletin (June 2010) The BP Oil Spill and ESG.

20. www.bp.com/extendedgenericarticle.do?categoryId=2012968&contentId=7063863 last accessed 2 February 2011.

21. www.timesonline.co.uk/tol/news/uk/article7150177.ece

www.bp.com/extendedgenericarticle.do?categoryId=2012968&contentId=7063863

www.timesonline.co.uk/tol/money/pensions/article7148161.ece last accessed 2 February 2011.

22. MSCI Research Bulletin (June 2010) The BP Oil Spill and ESG.

23. www.responsible-investor.com/home/article/norwegian_global_fund_takes_11bn_hit_on_bp/ last accessed 2 February 2011, Oanda exchange rate 0.82376 as of 18 August 2010.

Externalised environmental costs pose risk to Universal Owners. Universal Owners are often highly diversified, and represent a significant cross-section of publicly-traded stock and debt in the economy.[24,25] The large size of their portfolios makes large short-term changes in asset allocation to avoid sudden or systematic risks impractical, due to high transaction costs.[26] Their portfolios may include passively managed assets, such as equity index trackers, as well as ownership of large chunks of companies, which cannot be sold without damaging investment values. Given their large diversification, returns to institutional investors' portfolios are more closely correlated with returns of capital markets as a whole than to any particular sector. Universal Owners have a clear financial interest in the enduring health of the economy.

Through their diversified holdings, Universal Owners are exposed to externalised environmental costs generated by some companies and ultimately incurred by others. The negative financial effects of environmental damages could reduce the value of funds with broad investments in capital markets over long-term investment horizons. It is in the financial interest of Universal Owners to address environmental impacts of business activities to reduce this exposure.

CASE STUDY:

UNIVERSAL OWNER EXPOSURE TO FINANCIAL CRISES

The 2007 financial crisis starkly exposed bounded rationality and limitations in the efficient market hypothesis. Lack of transparency surrounding subprime mortgage lending debts, structural disequilibrium and conflicts of interest contributed to risk management failures. Markets ignored warnings of excessive liquidity risks until asset values collapsed. Economic agents failed to recognise or model externalities and amplified systemic reactions that unfolded in 2008.[27] As a result, pension funds in developed countries experienced average negative returns of 21%, losing US$ 5.4 trillion. While they regained some investment losses during 2009, the crisis hit pension and reserve funds hardest in countries heavily invested in equities.[28] OECD defined benefit pension plans had average funding deficits estimated at 18% in June 2009.[29] Universal Owners have a role as suppliers of assets to address systemic financial risks and volatility.[30]

There is a risk that the mispricing of securities, which contributed to the financial crisis,[31] could be repeated. Excessive risk-taking in the financial markets reflects asymmetrical information and the principal-agent problem between Universal Owners as principals and asset managers as agents entrusted with the assets of beneficiaries. It is difficult for trustees to ensure asset managers act in the best interests of beneficiaries in the long term while providing incentives for short-term fund performance relative to benchmark indices. Reforms of corporate governance standards and regulatory controls in response to the financial crisis are coinciding with a greater focus on risk management. This could increase awareness of the long-term economic and financial implications of environmental and social sustainability issues, however weakly.

24. For example, US institutional investors held 73% of the 1,000 largest US companies at the end of 2009. The Conference Board (2010) The 2010 Institutional Investment Report, Trends in Asset Allocation and Portfolio Composition, Research Report R-1468-10-RR.

25. PRI signatories collectively represent some US$ 25 trillion in assets, which equates to 10% of the value of capital markets.

26. Chan and Lakonishok (1995); Chordia and Subrahmanyam (2004); Keim and Madhavan (1995).

27. Dwight M.J. (2008) Catastrophe Insurance and Regulatory Reform After the Subprime Mortgage Crisis, Paper prepared for the Irrational Economist: Future Directions in Behavioral Economics and Risk Management.

28. OECD (October 2009) Pension Markets in Focus, Issue 6.

29. http://www.oecd.org/document/39/0,3343,en_2649_34853_43944615_1_1_1_1,00.html last accessed 2 February 2011.

30. Hawley J.P. and Williams A.T. (2003) Shifting Ground: Emerging Global Corporate Governance Standards and the Rise of Fiduciary Capitalism.

31. Thomson Reuters (2008) Valuation Risk: A new standalone risk class, Valuation Risk White paper.

PRI and UNEP FI launched the Universal Owner Project to assess the most material environmental external costs and to help address these costs through collaborative shareholder engagement with companies and policymakers. PRI commissioned Trucost to identify the economic benefits of reducing externalities, assess the impact of externalities on capital markets, and evaluate how externalities could affect a hypothetical diversified portfolio. This is the first study to examine links between the value of ecosystem services, environmental external costs from business activities, the global economy, and risks to capital markets and diversified investors.

The project aims to provide a platform for investor collaboration to address the most significant environmental externalities from companies held in their funds. Action by investors to reduce externalities could have a positive effect on the economy, capital markets and investment returns.

This study on environmental costs is the first in a series of reports that the PRI Initiative plans to commission around externalities. Further research will be conducted into the Universal Ownership theory and wider social and governance issues such as health, education, corruption and food security in the future.

Scope of the study

This report set out to identify:

1. The scale and nature of current and future environmental externalities.
2. How environmental damage poses financial risks to economies, companies and investment funds.
3. Why it is in the interests of Universal Owners to address externalities.
4. What investors can do to address environmental impacts.

Trucost conducted a wide-ranging review of academic literature to identify and prioritise environmental externalities in the global economy. Trucost scanned bibliographies for peer-reviewed publications to collect valuation literature and conducted an extensive internet search. Over 1,000 environmental and ecological economics studies were reviewed to compile a library of external costs.

Findings on the pricing of environmental externalities from each study were summarised to calculate valuations of the external costs of seven major environmental impacts:

- Greenhouse gas (GHG) emissions.
- Emissions of key air pollutants that contribute to acid rain and smog – sulphur dioxide (SOx), nitrogen oxide (NOx) and particulate matter (PM).
- Natural resource use. Due to limited information on external costs associated with use of ecosystem goods and services, Trucost's estimated externality costs for use of natural resources are limited to water, timber and fish. The study incorporates data on the valuation of forest resources from the Valuation Database of the UN Environment Programme initiative on The Economics of Ecosystems and Biodiversity (TEEB).
- Volatile organic compounds (VOCs).
- General waste.
- Heavy metals (mercury).

Data on external costs relate specifically to each type of environmental impact to avoid double counting.

Although actual external costs may vary from estimates, applying a monetary value to environmental impacts is useful:

- To measure the value of marginal changes in natural capital and the loss of or damage to environmental services.
- As a step towards internalising environmental costs.
- To monitor changes in potential risks from externalities.
- To identify sources of the most material externalities – and target action to address the greatest risks to ecosystems.
- To manage and reduce exposure to environmental liabilities.

Incorporating environmental impacts into traditional financial metrics is a vital step towards including the true value of natural capital in decision-making. Quantifiable prices can be applied to environmental goods, as well as to the environmental damages of pollution and resource depletion. Natural capital and ecosystem services can be valued to measure trade-offs between the economic costs of using them, and the benefits of leaving them intact.

Methodology

This discussion paper takes a new approach by relating potential environmental external costs to the economy, capital markets and investors. It quantifies the scale of externalities in proportion to the global economy, the value of listed companies and equity funds. The main sources of environmental externalities from business activities are identified.

To address valuation challenges and compare externalities in a consistent and comparable manner, this study:

- Evaluates the scale of externalities caused by global human activity in 2008 using external costs of marginal changes in resource use, pollution and waste. The price for each tonne of pollutant emitted or resource used represents the cost in annual present day terms. Trucost combined the valuations of external costs for each environmental impact with global quantities of resources used, waste generated or pollutants released, where data for 2008 were available.
- Extrapolates today's damage values into the future to construct a global estimate of externalities between 2008 and 2050. Trucost applied rising external costs to projected "flows" of resource use, waste and pollutants to calculate total annual damages during the 42-year period.

Techniques to evaluate the costs of all environmental externalities are broadly divided into three categories:

- **Revealed preference approaches.** Valuations take account of the market price of goods and services, pricing that reflects the value of environmental amenities, and production functions – the effects of using goods such as fish on future production possibilities. People's preferences are identified by observing economic behaviour and goods traded in the market.
- **Cost-based approaches.** These include costs to replace ecosystem goods and services, expenditure on mitigation or averting damage, and the damage costs avoided by preventing climate change or maintaining ecosystems.
- **Stated preference approaches.** This technique uses surveys to directly measure people's willingness to pay (WTP) to maintain ecosystem services that are not traded.

Costing greenhouse gas emissions

Trucost uses a forward-looking price to calculate the global annual external costs of greenhouse gases emitted in 2008 as US$ 4.5 trillion. This represents the present day value of future climate change impacts and is based on the social cost of carbon from the Stern Review on the Economics of Climate Change (2006).[32] The Stern Review models the cost of emissions over 200 years based on likely climate change impacts, if business continues as usual with low per capita economic growth, rising population levels and slow, fragmented technological development, based on projections in an "A2" scenario by the Intergovernmental Panel on Climate Change.[33]

Estimates of the future economic damage caused by the flow of greenhouse gas (GHG) emissions are translated into a marginal damage cost per tonne of carbon dioxide equivalent emissions (CO_2e) in 2008. The Stern Review's social cost of carbon uses an implicit 1.4% discount rate to calculate the present day value of future climate change impacts.[34] The resulting cost of US$ 85 per tonne of CO_2e represents the present day value of damages that will occur over many future years due to each additional tonne of GHGs emitted today. The figure incorporates non-market impacts on health and the environment, but does not capture the full range of ecosystem impacts. Trucost applied the US$ 85 carbon cost to each tonne of greenhouse gases emitted in 2008 to calculate the global external cost in 2008.

Trucost applied incrementally rising carbon costs to projected emissions during the period to 2050 under the IPPC A2 business-as-usual scenario. To reflect a larger future economy affected by mounting climate change impacts, damage values rise by approximately 2.4% per year.[35]

The Stern Review uses estimates of future carbon costs from the PAGE2002 Integrated Assessment Model,[36] incorporating factors such as changes in GHG emissions and regional economic impacts. Stern estimates that the costs of climate change impacts could be equivalent to 5% of GDP per capita under a business-as-usual scenario, based on market impacts alone, or 11% including an estimate for the value of health and environmental effects that do not have market prices (externalities).

32. Stern, N. (2006, 2009).

33. IPCC Scenario A2, Parry, M.L., Canziani and O.F., Palutikof, J.P. (2007).

34. Sterner, T. and Persson, M. (2007) An Even Sterner Review, Introducing Relative Prices into the Discounting Debate, Discussion Paper, Resources for The Future.

35. Hope, C. and Newbery, D. (2007) Calculating The Social Cost of Carbon, University of Cambridge.

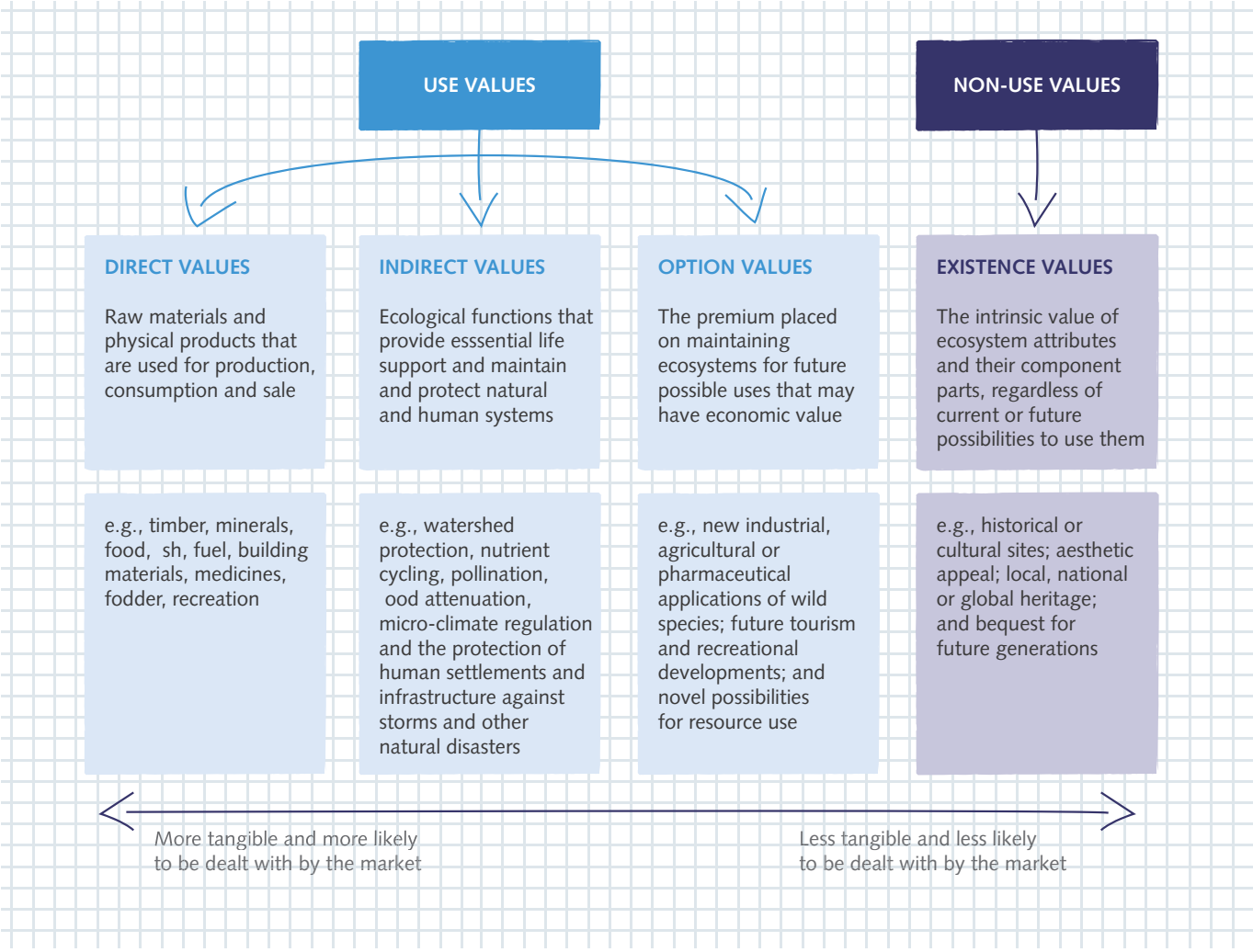
36. webarchive.nationalarchives.gov.uk/+/www.hm-treasury.gov.uk/d/Chapter_6_Economic_modelling_of_climate-change_impacts.pdf unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5447.php, accessed 17 February 2011.

If the climate is more sensitive to emission levels, these losses could rise to 7% and more than 14%, respectively. Stern adjusted figures for equity weighting to reflect the likelihood that less developed countries will be most exposed to impacts. The resulting projected losses would amount to up to 20% of global GDP, now and forever. The Stern Review estimates the social cost of carbon for a scenario of unmitigated climate change, where the loss of consumption expressed per year, averaging over time and over different possible outcomes, lies in the middle of the 5-20% estimate.

Calculating the environmental costs of resource use

This study uses the Total Economic Value (TEV) taxonomy as a theoretical framework to monetise ecosystem goods and services. The framework, which values ecosystems based on their use and other benefits, is used to calculate the aggregated, marginal values of changes in ecosystems caused by human use of water, fish and timber.[38]

DIAGRAM 2:
The Total Economic Value framework[37]



37. World Business Council for Sustainable Development (2009) Business and Ecosystems, Issue Brief, Corporate Ecosystem Valuation.

38. Due to lack of available global data other natural resources are excluded.

- Direct use values take into account the value of ecosystems as a source of raw materials and physical products used by society and marketed, such as food, fuel, construction materials, drinking water and medicine. Values are derived from direct use or interaction with ecosystem resources and services, and market-based valuations building on estimated demand and supply.
- Indirect use values relate to the support and protection that ecosystems provide to the economy and property. They also cover ecosystem services that "regulate" the environment, such as nutrient cycling and flood, climate and pollution control. For example, a tropical forest that provides watershed protection by controlling sedimentation and flood drainage indirectly provides value to downstream users, such as agriculture, fishing and water industries. Tropical forests may also regulate microclimates that indirectly support agricultural areas. Disturbing a forest would cause changes in the economic value of activities that it protects or supports. Further research is needed to understand the indirect economic benefits of ecosystem services, and risks of damaging them.
- Option values relate to the premium placed on preserving species and genetic resources for future possible use. Potential undiscovered uses could include commercial, industrial, agricultural and pharmaceutical applications.
- Non-use values are the intrinsic values of ecosystems, regardless of their potential use. For instance, cultural, aesthetic and heritage worth. Existence values are relatively difficult to measure. However, empirical estimates indicate that their economic value may be significant.

Traditional economic analysis under-represents indirect, option and non-use values. Valuation of option and non-use values is still evolving, therefore the costs drawn from the literature review are mainly composed of use values.

Water: Under the TEV framework, removing water from a stream reduces its flow, which can adversely affect individuals or entities that value the water downstream, imposing an external cost. The environmental cost is then defined as the total economic costs (welfare loss) of the physical environmental damage to the water system. External costs were applied to data on current and projected water consumption from the UNESCO Intergovernmental Scientific Programme in Water Resources.

Timber: The valuation of the external cost for timber includes estimates of environmental costs from deforestation. This takes account of data from the TEEB study, which reflects the loss of provisioning (direct) and regulating (indirect) services. The external cost is then applied to changes in projected net forest cover use from the IPCC A2 scenario to determine the extent of deforestation in 2050. The future external costs of using timber were calculated using a demand curve to show an increase in use.[39] Projected prices grow faster than estimated population and GDP per capita as demand grows for forests as a carbon sink.[40] Deforestation accounts for 17-20% of global GHG emissions and is the second-largest human-induced source of CO_2 emissions, after fossil fuel combustion.[41] External costs for timber rise year on year in proportion to the value of carbon sequestration by forests. The external cost of timber use in 2050 is a conservative projection, as the role of forests in providing other environmental services will dramatically increase the costs of deforestation over time.

Fish: The damage cost of fish stocks used in this study is estimated as the impact of depletion costs or loss of potential economic benefits resulting from unsustainable fishing practices. The estimates are derived primarily from their use values and exclude the value of biodiversity losses, any compromise to the ocean carbon cycle as well as the additional value of benefits from healthy marine ecosystems. The future losses are estimated assuming a linear relationship between damage and state of the world's fish stocks since 1974, reported by the Food and Agriculture Organization (FAO). Extrapolating these trends over time, the damage cost is increased in proportion to the changing percentage of fully or over-exploited global fish stocks up to 2050.

This study does not attempt to provide an all-encompassing estimate of ecosystem degradation due to difficulties in understanding links between businesses and their use of ecosystem services. The three ecosystem services accounted for represent a share of the total economic value of global ecosystems.

39. UNEP (2008) The economics of ecosystems & biodiversity (TEEB), Interim report.

40. Braat, L. and ten Brink, P. (eds) (2008) The Cost of Policy Inaction, The case of not meeting the 2010 biodiversity target, Study for the European Commission, DG Environment.

41. FAO, UNDP, UNEP (2008) UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Development Countries (UN-REDD) Framework Document; van der Werf, G.R., Morton, D.C, DeFries, R.S., Olivier, J.G., Kasibhatla, P.S., Jackson, R.B., Collatz, J.G. and Randerson, J.T. (2009) CO_2 emissions from forest loss, Nature Geoscience, Vol. 2: pp. 737-738.

However, a significant number of ecosystem services – and thus a significant share of ecosystem-related environmental externalities – could not be accounted for in this study. For instance, damages to biodiversity from land-use change in biomes such as grasslands and pollution damage in aquatic regions are not included in environmental costs. Valuations of the lost opportunity costs from failure to maintain ecological infrastructure provided by wetlands and other habitats are also excluded. The actual costs of ecosystem goods and services could be as high as the costs of greenhouse gas emissions. For instance, the TEEB interim report estimates that at a global level, the economic impact of biodiversity loss and ecosystem degradation on the world economy amounts to US$ 2-US$ 4.5 trillion per year.[42]

The resulting welfare losses representing 7% of annual consumption by 2050 indicate the economic value of the loss of biodiversity, which is not fully accounted for in this study. Although valuation methods differ in that TEEB calculates cumulative current and future costs of losses, whereas Trucost attributes external costs on an annual basis, the TEEB study provides a complementary approach to understand the extent of ecosystem degradation.

Two approaches to accounting for environmental damage: Stock vs. flow

The environment provides the economy with flows of materials including timber, freshwater and other natural resources. It also delivers flows of services ranging from the assimilation of waste materials to the regulation of the global climate. In economic terms, environmental resources can be understood as "natural capital", and the flow of goods and services provided as "income" on that capital, while the stock that yields the flow is the natural capital itself.[43] The stock value of environmental resources is based on its current use continuing into the future and is therefore estimated as the present value of the future stream of net benefits, discounted. The level of natural capital must be maintained to ensure enduring flows of environmental materials and services in the future. However, environmental degradation from pollution and natural resource depletion changes the environment and its functions, which impacts the welfare of society.

The damage caused in one year can be understood as a cost allowance that reduces the future "income" earned from the maintenance of this natural capital.[44] This study estimates values for the flows of goods and services lost or damage caused annually, rather than the extent of damage to the underlying stock. For example, it accounts for the loss of goods and services provided by forests in one year. However, accumulating losses can deplete the stock of natural capital over time. Instead of estimating stock values of damage or loss, this study has measured the flow or loss in income from environmental damage that an investor would be exposed to in an annual accounting period. Another approach, used in the TEEB review and COPI project,[45] is to measure cumulative losses of natural capital stock over time.

42. www.teebweb.org/LinkClick.aspx?fileticket=UTSaK8Bb3AY%3D&tabid=1052&language=en-US last accessed 11 February 2011.

43. Costanza, R. and Daly, H. E. (1992), Natural Capital and Sustainable Development, Conservation Biology, Vol. 6, No. 1: pp. 37-46.

44. Bertelmus P. (2009) The cost of natural capital consumption: Accounting for a sustainable world economy, *Ecological Economics*, Vol. 68, Issue 6: pp. 1850-1857.

45. The COPI Project estimates the Cost of Policy Inaction – the environmental damage occurring in the absence of additional policy or policy revision. Braat, L. and ten Brink, P. (eds) (2008) The Cost of Policy Inaction, The case of not meeting the 2010 biodiversity target, Study for the European Commission, DG Environment.

Valuing waste and pollution

Trucost took account of the direct and indirect environmental and health effects of waste and pollution to calculate related external costs in 2008. This study assumes that damage values per unit of waste and pollution would increase in line with population and wealth (measured as GDP in purchasing power parity per capita). To value external costs for general waste and the pollutants analysed, studies use objective techniques that rely on observable environmental changes and market prices. Market prices can be used to value changes in production, replacement costs or preventive expenditures, and impacts on human health (costs of illness). As an example, for air pollution, a dose response relationship (DRR) is commonly used to link changes in ambient pollution to health outcomes.[46] The DRR estimates the statistical relationship between levels of air pollutants and health impacts – illness, lost work days and so on. A monetary value can be applied to quantified health impacts.

External costs were applied to data on releases of NOx, SOx, volatile organic compounds, particulate matter[47] and mercury[48] based on the IPCC A2 business-as-usual scenario, which includes the probable trajectory of future quantities of a range of pollutants. Other heavy metals with potentially toxic effects, such as arsenic, cadmium and lead, were excluded due to lack of global data. Human exposure to mercury can damage nervous systems and kidneys.

External costs for waste include damages from contaminating surface water, groundwater, soil and air, with negative effects on humans, other species and ecosystems. Figures cover waste from human activities including extracting raw materials, processing them, and consuming resulting products. Figures exclude hazardous waste and the costs of waste management. Data on quantities of waste are based on projections from the OECD Environmental Outlook baseline scenario, as there is no consensus on global waste figures.

Methodological limitations and challenges

Pricing nature inevitably undervalues life on earth and the value of the environment cannot be understood fully in monetary terms. Different valuations of the costs of environmental depletion and degradation cover a variety of impacts, spatial scales and time dimensions. The complex, dynamic links between ecosystems, business and human wellbeing cannot be captured fully in a static, numerical snapshot of impacts.

It is difficult to set a minimum value for externalities. Academic literature could exclude damage factors due to gaps in knowledge about feedback mechanisms, which could trigger sudden, irreversible ecosystem change, and under-researched plants or biological organisms important to ecosystem services. A baseline value is likely to rise as more ecosystem services are examined and understanding grows of human dependence on the Earth's life-support systems. Environmental external costs are complex and evaluating all of the uncertainties and margins of error contained within the literature reviewed is beyond the scope of this report.

Geographic dispersal can complicate attempts to evaluate externalities. There are considerable data gaps across geographies and it is difficult to compare data from different sources.

Average, globalised, economic values may not reflect fully variations in regional dependence on specific ecosystem services. Local factors such as competition for resources and scarcity of ecosystem services could increase or reduce costs.

Externalities occur over time and damages mount over long periods. For instance, the physical effects of greenhouse gas-induced climate change will occur globally over decades or longer. The effects of other impacts such as water use can be more localised and imminent. Therefore, Trucost uses a forward-looking approach to value climate change damages in order to make the costs of GHG emissions comparable with other environmental external costs. The future physical effects and monetary values of externalities depend on uncertainties such as changes in societal preferences, and increased competition for declining natural resources and discount rates used.[49] To find out more about how valuations change over time, see Appendix II on page 56.

46. Garrod, G. and Willis, K. (2000) Economic valuation of the environment: methods and case studies.

47. Streets, D.G. (2004) Dissecting future aerosol emissions: warming tendencies and mitigation opportunities, Climate Change, Vol. 81, No. 3-4: pp. 3313-3320.

48. Streets, D.G, Zhang, Q. and Wu, Y. (2009) Projections of Global Mercury Emissions in 2050, Environmental Science & Technology, Vol. 43, No. 8: pp. 2983-2988.

49. National Research Council of the National Academies (October 2009) Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.

The actual value of externalities is likely to be higher than that stated in this study. Due to limited available global data, the analysis excludes most natural resources used, as well as many environmental impacts including water pollution, most heavy metals, land use change other than that connected with the use of forest resources, soil degradation, pesticide and fertiliser residues, the effects of persistent, bioaccumulative or toxic substances such as certain brominated flame retardants and phthalates, emissions of ozone-depleting substances and waste in non-OECD countries. This study therefore significantly undervalues environmental externalities related to the degradation and destruction of many ecosystem services (both use and non-use values). Actual figures for externalities from damage to all ecosystem services would also be much higher if degradation of environmental services, including habitat maintenance and nutrient cycling, could be accounted for fully.

Trucost methodology to measure corporate environmental impacts

Valuations of different corporate environmental impacts drawn from the research were incorporated into Trucost's environmental input-output model to identify the most significant externalities at company and portfolio levels. Prices were applied to quantitative data on the environmental impacts of 3,000 of the largest public companies in Trucost's database. The study combines findings from the literature review with data on corporate environmental externalities to examine:

- **The scale of externalities caused by the 3,000 companies, to estimate the costs of externalities from global capital markets.** Trucost identified externalities from the operations and supply chains of companies in different sectors. It is outside of the scope of the report to identify external costs at a company level.
- **Externalities from holdings in a hypothetical large equity portfolio.** The value of externalities from 2,439 companies in the MSCI All Country World Index were analysed as a proxy for a typical large, diversified equity fund. The analysis uses Index sector weightings as of 31 December 2008. It is outside of the scope of the study to identify externalities linked to specific equity portfolios or asset allocations.

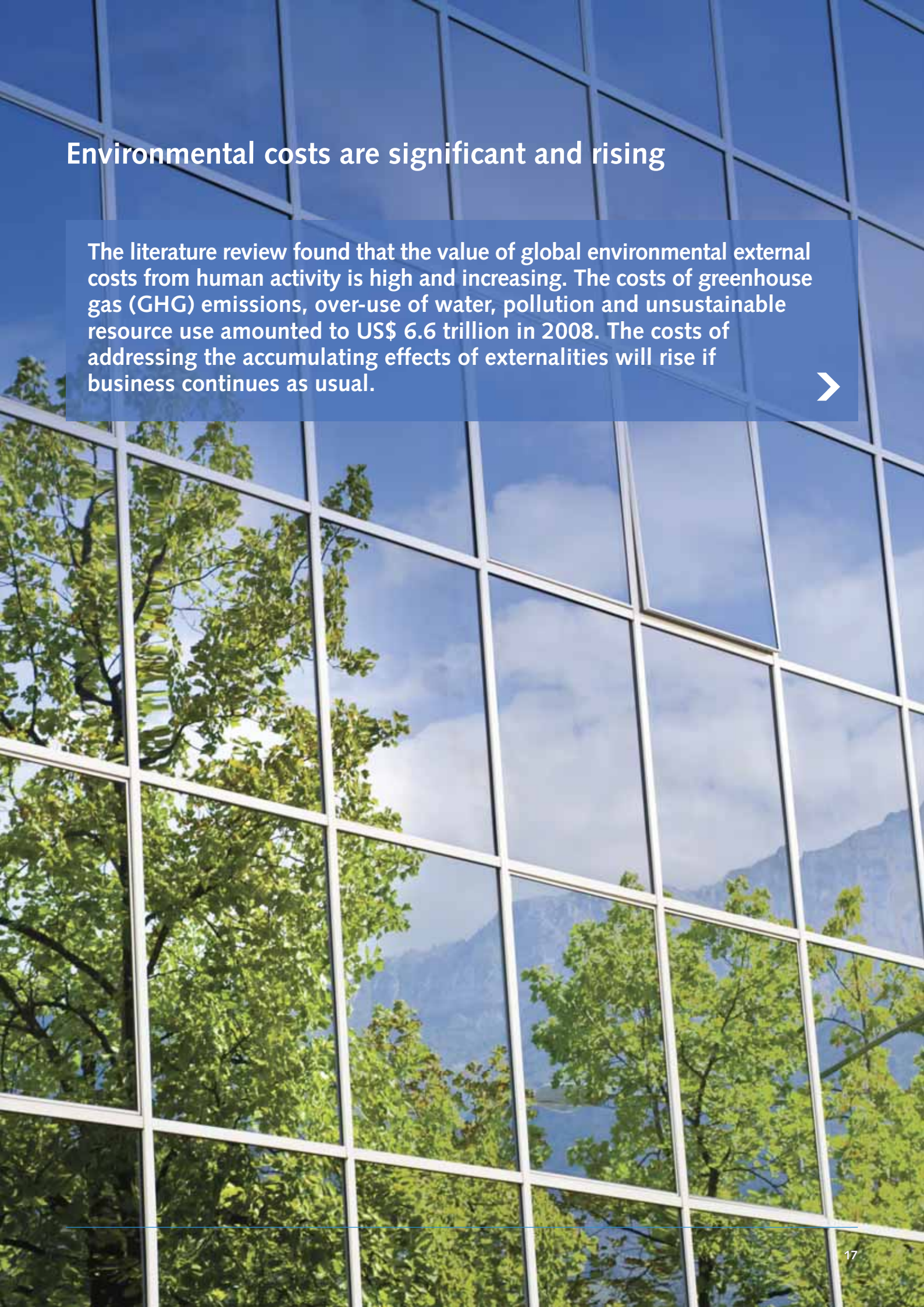
Leading shareholder engagement practitioners within the investment community have contributed to consultations and stakeholder workshops on preliminary findings to help develop recommendations on how Universal Owners can address externalities.

To calculate the environmental impacts of companies included in the study, disclosures were reviewed from sources including company annual reports and accounts, environment reports, sustainability or corporate social responsibility reports, and websites. Calculations incorporate disclosed quantitative data on companies' actual pollutant releases and resource use. Where a company only discloses data for part of its overall activities, Trucost may standardise or normalise quantities in order to calculate the environmental impacts of the business's entire operations in line with environmental reporting standards. Where companies disclose only resource use such as fuel consumption, this information is used to derive environmental data where possible.

Where companies do not disclose adequate data, Trucost used its environmental profiling input-output model to calculate the type and level of environmental resource use and non-product output. These calculations are based on the economic activity of any given company operating in 464 industries, using data on industry emissions derived from national and industry-compiled emissions registries. Detailed government census and survey data on resource use and pollutant releases, industry data and national economic accounts inform calculations. Trucost engages with companies, which are given the opportunity to verify their data and provide more information. Trucost's comprehensive coverage ensures that all companies within the universe analysed are included, not just those that disclose environmental information. Environmental profiling using an input-output model may not account fully for company-specific factors, and this analysis is a "best efforts" attempt to understand environmental impacts in the current absence of sufficient and comparable company disclosures on the environmental impacts of operations and supply chains.

Environmental costs are significant and rising

The literature review found that the value of global environmental external costs from human activity is high and increasing. The costs of greenhouse gas (GHG) emissions, over-use of water, pollution and unsustainable resource use amounted to US$ 6.6 trillion in 2008. The costs of addressing the accumulating effects of externalities will rise if business continues as usual.



Global externalities were estimated at US$ 6.6 trillion in 2008, equating to 11% of the value of the global economy at the time (US$ 60 trillion in GDP). To put US$ 6.6 trillion into context, annual global environmental externalities are 20% larger than the US$ 5.4 trillion decline in the value of pension funds in developed countries caused by the global financial crisis in 2007/08 (see "Universal Owner exposure to financial crises" on page 9. GHGs account for the majority of external costs in 2008 (US$ 4.5 trillion). This represents the present day value of future climate change impacts and is based on the social cost of carbon from the Stern Review on the Economics of Climate Change (2008).

Under a scenario of low per capita economic growth and a growing population, the value of annual environmental externalities is estimated to reach US$ 28.6 trillion in 2050. This is mainly from a projected increase in costs for GHG emissions from US$ 4.5 trillion to US$ 21 trillion. The actual value of environmental costs is likely to be higher, since the analysis excludes most natural resources used, as well as environmental impacts such as water pollution, due to lack of global data.

TABLE 2:
Annual environmental costs for the global economy in 2008 and projections for 2050

Environmental impact	*External costs in 2008 (US$ billions)*	*External cost relative to global GDP in 2008*	*Projected external costs in 2050 (US$ billions)*	*Projected external cost relative to global GDP in 2050*
Greenhouse gas (GHG) emissions	4,530	7.54%	20,809	12.93%
Water abstraction	1,226	2.04%	4,702	2.92%
Pollution (SOx, NOx, PM, VOCs, mercury)	546	0.91%	1,926	1.20%
General waste*	197	0.33%	635	0.39%
Natural resources				
Fish	54	0.09%	287	0.18%
Timber	42	0.07%	256	0.16%
Other ecosystem services, pollutants and waste	Not available (NA)	NA	NA	NA
Total	**6,596**	**10.97%**	**28,615**	**17.78%**

*The estimate for general waste only includes data on OECD countries, as there is no consensus on global waste figures.

The value of global annual externalities is based on external costs of marginal changes in resource use, pollution and waste. Findings reflect uncertainties and margins of error inherent in estimates of current and future externalities. While valuations are imprecise, these numbers are underestimates as a significant number of ecosystem services, habitat maintenance and nutrient cycling, were excluded from this study due to a lack of global data. Actual values are also likely to be higher because this study takes a global view that simplifies many economic and environmental complexities. To find out more about valuations and limitations, see Methodology on page 11.

The estimated costs for natural resource depletion and environmental degradation reflect the global cost of capital maintenance.[50] Annual environment-related damages to human welfare and the economy represent the depreciation of natural capital. Although measuring costs relative to GDP compares different metrics, it puts the value of externalities into context and shows the economic significance of environmental impacts. It is difficult to estimate the actual external costs imposed on the economy and included in GDP calculations over time. Some costs translate directly into monetary impacts that would filter into GDP measures, some would have indirect effects, and others would be excluded from GDP statistics.

National accounts largely exclude negative effects on humans, ecosystem services and the economy. Since resources are treated as current income instead of capital depreciation, conventional GDP measures do not fully account for the effects of current consumption, emissions and waste sinks on future consumption. This compounds the market failure caused by a lack of adequate financial accounting standards that would ensure companies accurately account for environmental costs on their balance sheets. Incomplete financial and economic accounting can lead to policy measures such as incentive mechanisms that increase, rather than reduce, indirect and long-term environmental costs. For instance, over US$ 300 billion in subsidies that support fossil fuel production contribute to rising GHG emissions and related climate change costs.[51] The resulting failure to maintain natural capital, if uncorrected, could undermine economic growth over time. Measures of economic output, such as GDP, need to account for damage costs borne in the global economy more accurately. Approaches to correcting the market failure include the System for Integrated Environmental and Economic Accounting (SEEA), which incorporates the value of natural assets into key economic indicators.[52]

As the effects of externalities accumulate, the cost of addressing them will rise. If current rates of consumption and emissions continue, projected external costs could rise to over US$ 28 trillion in 2050, equating to 18% of projected GDP. This represents a 62% increase in externalities as a percentage of GDP between 2008 and 2050.

Trucost applied rising external costs to projected "flows" of greenhouse gas emissions, resource use, waste and pollutants to estimate the size of future annual externalities if business continues as usual under a scenario of regionally-oriented, low per-capita economic growth, rising population levels and slow, fragmented technological development (see page 11). Levels of projected externalities could be 9% higher under a scenario with more intensive use of fossil fuels, rapid economic growth, the global population reaching nine billion in 2050 and a high rate of technological change.[53] However, if clean and resource-efficient technologies are introduced and materials intensity falls as part of an emphasis on global solutions to economic, environmental and social stability, externalities could be 23% lower than the US$ 28 trillion.[54]

Uncertainties surrounding externalities underline the importance of reducing them to avert significant and growing risks. Variables such as population growth contribute to uncertainties inherent in estimates of future externalities. However, projections are likely to be conservative since values do not account for growing ecosystem sensitivity, increased natural capital scarcity and potential breaches of thresholds, which could trigger immediate changes such as ecosystem collapse or catastrophic climate change.[55] Environmental costs analysed in this report are likely to be incurred earlier than expected. This is because negative feedbacks from the combined effects of impacts, as well as interactions between climate change, marine and terrestrial ecosystems, could amplify the rate of environmental change and extent of damages. The cumulative depletion of natural resources increases the amount of capital required to extract scarcer resources and can accelerate damage to ecosystem services.[56] The costs reflect the scale of externalities caused by global economic activity and clarify which risks need to be addressed urgently.

50. Bertelmus P. (2009) The cost of natural capital consumption: Accounting for a sustainable world economy, *Ecological Economics*, Vol. 68, Issue 6: pp. 1850-1857.

51. www.worldenergyoutlook.org/docs/weo2010/press_release.pdf, last accessed 2 February 2011.

52. unstats.un.org/unsd/envAccounting/seea2003.pdf, last accessed 2 February 2011.

53. IPCC A1FI scenario, www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf, last accessed 10 January 2010.

54. IPCC B1 scenario, ibid.

55. World Resources Institute (2005) Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry.

56. Cleveland, C and Costanza, R. (ed) (26 May 2010) Biophysical economics, in Encyclopaedia of Earth, www.eoearth.org/article/Biophysical_economics, last accessed 2 February 2011.

CASE STUDY:
MITIGATION COSTS LESS THAN CLIMATE CHANGE DAMAGES

Greenhouse gas emissions are estimated to be the largest and most rapidly rising environmental cost between 2008 and 2050. This reflects estimates that hundreds of millions of people could suffer hunger, water shortages and coastal flooding as changes in climate regulation affect access to food production, water, health and the environment. Climate change impacts such as a temperature increase could lead to sea level rise for more than a millennium.[57]

Events such as hurricanes and droughts could be due to natural variability, climate change, or both. This makes it difficult to identify all of the current costs of climate change, although it is clear every region of the world bears costs now that will increase over time. Insurance company Munich Re reported that in 2010, a heatwave and air pollution caused at least 56,000 deaths in Russia, while floods in Pakistan caused US$ 9.5 billion in losses, and a storm in one of the severest hurricane seasons in 100 years caused US$ 3.9 billion in losses in Mexico, of which US$ 150 million was insured.[58]

Africa is highly exposed to the economic impacts of climate change. For instance, more frequent droughts and floods in East Africa have already cost 5-8% of GDP, with a long-term fiscal liability of over 2% of GDP annually.[59]

In China, almost two-thirds of recent economic losses caused by natural disasters, equivalent to 3.5% of GDP, were from climate-related events.[60] Sea level rise in the economically developed Pearl River Delta, Yangtze River Delta and Yellow River Delta areas could cause over US$ 65 billion in economic losses by 2030.[61]

Freshwater released from the melting Greenland ice sheet could result in the collapse of the thermohaline circulation and cause temperatures in Europe to fall,[62] leading to a shift in economic activity from north to south in Europe and North America. Accelerated climate change could have the reverse effect. Both changes would cause lower crop productivity in North America and Central Asia, with impacts on global food markets.

Strong and early action can dramatically limit climate change damages and would represent insurance to protect against rising future adaptation costs. Reducing GHG emissions could cost between 1-2% of global GDP.[63] Mitigation options include reforestation and forest regeneration, increasing resource efficiency, switching from fossil fuels to renewable energy supplies, and using low-carbon processes and materials in industrial processes such as cement and chemical production.[64] Low-cost energy efficiency measures alone could cut global CO_2 emissions by 8.2 Gigatonnes a year by 2030.[65]

The benefits of early mitigation far outweigh the risks of rising economic costs, if business continues as usual. Action to reduce emissions could increase global GDP in major economies.[66] The Stern Review estimated that implementing strong mitigation policies now could produce net benefits of US$ 2.5 trillion or more. According to The Climate Group, developing low-carbon technologies and services would contribute to a 0.8% increase in global GDP by 2020, compared with projected GDP without climate action.[67] Universal Owners have a vested interest in promoting action to mitigate GHG emissions and reduce risks from the economic effects of climate change.

57. www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf, last accessed 2 February 2011.

58. www.munichre.com/en/media_relations/press_releases/2011/2011_01_03_press_release.aspx last accessed 2 February 2011.

59. UN Economic Commission for Africa (Draft as of 14 May 2009) Economics of Climate Change: Key Messages.

60. Lin, E. and Zhou, J. et al., (28 August 2006) Climate Change Impacts and its Economics in China. webarchive.nationalarchives.gov.uk/+/www.hm-treasury.gov.uk/media/8A3/DD/stern_review_china_impacts.pdf last accessed 2 February 2011.

61. Ibid.

62. Arnell, N.W. (2006) Global impacts of abrupt climate change: an initial assessment, Tyndall Centre for Climate Change Research.

63. Stern, N. (2009) A Blueprint for a Safer Planet, How to Manage Climate Change and Create a New Era of Progress and Prosperity, p 51.

64. www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-ts.pdf, last accessed 2 February 2011.

65. http://www.iea.org/papers/2008/cd_energy_efficiency_policy/0_introduction/EffiRecommendations_web.pdf last accessed 2 February 2011.

66. The Climate Group (2009) Cutting the Cost: The Economic Benefits of Collaborative Climate Action.

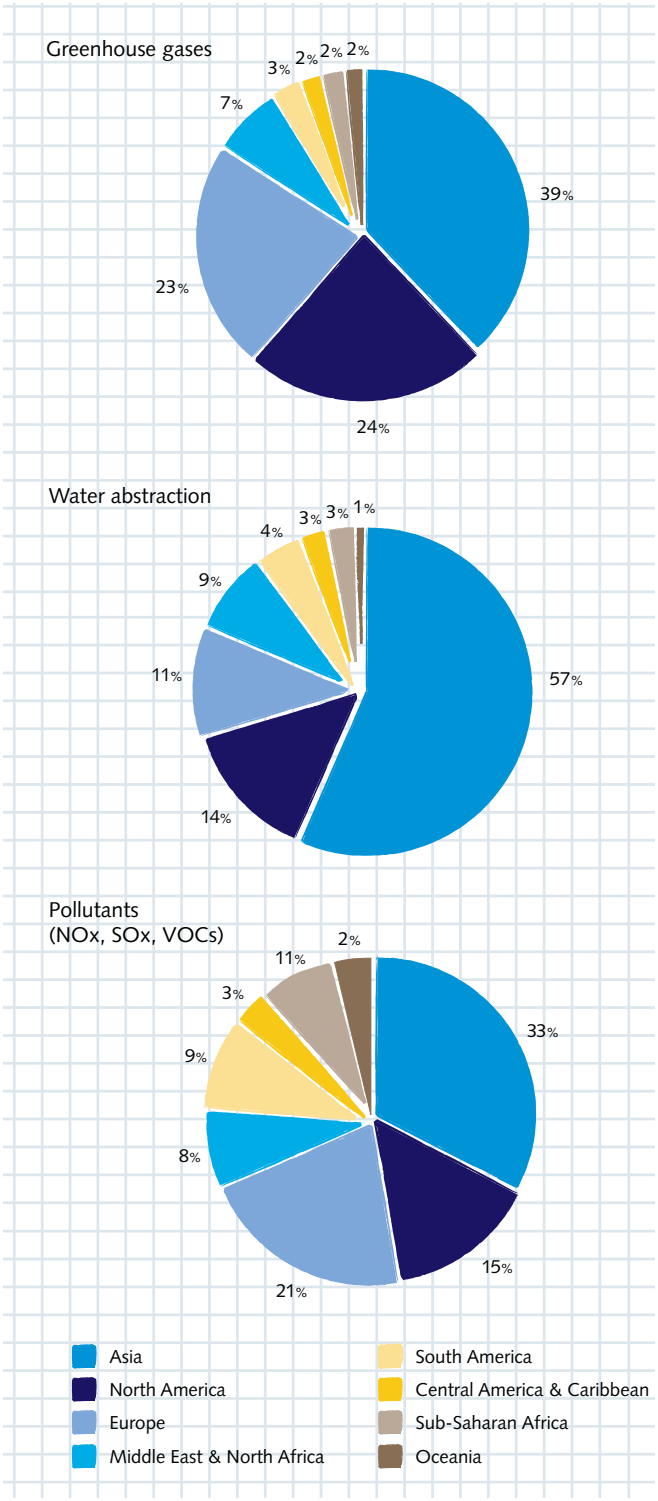
67. Ibid.

> Natural resources represent a significant share of world trade, amounting to around one-quarter of all merchandise exports. A complexity arises from the fact natural resources are essential to many production processes, and yet they are either finite in supply or exhaustible and potentially finite, if they are not properly managed. Their extraction and use need to be carefully managed in order to balance the competing needs of current and future generations. Some natural resources are by their nature what we refer to as potentially "open access" resources. This means they may be harvested... with scant consideration of the fact that they are finite or exhaustible, and in the absence of a price that reflects true scarcity. In the absence of effective government control or the establishment of an enforceable property rights system, these resources will be over-exploited and extracted at a socially suboptimal rate. Negative environmental effects of significant proportions can also result from the way in which natural resources are extracted and consumed.

Pascal Lamy, Director-General, World Trade Organisation, July 2010[68]

Reducing GHG emissions, water use and air pollution would have the greatest effect on reducing environmental costs. GHG emissions are the main driver of rising externalities. The future rise in costs for escalating GHG emissions reflect mounting climate change impacts which result in projected external costs of US$ 21 trillion in 2050. GHG emissions and resulting climate change impacts account for a large and growing share of environmental costs – rising from 69% to 73% of externalities between 2008 and 2050. Water abstraction and air pollution are the other main contributors to environmental costs, followed by emissions of volatile organic compounds, waste generation, fish and timber use and mercury emissions. Information on where externalities come from and who "owns" them can be used to reduce risks.

CHART 1: Breakdown of carbon, water and air pollution costs by region in 2008



68. www.wto.org/english/news_e/sppl_e/sppl165_e.htm, last accessed 2 February 2011.

CASE STUDY:
WATER: COSTS WILL INCREASE TO REFLECT GROWING SCARCITY

Growth in the human population, industry and irrigated agriculture will make it difficult to meet rising water demand and manage water services in the next two decades.[69] About 80% of the world's population live in areas without secure freshwater supplies.[70] Identifying and managing local and global threats is essential to protect freshwater resources and avoid costly remediation of water-related problems.

Water crises are developing in several regions, with water shortages and droughts, floods or both, now aggravated by climate change impacts. Water shortages in China due to over-use and pollution cost an estimated US$ 39 billion a year in lost crops, lower industrial production and hampered economic output.[71] Glaciers in the Himalayas that are crucial to water supplies in China and India are melting at an accelerated pace due to rising temperatures over the past 20 years. The "Water Towers of Asia" feed seven of the world's greatest rivers, including the Ganges and the Yangtze, and supply water to more than 1.3 billion people.[72] Water shortages, along with other climate change impacts, could destabilise political systems and lower economic activity in Asia in the future.[73]

Rising demand in some water-stressed parts of the United States will increase challenges for water and electric power utilities, as well as risks to economic productivity. Investors in municipal bonds for water and power infrastructure are exposed to water scarcity risks, which are not adequately taken into account in credit ratings (Ceres, 2010).[74]

Annual global water withdrawal is expected to grow to approximately 6.9 trillion m^3 by 2030.[75] This is 40% above current accessible and reliable supplies, and is likely to undermine the many economic benefits derived from water services that are essential to biological life, including humans.

More sustainable and efficient water management can provide economic benefits.[76] Investments of some US$ 15-US$ 30 billion in measures to improve water resource management in developing countries have delivered some US$ 60 billion in direct economic benefits. Investors and companies have an opportunity to improve management of water-related goods and services to realise financial gains. Managing benefits that water resources provide, for example through watershed protection, can avert water treatment costs and save up to 200 times the amount invested. The World Health Organization has estimated that for every US$ 1 invested to improve water supply in sectors including agriculture and industry, economic benefits could range from US$ 3-US$ 34, depending on the region and technologies applied.[77] Meeting UN Millennium Development Goals to improve water supply and sanitation could deliver US$ 84 billion in annual economic benefits.

69. www.benefits-of-recycling.com/importanceofconservationofwater.html last accessed 2 February 2011.

70. Vörösmarty, C.J. et al (2010) Global threats to human water security and river biodiversity, Nature, Vol. 467, No. 7315: pp. 555-561.

71. Facts and Details (April 2010) Water Shortages in China, factsanddetails.com/china.php?itemid=390&catid=10&subcatid=66, last accessed 2 February 2011.

72. www.trust.org/alertnet/news/climate-change-water-towers-of-asia-show-cracks/, last accessed 2 February 2011.

73. Garnaut, R. (2008) The Garnaut Climate Change Review.

74. Ceres (October 2010) The Ripple Effect: Water Risk in the Municipal Bond Market.

75. The 2030 Water Resources Group (2009) Charting Our Water Future, Economic frameworks to inform decision-making.

76. Hansen, S. And Bhatia, R. (2004) Water and Poverty in a Macro-Economic Context, Paper commissioned by the Norwegian Ministry of the Environment.

77. Hutton, G. and Haller, L. (2004) Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level, World Health Organization.

Location and wealth influence exposure to environmental costs

Environmental costs are unevenly distributed across regions. Costs for GHG emissions, water abstraction and pollution mainly arise from Asia, North America and Europe (see Chart 1). Timber, fish, waste and heavy metals could not be included due to lack of regional data.

Inequitable access to a declining pool of natural resources could undermine social stability, international collaboration and the benefits of an integrated global economy.[78] Resource depletion can lead to ecological deficits with significant impacts in some areas, leading to resource loss, ecosystem collapse, debt, poverty, famine, social unrest and war.[79]

Externalities are unevenly distributed between countries and socio-economic groups. While high earners generally have greater property rights, consume more, generate more waste and pollute more, people on low incomes tend to be most exposed to the health impacts of polluting factories and waste dumps.

Air and water pollution cause ill health and reduce labour productivity foremost in developing countries.[80] The unequal distribution of environmental damages is illustrated by the fact that most of the 2.7 million air pollution-related deaths each year are from low-income groups in developing countries.[81] Health costs of particulate air pollution in developing countries amounted to approximately US$ 100 billion in 1995.[82]

Many less developed countries generate externalities by extracting resources and manufacturing goods for export to developed and emerging markets. Trade can increase pollution by raising the scale of economic activity and providing incentives for pollution-intensive industries to operate in countries with large heavy manufacturing bases and weak environmental standards.[83] Multinational companies that outsource production could externalise environmental costs to developing countries with export-led growth. Externalities could undermine economic growth, with knock-on effects on trade. For instance, climate change impacts could cause significant falls in GDP in developing countries that are set to be major trading partners with Australia.[84] This could damage Australia's terms of trade and add to its climate change costs.

Strengthening regulatory controls on resource efficiency and environmental pollution in many emerging market countries will make it more difficult for companies to externalise damage costs through operations and suppliers located outside of OECD countries. Businesses, governments and investors could cooperate more comprehensively at a global level to help raise environmental standards and reduce externalities.

78. UNEP (2008) The economics of ecosystems & biodiversity (TEEB), Interim report.

79. www.footprintnetwork.org/en/index.php/GFN/page/footprint_for_nations/, last accessed 11 February 2011.

80. Government of India, Ministry of Finance Economic Survey 1998-99, indiabudget.nic.in/es98-99/environ.htm, last accessed 2 February 2011.

81. UNDP (1998) Human Development Report, Chapter 4, Unequal human impacts of environmental damage.

82. Ibid.

83. Copeland, B. and Taylor, M. (1995) Trade and Transboundary Pollution, American Economic Review, Vol. 85, Issue 4: pp.716-737.

84. Garnaut, R. (2008) The Garnaut Climate Change Review.

Public companies cause substantial environmental costs

The largest 3,000 listed companies by market capitalisation in Trucost's database were responsible for 35% of total global environmental costs analysed in 2008. The US$ 2.15 trillion in externalities from the companies' operations and supply chains equates to nearly 7% of their combined revenues. Five highly polluting sectors account for around 60% of all externalities from the 3,000 listed companies. For many companies, the majority of externalities are from supply chains.

Trucost constructed a hypothetical fund based on the MSCI All Country World Index (ACWI), a proxy for a typical large, diversified equity fund. Universal Owners that invest US$ 10 billion in such a fund could be responsible for US$ 560 million in annual environmental costs caused by companies held. These costs could equate to more than half of their combined earnings, weighted according to Index constituents.

Environmental costs generated by the top 3,000 companies in Trucost's database totaled US$ 2.15 trillion in 2008 – including impacts from operations and the production of purchased goods and services. Average external costs identified in the literature review were applied to environmental impacts caused by the operations and supply chains of the companies. Data covers direct environmental impacts from operations as well as those upstream from sourcing products, components and raw materials.

The listed companies are responsible for 35% of total global externalities caused by human and economic activity (US$ 6.6 trillion). External costs from all securities in capital markets would be higher than the US$ 2.15 trillion. Nonetheless, the 3,000 companies, with a combined market capitalisation of around US$ 30 trillion, represent a major proportion of the global equity market. Other actors in the economy, such as small and private companies, governments, other organisations and individuals contribute the remaining US$ 4.45 trillion of external costs. Chart 2 shows the share of environmental costs for the top three impacts – GHG emissions, water use and air pollution – from company operations, supply chains and the rest of the economy.

GHGs emitted by the listed companies and their suppliers account for over 30% (US$ 1.4 trillion) of total economy-wide carbon costs. Almost two-thirds of total costs from the 3,000 companies are due to GHG emissions, including direct emissions from operations under Scope 1 of the Greenhouse Gas Protocol corporate accounting and reporting standard developed by the World Resources Institute and World Business Council for Sustainable Development. Almost half of the companies' GHG emissions result from their purchases of electricity (Scope 2) and other goods and services (Scope 3).

CHART 2:
Environmental costs from company operations, supply chains and the rest of the economy

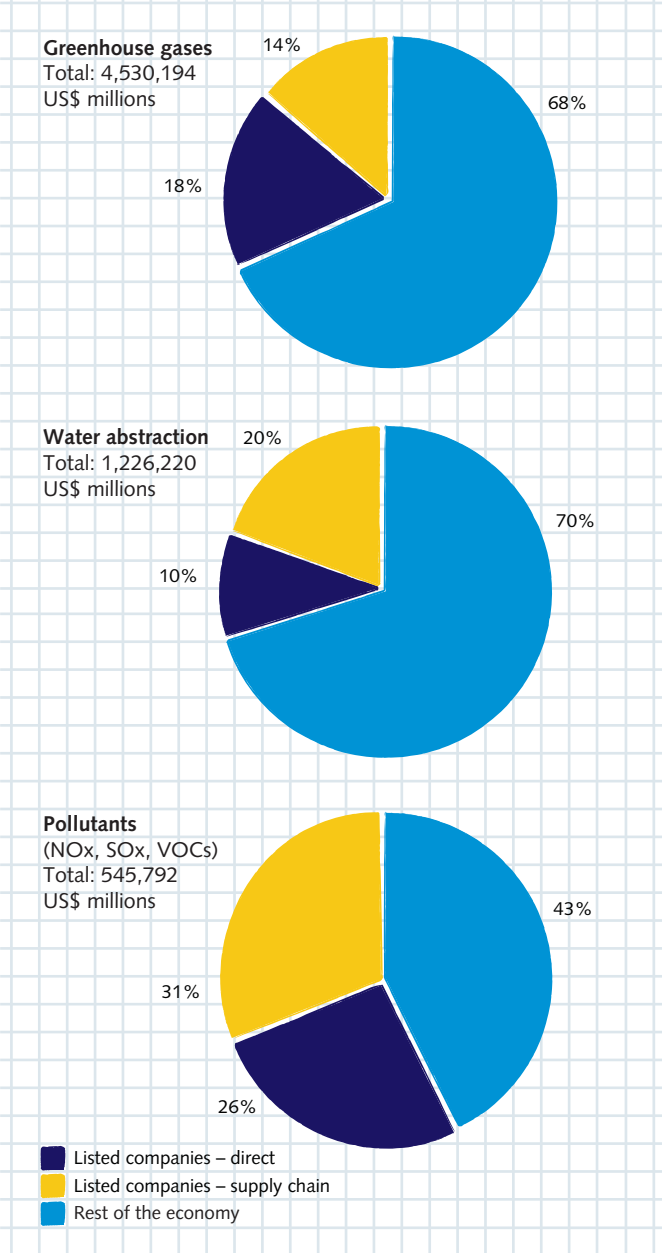


TABLE 3:
Annual environmental costs in 2008 attributable to the largest 3,000 public companies

Environmental impact	*External costs generated by listed companies in 2008 (US$ million)*	*% of externalities arising from supplied goods and services*	*Average external cost relative to revenue in 2008*
GHG emissions	1,444,864	44%	4.47%
Water abstraction	366,555	66%	1.13%
Pollution (SOx, NOx, PM, VOCs and mercury)	314,001	54%	0.97%
General waste	21,157	40%	0.07%
Natural resources			
Fish	6,099	79%	0.02%
Timber	1,542	68%	0.01%
Other ecosystem services, pollutants and waste	Not available (NA)	NA	NA
Total	**2,154,218**	**49%**	**6.66%**

Source: Trucost Plc

This study excludes the life cycle benefits of products which could contribute benefits known as "positive" externalities. The analysis excludes negative externalities from products made by the companies and used by society, such as automobiles and personal computers. Costs for damage caused by fish consumption are likely to be higher than estimated due to the accumulative effects of overfishing and related biodiversity loss. Costs for timber use reflect the externalities of deforestation, although environmental costs from illegal logging could be higher. The total environmental costs of damages to other ecosystem services, which are largely externalised by companies, are likely to be far higher (see Methodology on page 11).

The companies cause one-third of total water abstraction costs. Two-thirds of the companies' water externalities are from supply chains. Many companies would need to work with suppliers to manage business risks from water scarcity and to use resources more efficiently.

Almost half of the externalities are from outsourced activities in supply chains. This highlights potential exposure to rising input costs as externalities are increasingly internalised and passed on in higher prices for purchased goods and services over time. For instance, many utility companies that are included in the EU Emissions Trading Scheme (EU ETS) passed through the opportunity cost of freely allocated allowances for carbon dioxide emissions in higher electricity prices. Other industries including refineries and steel production are likely to pass through carbon costs where possible.[85]

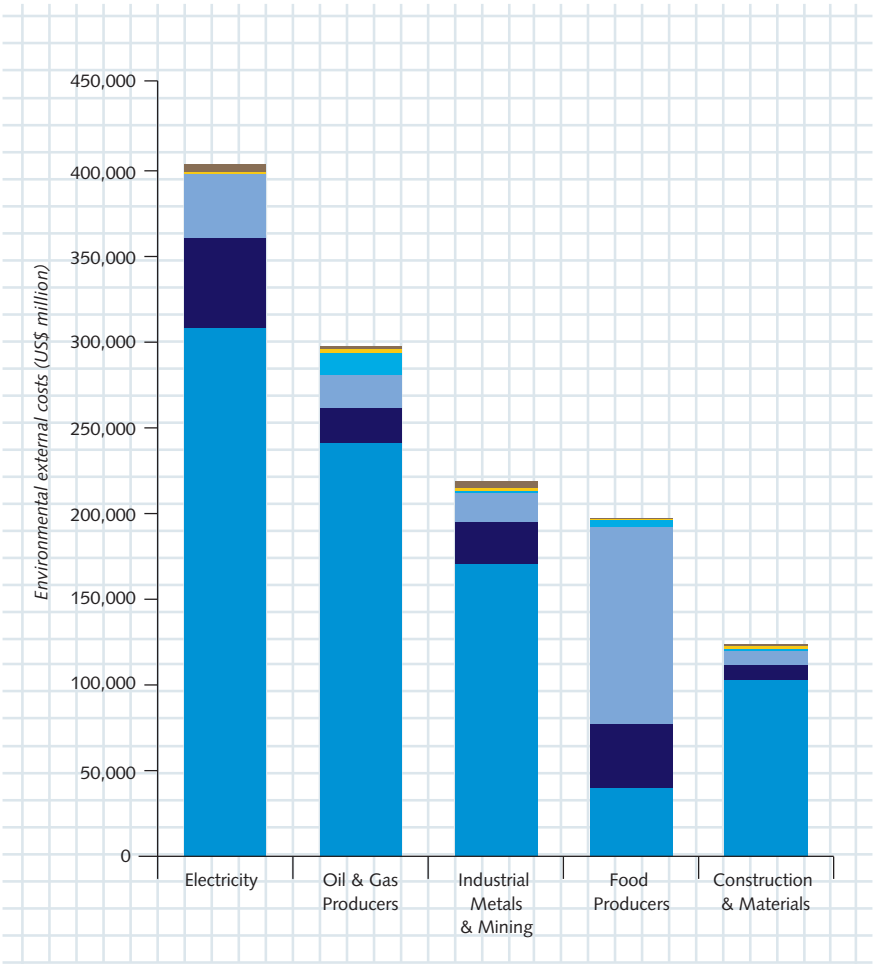
Actual externalities are likely to be higher than the US$ 2.15 trillion, since the analysis excludes external costs caused by product use and disposal, as well as companies' use of other natural resources and release of further pollutants through their operations and suppliers. The externalities associated with resource over-use and the depletion of natural stocks in the marine environment and forests would be far higher if all securities in capital markets, small and private companies, governments, other organisations and individuals were taken into account.

External costs from the 3,000 companies represent nearly 7% of their combined revenues. The materiality of externalities varies at a company and sector level. Assuming all environmental costs were internalised for each company, they would equate to between 0.34% and over 100% of revenue. There is a wide variation in environmental costs from different companies within the same sectors, with knock-on effects on financial exposure to externalities. For example, environmental costs in the "Basic Resources" sector would equate to between 1% and 84% of revenues at a company level.

85. European Climate Foundation (April 2010) Does the energy intensive industry obtain windfall profits through the EU ETS? An econometric analysis for products from the refineries, iron and steel and chemical sectors.

Risks vary between sectors and companies

CHART 3:
Environmental costs for top five sectors



Sector Environmental costs (US$ millions)	Electricity	Oil & Gas Producers	Industrial Metals & Mining	Food Producers	Construction & Materials
Heavy metals	4,207	1,668	3,954	377	915
General waste	814	2,431	2,043	547	1,917
VOCs	532	12,527	747	4,084	1,308
Water abstraction	36,692	20,081	17,154	114,880	7,399
Air pollution	53,133	24,580	24,440	37,151	8,487
Greenhouse gases	309,188	242,047	170,783	40,113	103,258
Total	**404,566**	**303,334**	**219,121**	**197,152**	**123,285**

Five sectors have the greatest environmental externalities. Some 623 companies valued at US$ 7.8 trillion in the Electricity, Oil & Gas Producers, Industrial Metals & Mining, Food Producers and Construction & Materials sectors are responsible for the majority of corporate externalities (see Chart 3).

The five sectors account for over US$ 1.25 trillion in externalities, or 58% of external costs caused by the 3,000 companies, and 26% of the combined market capitalisation of all 3,000 companies.

- GHG emissions are the main driver of external costs for the Electricity, Oil & Gas Producers, Industrial Metals & Mining and Contruction & Materials sectors. The Electricity sector contributes 21% of carbon costs from the listed companies. Reducing GHG emissions from these sectors would have the greatest impact on reducing carbon costs.
- Food Producers and Electricity sectors account for 41% of total costs from water abstraction. Water use is the main externality among Food Producers, largely through suppliers.
- Reducing water use and pollutant releases from companies in these sectors could reduce environmental costs significantly. The remaining 42% of externalities are from 2,377 companies within 37 sectors with a combined valuation of US $ 22.2 trillion.

Source: Trucost Plc

The environmental costs shown in Chart 3 include the costs of environmental impacts from supply chains. The externalities analysed that arise from agriculture are included in the supply chain of Food Producers. For greenhouse gas emissions, the analysis covers Scope 1 and Scope 2 of the GHG Protocol, as well as upstream emissions from purchased goods and services, under Scope 3. Externalities from some companies may be double-counted where the direct environmental impacts of their operations are also included as the indirect impacts of companies that they supply. However, including both direct and supply chain externalities helps ensure the study accounts for external costs where these are outsourced to other public and private companies. The data has not been adjusted to attempt to account for double-counting, because for the most part, the majority of impacts within the supply chain would lie with companies that would not be listed. The externalities from supply chains attributed to each of the 3,000 companies are in proportion to the amount of resources (e.g. energy for power generation) necessary for their business activities, minimising double-counting between companies. The analysis excludes costs from downstream environmental impacts caused by the use and disposal of goods sold.

Companies held in a typical large, diversified equity portfolio cause significant environmental costs

Trucost assessed the scale of externalities caused by 2,439 companies listed in the MSCI All Country World Index (ACWI) in 2008. This Index is diverse and spans the major national economies of the developed and emerging markets. Many Universal Owners will own all of the companies in the Index, which can therefore be used to calculate their approximate equity exposure to environmental costs.

A hypothetical fund was constructed, valued at US$ 20 billion with 50% of assets invested in equities in the MSCI ACWI using the same weightings. Environmental costs caused by 2,439 companies in the Index amounted to over US$ 1 trillion in 2008. Externalities for each company were allocated to the hypothetical equity portfolio in proportion to assumed ownership of stock, applying the Index sector weightings. The external costs from each company were summed up across the portfolio to give the total environmental external costs related to fund holdings.

Findings showed that for every US$ 10 billion invested in equities in the Index, an investor would be proportionally responsible for US$ 560 million of the externalities caused by the listed companies annually. Trucost measured the US$ 560 million in external costs relative to the total earnings across all companies, weighted according to Index constituents. The scale of externalities caused by portfolio companies annually could equate to greater than 50% of these earnings (measured as earnings before interest, taxation, depreciation and amortisation or EBITDA).

Externalities pose financial risk to portfolios

Rising environmental costs contribute to economic and market risks, which could affect asset values and fund returns. Universal Owners can be exposed to environmental costs through:

- **Reduced cash flows for companies held in portfolios, and lower dividends.**
- **More uncertain, rapidly changing conditions in capital markets.**
- **Depleted natural capital and reduced future cash flows to the economy.**
- **Increased environmental costs for companies causing damage.**

Universal Owners are likely to suffer larger losses due to environmental externalities than would be the case if companies were forced to internalise these costs and thereby incentivised to reduce them. While the impact of externalities on individual portfolios would vary, large investors could be exposed to a decline in the overall value of investments due to the pervasive nature and scale of externalities. Universal Owners have an incentive to address the risk of a net loss from cumulative portfolio-wide externalities.[86]

86. Hawley, J., Williams, A.T. (July/August 2000) The Emergence of Universal Owners: Some Implications of Institutional Equity Ownership, Challenge, Vol. 43, No. 4: pp. 43-61.

Reducing environmental externalities would reduce net costs in the economy and ultimately benefit Universal Owners. Environmental costs could reduce cash flows for companies held in portfolios and lower future dividends. Some environmental costs externalised by companies held in large, widely diversified portfolios will be incurred by other companies in the same portfolio. Companies and their owners can incur the costs of damage to natural capital and human health through productivity falls and rising input costs, including higher taxes, levies and insurance premiums. Companies might be unprepared for higher operating costs than forecast, falling revenues, unplanned capital investments and increased costs of capital driven by lower risk-weighted projected returns.

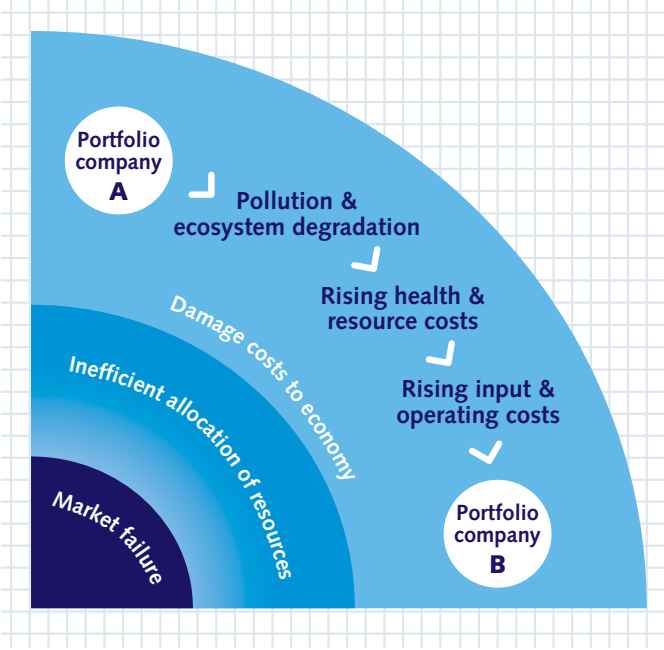
Rising externalities over time at a portfolio level are generally larger than short-term gains from companies that profit from externalising environmental costs. Accumulating externalities could lower fund returns overall.[87] For example, profits from oil companies and power utilities that externalise carbon costs can drive up stock prices and appear to benefit investors in the short run. However, over time the disruptive influence of climate change, such as rising ocean levels, more intense storms and changes in precipitation, could cause falls in returns from water utilities and real estate assets that have to divert capital expenditure to address flood risks and water scarcity. Falls in dividends and asset values could outweigh short-term gains from the energy and electricity sectors over time.[88]

Companies can pay for externalities through market mechanisms such as rising commodity prices.[89,90] Certain companies and industries can pay a disproportionate share of externalities over time. For instance, a firm's depletion of natural resources such as timber can reduce the supply of raw materials for other firms using forest products.

Pollution externalities can be passed between companies in different sectors. For example, emissions from the energy, waste and transport sectors form ground-level ozone, which affects food production. In 2000, ozone caused falls in crop yields with a value of US$ 14-US$ 26 billion.[92]

The greatest losses were in China, where air pollutants caused wheat yields to fall by over 20%.[92] Production falls resulted in higher prices and inflation, increasing input costs for food companies and reducing the purchasing power of the urban poor.[93] Across East Asia, ozone could reduce yields of crops such as wheat and rice by 7-15% by 2020.[94]

DIAGRAM 3:
Flow of externalities through equity portfolios



87. Dias, D., Repetto, R., Thomas, S. (May 2007) Integrated Environmental and Financial Performance Metrics for Investment Analysis and Portfolio Management, Corporate Governance: An International Review, Vol. 15, Issue 3, pp. 421-426.

88. Seitchik, A. (2007) Climate Change from the Investor's Perspective.

89. Johnson, D.B. (April 1973) Meade, Bees and Externalities, Journal of Law and Economics, Vol. 16, No. 1: pp. 35-52.

90. Xepapadeas, A.(2009) *Ecological Economics*: Principles of Economic Policy Design for Ecosystem Management VII. 9.

91. www.environmental-expert.com/resulteachpressrelease.aspx?cid=8819&codi=43964, last accessed 11 February 2011.

92. Woodrow Wilson International Center for Scholars (2007) A China Environmental Health Project Research Brief, Transboundary Air Pollution - Will China Choke On Its Success?

93. Boonekamp, L. (May-June 2008) Food prices: The grain of truth, OECD Observer No 267.

94. Takigawa, M. et al (2009) Future projection of surface ozone and its impact on crop yield loss over East Asia in 2020, Japan Agency for Marine-Earth Science and Technology, Workshop Paper.

Externalities can affect fund values by creating more uncertain, rapidly changing conditions in capital markets. Large pension funds would typically include a weighted selection of financial assets in proportion to global capital markets.[95] The size of Universal Owners can prevent them from trading in and out of a market. Rising externalities accumulate and can increase volatility in capital markets, which could become more vulnerable to sudden low-probability, high-impact environmental changes. For example, climate change is driven by the stock of carbon dioxide in the atmosphere, not just the current flow of emissions.[96]

Increased climate variability could indicate the onset of substantial, long-term shifts in ecosystems.[97] This volatility could undermine economic growth and reduce fund returns. Higher uncertainty about economic variables could lead to higher systemic risks, resulting in investors requiring higher discount rates on their investments. Existing risk controls may underestimate the potential for environmental challenges to create a more uncertain, rapidly changing economic environment. Financial risks from low-probability, high-impact events such as hyperinflation or sudden climate change impacts are downplayed in statistical modelling.[98] Risks from environmental degradation and depletion may pass undetected until critical thresholds or "tipping points" are breached. When this happens, changes may accelerate and cause permanent damage to the environment, society and economy. Switches in the economy to a new equilibrium can create drastic capital relocation and price movements.[99] If an unanticipated negative shock collectively affects the capital markets, pension fund returns could be impacted adversely through a diminished, lower-value investment universe. Such systemic risks cannot be managed sufficiently through diversification or arbitrage. It is in beneficiaries' interests that asset owners and asset managers address growing systemic risks from externalities to portfolio returns.

Allocating capital to environmentally damaging activities could deplete natural capital and reduce cash flows to the economy. Inefficient allocation of capital across the economy leads to a decline in the asset base over the medium to long-term. The inefficient distribution of resources between the present, near future and far future is due partly to an irrational undervaluing of future satisfaction. Investment in inter-generational welfare is inadequate.[100] Markets are yet to recognise that investment in resource-intensive and polluting activities limits production opportunities with lower externalities. For instance, investment in coal-fired power generation will cause greenhouse gas emissions that result in future capital being allocated to address climate change impacts. In contrast, investing in technologies such as renewable energy and combined heat and power could limit emissions and cut damage costs.

CASE STUDY:

POLLUTION DAMAGES THE RUSSIAN ECONOMY

Pollution in Russia is reducing labour productivity and damaging natural resources, adding to budgetary problems.[101] The main environmental issue is water pollution from municipalities, industry and agriculture. Economic losses from environmental degradation equate to 10-12% of GDP.[102] Future environmental degradation costs could entail major fiscal costs, according to OECD.[103]

95. Hawley, J., Williams, A.T. (July/August 2000) The Emergence of Universal Owners: Some Implications of Institutional Equity Ownership, Challenge, Vol. 43, No. 4: pp. 43-61.

96. Gollier, C., Jullien, B. and Treich, N. (2000) Scientific progress and irreversibility: an economic interpretation of the 'Precautionary Principle', Journal of Public Economics, Vol. 75: pp. 229-253.

97. Carpenter, S.R. and Brock, W.A. (2006) Rising variance: a leading indicator of ecological transition, Ecology Letters, Vol. 9, Issue 3: pp. 311-318.

98. Ritter, J.R. (2004) Economic growth and equity returns, EFA 2005 Moscow Meetings Paper, University of Florida.

99. Malliaris, S. and Yan, H. (March 2009) Nickels versus Black Swans: Reputation, Trading Strategies and Asset Prices, Yale School of Management.

100. Collard, D. (1996) Pigou and future generations: a Cambridge tradition, Cambridge Journal of Economics, Vol. 20, Issue 5: pp. 585-597.

101. National Intelligence Council (1999) The Environmental Outlook in Russia.

102. Ibid.

103. OECD (June 2009) Economic Survey of the Russian Federation, OECD Policy Brief.

Inadequate data on how environmental costs are internalised undermine the efficiency of securities markets where share prices should fully reflect all available information. The focus of equity markets on quantifiable, near-term influences on financial performance contributes to lack of transparency in how externalities pass between the economy, private enterprise, capital markets and investors. Measures to evaluate economic growth as GDP are usually historical, with smoothing and averaging characteristics.[104] In contrast, capital market valuations are forward-looking and based on expectations of future growth.[105]

Despite the lack of empirical data on the relationship between the Universal Owners' equity portfolios and the wider economy, the linkages between externalities, GDP, and companies' future cash flows can be explained using a theoretical framework.[106] Conclusions from the theoretical equations (see Appendix IV on page 59 for further detail) show that if externalities highlighted in this report have a meaningful impact on the economy's future GDP as analysed (e.g. 11-18%), then externalities could also have a nearly identical meaningful impact on an institutional investor's portfolio future cash flows (e.g. 11-18%). Weakening of company cash flows could affect capital investment in growth opportunities, which in turn can lower dividends and long-term asset values.

CASE STUDY:

EUROPE PAYS THE PRICE FOR AIR POLLUTION

The World Health Organization has estimated that cutting particulate matter (PM) emissions to reduce air quality-related disease and deaths by around 15% could save the European Union up to € 190 billion (US$ 256 billion) per annum – or over 1.7% of GDP in 2005. Industry and transport could use cleaner fuels and improve energy efficiency to help cut PM emissions.

This helps to assess the risk that externalities could result in a deteriorating asset base with a significant impact on Universal Owners' equity portfolio cash flows and dividends. It is in the interests of institutional investors to identify how economy-wide externalities influence investment returns[107] and how equity holdings are exposed to environmental externalities that erode economic value.

If all public companies reduced external environmental costs, the best outcomes would result in capital markets maximising the pool of available natural capital over time. Corporations that excessively damage ecosystem services and pollute are inefficient in their use of natural resources and reduce profits for all in the long run. Business failure to cooperate and act collectively creates a problem of "free riders" and presents a barrier to addressing negative externalities.[108] Such market inefficiencies could be addressed through government action, market reform, or both.[109] Most companies will only be willing to address externalities if others do the same – whether through voluntary or mandatory means.

104. Chen, N., Roll, R. and Ross, S. (July 1986) Economic Forces and the Stock Market, Journal of Business, Vol. 59, No. 3: pp. 383-403.

105. Levine, R. and Zervos, S. (June 1998) Stock Markets, Banks, and Economic Growth, American Economic Review, Vol. 88, No. 3: pp. 537-558.

106. In this section the focus is on a theoretical framework for equities. Framework for bonds would be similar but not identical.

107. Hawley, J., Williams, A.T. (July/August 2000) The Emergence of Universal Owners: Some Implications of Institutional Equity Ownership, Challenge, Vol. 43, No. 4: pp. 43-61.

108. Macey. J.R. (2004) Efficient Capital Markets, Corporate Disclosure, and Enron, Cornell Law Review, Vol. 89, Issue 2, p. 394.

109. Dahlman, C.A. (1979) The Problem of Externality, Journal of Law and Economics, Vol.22, No.1: pp. 141-162.

> We see the Universal Ownership theory as an absolutely essential part of our investment philosophy – addressing externalities is crucial. Markets that are not working properly destroy value for participants and have inefficiencies. If a company is constantly externalising costs it is less efficient than its rivals. If the former is outcompeting the latter, this is not in the interest of company owners.

Paul Lee, Director, Hermes Equity Ownership Services

CASE STUDY:

COMPENSATION COSTS RISING FOR EU OIL INDUSTRY

A legal precedent was set in Europe in March 2010 when the Paris Court of Appeal found that general environmental damage caused by oil company Total S.A. was "on a par with economic harm to individuals or corporations for which companies must pay compensation." This allows for a value to be assigned to living organisms that have no commercial value, according to the League for the Protection of Birds.

The court confirmed Total's criminal responsibility for its failure to apply precautionary rules. An oil tanker it chartered in 2008 spilled 20,000 tonnes of crude oil off the French coast, killing thousands of birds and marine animals. Total has spent over € 370 million (US$ 497.7 million) on fines, damages to environmental groups, local governments and others involved in clean-up operations, as well as on pumping crude oil from the shipwreck, treatment and clean-up.[110,109]

Funds can be exposed to increased environmental costs from companies causing damage. Although specific companies may benefit from externalising costs in the short term, free riders are likely to have to pay a greater share of costs internalised in the future. Highly polluting companies could benefit most from managing their externalities to reduce exposure to:

- Rising insurance premiums and more restricted insurance policy terms and conditions.
- Shifts in marketplace demand towards products and services with lower environmental impacts.[112]
- Increased costs of capital driven by brand damage.
- Rising regulatory, legal and legislative compliance costs.
- Loss of license to operate.
- Operational and supply chain inefficiencies and disruptions that result in higher resource costs than sector peers.
- Stricter environmental liability regimes.

Companies are becoming increasingly liable for pollution costs. For instance, a Tort Liability Law in China strengthened legislation in 2010 to make companies that pollute liable for damage caused.[113] The EU Environmental Liability Directive (2009) makes operators financially liable for damage in order to prevent and remedy environmental damage to legally protected habitats and species, as well as to water resources and land.[114]

110. Update 3-French court upholds oil spill ruling vs. Total, Reuters UK, 30 March 2010, uk.reuters.com/article/2010/03/30/total-trial-idUKLDE62T0QR20100330, last accessed 2 February 2011.

111. www.total.com/en/press/press-releases/consultation-200524.html&idActu=2329, last accessed 2 February 2011.

112. For instance, Walmart aims to cut 20 million tonnes of GHG emissions from its global supply chain between 2010 and 2015. walmartstores.com/pressroom/news/9668.aspx, 25 March 2010.

113. www.mondaq.com/unitedstates/article.asp?articleid=92624&email_access=on, last accessed 2 February 2011.

114. www.defra.gov.uk/environment/policy/liability/index.htm, last accessed 2 February 2011.

Governments are increasingly applying the "polluter pays" principle to make companies bear the costs of reducing pollution and waste or compensate for the damage done to society. To reduce externalities incurred by taxpayers, governments can attribute external costs to different parties along the value chain involved in the supply and consumption of goods and services. OECD countries in particular are implementing measures to internalise environmental costs. Pollution costs are rising through:

- Regulations being strengthened by governments worldwide to protect human health and the environment. Companies with long-lived, capital-intensive infrastructure can incur significant abatements costs to comply with environmental performance standards and process requirements to control pollution and increase efficiencies.
- Increasing levels of fines and penalties for breaching environmental legislation.
- Lawsuits.
- Stricter environmental impact assessment requirements to obtain planning permission for developments and secure a license to operate. This reflects a shift from a focus on cleaning up and controlling damage to preventing it under the "precautionary principle".[115]
- Rising corporate taxation.
- Measures such as market-based instruments that enable cost-effective abatement (e.g. cap-and-trade programmes).[116]

The removal of environmentally damaging subsidies, such as over US$ 300 billion in fossil fuel subsidies in G20 countries,[117] and the surge in environment-related subsidies, tax breaks and other financial incentives, will change competitive dynamics. Heavy polluters will be more exposed to regulatory compliance costs.

Legal action and the cost of externality-driven bankruptcy may take years and billions of dollars to resolve, with effects on shareowners. Firms or industries unable to reduce environmental impacts or absorb environmental costs as they are internalised will have to raise the prices of products. This will increase incentives for other companies to produce substitutes with lower external costs.[118]

Abatement costs are usually lower than pollution damage costs – making companies responsible for damage can increase economic efficiency. Policy measures that internalise the external cost of damage from environmental degradation or pollution can help ensure that abatement costs are lower than pollution damage costs. The costs to firms of avoiding externalities under regulatory controls are lower generally than the costs of damages caused by environmental degradation. The US Environmental Protection Agency estimates that every dollar spent on air pollution control saves US$ 20 in healthcare costs alone.[119]

CASE STUDY:

BENEFITS OF CUTTING AIR POLLUTANTS OUTWEIGH COMPLIANCE COSTS IN THE US

A US Clean Air Interstate Rule created an emission trading system for oxides of sulphur (SOx) and nitrogen (NOx). The Acid Rain Program caused SOx emissions to fall by 56% between 1980 and 2008. Annual compliance costs of some US$ 725 million in 1995 compare with expected health benefits of US$ 85-US$ 100 billion per year by 2015. A related fall in particulate matter emissions would prevent up to 50,000 premature deaths annually.

115. www.sehn.org/wing.html, last accessed 2 February 2011.

116. For example, an emissions trading system (ETS) requires installations such as power generators and industrial plants to surrender one permit for each tonne of a pollutant emitted. Fewer permits are issued than the overall level of pollutants to set a cap on emissions and create a market. Firms that emit more than the number of permits held can buy allowances from others that have reduced emissions. Carbon pricing aims to make the cost of avoiding an additional tonne of a pollutant – known as the marginal abatement cost – equal to the long-term cost of damage done by each additional tonne of a pollutant – known as the marginal damage cost. The European Union implemented the world's first mandatory cap-and-trade programme for carbon dioxide emissions in 2005, and New Zealand launched a national ETS covering the six greenhouse gases under the UN Kyoto Protocol in 2008. National or regional carbon trading is planned in further major economies including Japan, South Korea and parts of China and the United States.

117. www.worldenergyoutlook.org/docs/weo2010/press_release.pdf, accessed 13 January 2011.

118. Dias, D., Repetto, R., Thomas, S. (2007) Integrated Environmental and Financial Performance Metrics for Investment Analysis and Portfolio Management, Corporate Governance: An International Review, Vol. 15, Issue 3: pp. 421-426.

119. Jaffe, A.B., Newell, R.G., Stavins, R.N. (2005) A tale of two market failures: Technology and environmental policy, *Ecological Economics*, Vol. 54, Issues 2-3: pp. 164-174.

It is in investors' financial self-interest to take a leadership role in analysing critical long-term risks and opportunities such as CO_2 emissions. Arguably, for trustees such as pension fund and foundation boards it is a key element of fiduciary duty. It is all too easy to put seemingly environmental issues like this into the box of 'politics', disconnected from investment policy-making. But, while investors can debate the appropriate course of action, there should be little disagreement that dire outcomes are possible and imminently material.

Seitchik (2007)[120]

If pollution costs, when internalised, are equal to or higher than the costs of avoiding damage, capital will be allocated to abatement technologies or less harmful technologies, processes or materials. Policies that change relative prices can stimulate research and development and the diffusion of cleaner alternative inputs, production methods and products.[121] Resource efficiency gains can be achieved relatively easily and cost effectively. Pollution prevention and innovation in energy and resource conservation have reduced costs and reinforced competitiveness in EU industries. The European Commission has estimated that eco-innovative products and technologies in sustainable construction, renewable energy, bio-based products and recycling in the EU could grow from € 92 billion (US$ 126 billion) in 2006 to € 259 billion (US$ 356 billion) in 2020.[122]

Fund beneficiaries stand to gain from action to reduce environmental costs

Reducing externalities from portfolio companies is in the interests of beneficiaries. Workers and retirees invested in pension funds are beneficial owners of companies. As such, they will ultimately pay the environmental costs that corporate externalities impose on taxpayers and other portfolio companies. Beneficiaries of funds invested in companies exposed to environmental costs could be at risk from lower pension payments in the future. They could also pay for corporate externalities through taxes.

Labour organisations such as the Service Employees International Union (SEIU), which represents more than two million workers in the US and Canada and more than one million pension plan participants, recognise the importance of externalities to pension fund beneficiaries. Dennak Murphy, Director of SEIU's Real Estate Capital Stewardship Program, said "Corporate externalities often disproportionately impact middle and low-income communities while depleting the budgets of local, regional and national plan sponsors. We therefore encourage fund managers to support the management and reduction of environmental and social externalities."

The risk that environmental externalities can affect the values of companies and risk-adjusted returns on investments prompted the Fonds de Réserve pour Les Retraites (FRR) to develop a strategy to integrate environmental factors into its investments.[123] FRR expects future natural resource shortages to constrain the economic environment as costs are applied or increase for non-renewable resources, contributing to higher inflation and lower economic growth. FRR acknowledges that the micro-economic impacts of climate change for certain regions, sectors or businesses are occurring already and likely to intensify. Protecting beneficiaries from the effects of climate change on portfolios is one of the fund's priorities.

The risk that externalities could harm institutional portfolios provides the financial rationale for fiduciaries to encourage portfolio companies to minimise environmental impacts. A 2009 report on fiduciary responsibility by the UNEP FI Asset Management Working Group concludes that environmental, social and governance (ESG) issues should be embedded in the legal contract between asset owners and asset managers, with the implementation of this framework being governed by trustees via client reporting. The study recommends that advisors to institutional investors, such as asset managers and investment consultants, have a duty to proactively raise ESG issues, and that responsible investment should be the default position for all investment arrangements.[124]

120. Seitchik, A. (2007) Climate Change from the Investor's Perspective.

121. Rayment M. et al (2009) The economic benefits of environmental policy, GHK, Sustainable Europe Research Institute (SERI), Transport & Mobility Leuven, VU University Amsterdam, Institute for Environmental Studies (IVM).

122. Ibid.

123. www.fondsdereserve.fr/IMG/pdf/FRR_working_document_environment.pdf, last accessed 2 February 2011.

124. UNEP FI (2009) Fiduciary responsibility – Legal and practical aspects of integrating environmental, social and governance issues into institutional investment.

CASE STUDY:
CHINA CONNECTS POLLUTION COSTS TO COMPANIES AND INVESTORS

The Chinese government's *Green National Accounting Study Report* states that pollution cut GDP by 3.1% in 2004, whereas abatement costs would account for just 1.8% of GDP.[125] Price-sensitive sectors with higher abatement costs are more resistant to pollution controls.

Economic instruments are increasingly being used to control pollutants. Firms that breach environmental legislation can face daily fines or be forced to stop production. For instance, Sinopec Guangzhou Co paid 20 million Yuan (US$ 2.9 million) in discharge fees and penalty fines in 2008 for emitting toxic materials such as sulphur.[126]

Authorities should report pollution offences to the People's Bank of China, securities industry regulatory bodies, commercial banks and credit institutions and/or the Securities and Futures Commission so that finance-related penalties can be applied.[127] China's Green Credit policy, introduced in 2007, restricts access to commercial credit for companies that fail to comply with pollution controls. Banks are to stop making loans to energy-intensive and highly polluting businesses. Loans can be refused or called in if companies breach environmental regulations. Some 38 companies were blacklisted in 2008, with 12 banned from obtaining loans. In one province, more than US$ 137 million in loans were called in.[128]

Foreign direct investment in China was US$ 108 billion in 2008. China plans to use environmental protection and land-use intensity indices to ensure foreign-funded businesses use capital more effectively.[129] Regional economic planners are to assess issues such as capital input in environmental protection before approving foreign-funded enterprises.

A Green Securities policy requires companies in 13 heavily polluting industries to pass an environmental assessment before listing on a stock exchange or refinancing, while a Green Insurance policy requires businesses at risk of pollution incidents to acquire adequate insurance to compensate for environmental damages. The government also aims to use taxes and emissions trading to address environmental pollution.

CASE STUDY:
ABATEMENT COSTS FOR US FIRMS ARE LOWER THAN POLLUTION DAMAGES

Penalties for non-compliance with environmental standards can internalise some pollution costs. In 2008, criminal fines for environmental breaches in the US totalled US$ 167 million.[130] Polluters faced greater costs under the EPA Superfund Enforcement programme, which requires companies to pay for clean-up of sites they have polluted. Companies had to pay US$ 11.8 billion in pollution controls, clean-up and environmental projects in 2008.

Almost half of the pollution reductions were to come from American Electric Power (AEP), through one of the largest environmental settlements in history at US$ 4.6 billion. Abatement measures required of AEP are expected to save over US$ 32 billion in health costs.[131] The EPA plans to introduce financial assurance requirements to ensure owners and operators of facilities that manufacture chemicals, produce petroleum and coal products, or generate electricity are able to pay to clean up their environmental releases to reduce the burden on taxpayers.[132]

125. www.gov.cn/english/2006-09/11/content_384596.htm, last accessed 2 February 2011.

126. Chung, O. (17 April 2010) China's listed polluters made public, Asia Times.

127. www.chinaenvironmentallaw.com/2009/03/27/chinas-new-environmental-penalty-opinion/, last accessed 2 February 2011.

128. www.china.org.cn/english/environment/242659.htm, last accessed 2 February 2011.

129. www.chinadaily.com.cn/bizchina/2009-02/20/content_7497244.htm, last accessed 2 February 2011.

130. www.epa.gov/oecaerth/data/results/annual/index.html, last accessed 2 February 2011.

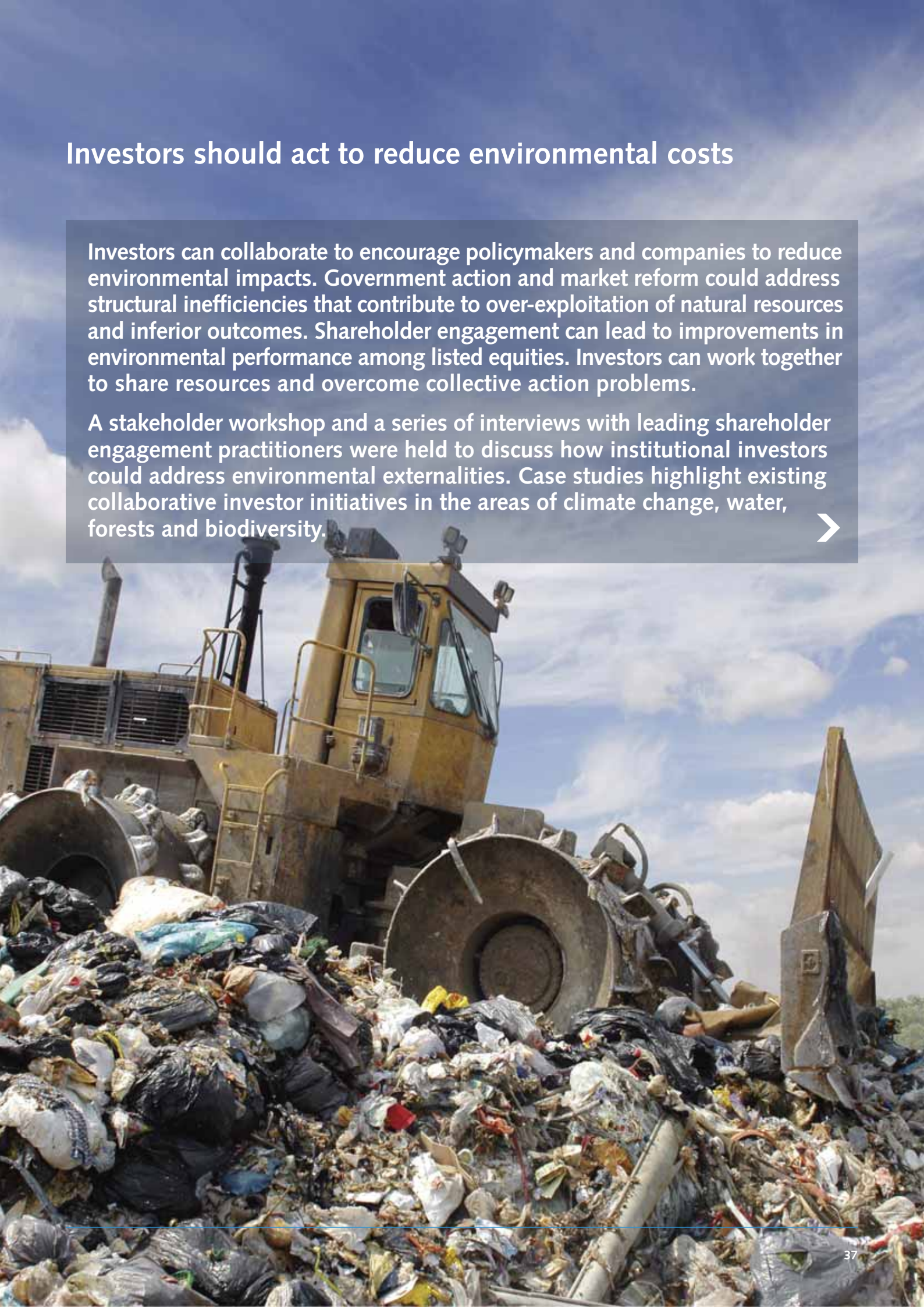
131. www.aep.com/investors/annrep/08annrep/AepAnnRpt2008.pdf, last accessed 2 February 2011.

132. yosemite.epa.gov/opa/admpress.nsf/d985312f6895893b852574ac005f1e40/a8c0942a295468338525769c00689c70!OpenDocument; www.epa.gov/superfund/policy/financialresponsibility/index.html, last accessed 2 February 2011.

Investors should act to reduce environmental costs

Investors can collaborate to encourage policymakers and companies to reduce environmental impacts. Government action and market reform could address structural inefficiencies that contribute to over-exploitation of natural resources and inferior outcomes. Shareholder engagement can lead to improvements in environmental performance among listed equities. Investors can work together to share resources and overcome collective action problems.

A stakeholder workshop and a series of interviews with leading shareholder engagement practitioners were held to discuss how institutional investors could address environmental externalities. Case studies highlight existing collaborative investor initiatives in the areas of climate change, water, forests and biodiversity.



Investors can encourage policymakers to implement measures that sustain natural capital and reduce pollution

Responsible investment activities can include public policy engagement to proactively address environmental, social and governance (ESG) issues. Many of the investors interviewed as part of this project agreed that seeking improvements to regional, national, or international policy frameworks is the most effective way for investors to reduce environmental externalities. Improved policy frameworks are needed to protect ecosystem services and reduce environmental externalities driven by structural inefficiencies. Institutional investors could explore the potential to support policies and incentives that help correct market failures and internalise costs. Stronger policies would level the playing field for companies, while reducing environmental damages.

Investors can also support calls for stronger reporting frameworks and accounting standards, which would require companies to report on environmental impacts and potential liabilities. For example, investors could support the efforts under way in relation to integrated reporting through the International Integrated Reporting Committee, or the Sustainable Stock Exchanges, an initiative convened by the PRI, UN Global Compact, and United Nations Conference on Trade and Development (UNCTAD). It aims to encourage authorities of global stock markets to consider actions they can take to encourage better ESG disclosure. Disclosure of the full financial costs of environmental impacts would make it easier for analysts and fund managers to assess and manage the potential materiality of corporate environmental impacts.

Interviews revealed that investors face a range of challenges in engaging effectively with policymakers and regulators on environmental externalities.
These include:

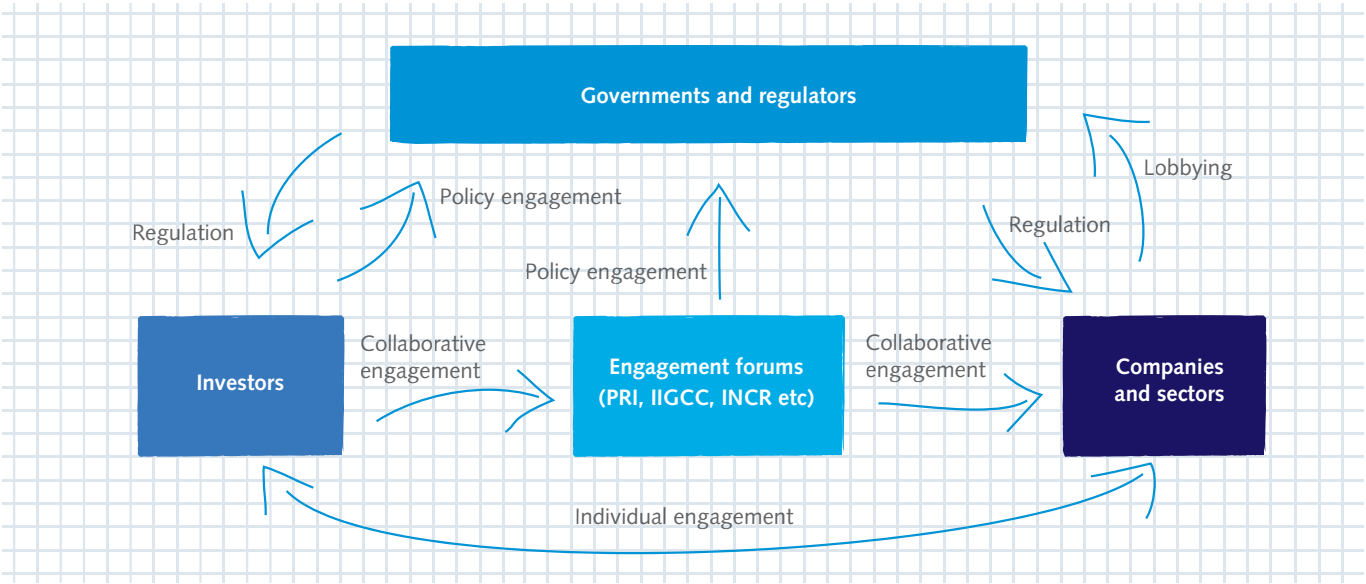
- **Need for expertise:** Engaging to influence policy change and address specific externalities requires greater resources and different competencies than are typically used in engagement with companies. To date, most engagement efforts with policymakers have centred around the need for better disclosure of material risks to enable investors to assess potential consequences on their portfolios.
- **Long-term commitment:** The uncertain and long-term financial impact of externalities makes it difficult for investors to resource long-term policy engagement. Policy engagement requires a long-term vision, over at least a 5-10 year horizon, as well as patience and the commitment to sustained dialogue needed to see changes through.
- **Business lobby activities:** Business-led coalitions with direct interests in policy outcomes can seek concessions that are at odds with the interests of long-term investors. These coalitions are often well resourced and sophisticated in promoting their short-term interests through lobbying.
- **Lack of incentives for asset managers:** Asset owners seeking responsible asset managers or purchasing engagement services often focus on engagement with companies, rather than addressing long-term policy challenges. This can reduce the incentive for asset managers to devote resources to engagement focused on long-term systemic risks (see "Stronger mandates for asset managers can support engagement on externalities" on page 50).

Institutional investors could act on recommendations featured in this section to help meet these challenges.

> "Engaging on a company or sector level is often less efficient than trying to get policies changed. Sometimes engaging with the market or the framework within which all the companies operate can be a more efficient way for Universal Owners to address externalities."

David Russell, Co-Head of Responsible Investment, Universities Superannuation Scheme

DIAGRAM 4:
Possible engagement mechanisms for addressing externalities



Seeking systemic change to protect natural assets

Collaboration can facilitate investor engagement with policymakers. Some institutions find it difficult to justify expenditure and long-term commitment to engagement from which other investors would benefit.[133] Collaboration among groups of asset owners and managers provides a means of collective action, which can help overcome this "free rider" effect, as well as a lack of resources or expertise (see box: "Effective collaboration"). Forums such as the PRI Engagement Clearinghouse and Public Policy Network, and investor networks on climate change such as the Institutional Investors Group on Climate Change (IIGCC), the Investor Group on Climate Change Australia / New Zealand (IGCC), the Investor Network on Climate Risk (INCR), and UNEP FI's Climate Change Working Group (CCWG), provide tools and platforms for investor dialogue with policymakers.

The UK's Local Authority Pension Fund Forum (LAPFF), which brings together local authority pension funds with combined assets of over US$ 100 billion, sees collaboration as a powerful tool to share resources and influence. LAPFF Chair Ian Greenwood said, "Clearly shareholders cannot tackle [climate change] alone, which is why LAPFF believes that collaborative engagement is vital. If investors are to play an active role, as we believe they should, then we have to work together."[134]

Significant examples of collaborative initiatives on climate policy include INCR's engagement campaign that prompted the US Securities and Exchange Commission to issue interpretive guidance on climate risk in February 2010 (see case study), and the 2009 and 2010 Investor Statements on Climate Change.

133. Johnson, M. (6 October 2010), Responsibility debate comes to the fore, Financial Times.

134. www.lapfforum.org/pubs/press_coverage/CCProfPensions1108.pdf, last accessed 2 February 2011.

> "Universal Ownership theory and the notion that investors should care about externalities is part of the bedrock principles of responsible investment – investors will pay at some point even if they don't know the cost now – for example, liabilities from the Exxon oil spill, or use of asbestos and bankruptcies. Success [in influencing regulators] takes time."

Julie Gorte PhD, Senior Vice President for Sustainable Investment, Pax World

CASE STUDY:

ENGAGEMENT WITH THE US SECURITIES AND EXCHANGE COMMISSION DELIVERS RESULTS

SUMMARY

- Investors filed several petitions urging the US Securities and Exchange Commission (SEC) to issue guidance on climate change disclosure. Twenty investors with US$ 1 trillion in assets under management supported the 2009 petition.
- As a result, the SEC issued interpretive guidance that clarifies the climate-related "material" effects on businesses that publicly listed companies should disclose to investors. This is the first economy-wide climate risk disclosure guidance in the world.

SUCCESS FACTORS

- **Long-term engagement and persistence** contributed to the success of the engagement with public policymakers. The initiative lasted three years between 2007 and 2009 before it resulted in a successful outcome.
- **A broad and diverse coalition of investors** increased the power of collaboration.
- **Making a clear business case for change** enabled investors to demonstrate to the SEC that climate risk was material for them.
- **Data to support the engagement** demonstrated to the SEC that companies were under-reporting and inconsistently disclosing climate risks. Investors analysed companies' 10-k reports and filings.

OPPORTUNITIES

- **Potential for engagement with regulators in other geographies.** Investors in locations with limited disclosure of material climate change risks and opportunities among publicly listed companies could consider similar engagements with regulatory bodies.
- **Engagement could be broadened to other externalities.** Investors could call for regulators to issue guidance on corporate disclosure of other potentially material risks, such as water availability and liabilities related to biodiversity.

Anne Stausboll, CEO of the California Public Employees' Retirement System, said: "We're glad the SEC is stepping up to the plate to protect investors. Ensuring that investors are getting timely, material information on climate-related impacts, including regulatory and physical impacts, is absolutely essential. Investors have a fundamental right to know which companies are well positioned for the future and which are not."[133]

More information: www.incr.com

133. www.ceres.org/Page.aspx?pid=1194, last accessed 22 March 2010.

The PRI Public Policy Network

The PRI Public Policy Network aims to increase the visibility of responsible investment through four key activities:

- **Public sector support for responsible investment** – Explore how public sector agencies can work with investors to enhance corporate sustainability across environmental, social, corporate governance and financial aspects.
- **Greater investor participation in the public policy process** – at a national level and UN and multilateral level, and through quasi-regulators such as stock exchanges and accounting standards boards.
- **Encourage government funds to adopt RI policies and integrate ESG issues** – Governments, either through public procurement or through government pension funds, can become responsible investors.
- **Public-private investment opportunities** – Public sector participation can catalyse investment in ways that can deliver on public policy goals and generate commercial returns in areas such as clean tech, microfinance, development infrastructure and sustainable venture capital.

The 2010 Investor Statement on Climate Change called for progress on climate policy at a national level, including improved policy frameworks on renewable energy, energy efficiency, and low-carbon infrastructure. It also urged international progress in areas such as financial architecture of climate funding, a programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+), improvements to measurement, reporting, and verification of emissions, and international finance tools that could mitigate risk to encourage greater climate-related investments in developing countries.

The statement was sent to national governments and climate negotiators prior to the UN Framework Convention on Climate Change (UNFCCC) talks in Mexico, and served as a basis for dialogue with policymakers. While a binding international agreement for emission reductions from 2013 onwards has not been reached yet, this process has established a strong precedent for global investor collaboration on climate policy, and provided a clear message and agenda from the financial community to policymakers. UNFCCC Executive Secretary Christiana Figueres told delegates at an event in New York in 2010, "Government will be bolder if they are told that they can do so by investors and businesses."[136]

Investor interviews highlighted several opportunities for future collaborative engagement on public policy – for example, international and local investors could collaborate more to back stronger policy frameworks on environmental externalities in emerging markets. Investors could also work more closely with investee companies and industry bodies to support greater regulatory certainty and develop common positions on the regulatory changes that are needed, for example in climate or energy policy. In some cases greater cooperation between business leaders and investors could help to overcome political difficulties faced by governments seeking to reduce environmental damage. Investors and companies could also collaborate where policy changes are required to address externalities at a regional level – for example, to improve watershed management.

Investors can also build on progress made in areas such as REDD+,[137] encouraging policymakers to create conditions for a strong and consistent market environment to protect forests and other ecosystem services.

136. www.bloomberg.com/news/2010-09-20/climate-deal-in-cancun-may-hinge-on-companies-lobbying-un-s-figueres-say.html, last accessed 2 February 2011.

137. Eliasch, J. (2008) Climate Change: Financing Global Forests, The Eliasch Review, UK Office of Climate Change, Environmental Valuation Reference Inventory.

CASE STUDY:

CLIMATE NETWORKS CAN SUPORT INVESTOR ACTION ON CLIMATE CHANGE

Networks include the Institutional Investors Group on Climate Change (IIGCC), the Investor Group on Climate Change Australia / New Zealand (IGCC), the Investor Network on Climate Risk (INCR), and UNEP FI's Climate Change Working Group (CCWG).

KEY STRENGTHS

- **Bringing investors together.** Dedicated climate networks have acted as a focal point for expertise. They have brought together large numbers of investors to articulate their requirements for long-term, credible policy frameworks.
- **Overcoming barriers related to the lack of resources.** Significant resources are needed for sustained policy advocacy. Networks can provide centralised coordinating capacity enabling investors to plan and act over the long term.
- **Promote greater understanding and awareness of climate change.** These groups can develop and share tools that enable investors to systematically integrate climate change factors into asset allocation and strategic decision-making.

ACHIEVEMENTS

- **International collaboration on climate policy.** IIGCC, IGCC, INCR, UNEP FI, with the support of the PRI, have collaborated on investor statements on climate change, which serve as a basis for policy dialogue. The most recent Statement, in November 2010 in advance of UNFCCC negotiations in Cancún, was supported by a record 259 investors with over US$ 15 trillion in assets under management, making this the largest ever investor collaboration on climate policy.
- **Engagement with regional policy makers.** Investor groups can provide expertise and collective resources needed to engage with regional policy makers. Recent initiatives have included INCR's statement calling for the US government to extend renewable energy tax credits; IIGCC's work on policy statements at EU level; and IGCC's engagement with Australian public policymakers on issues such as emissions trading and company disclosure, and the reform of renewable energy policies.
- **Seeking to improve disclosure in carbon-intensive industries.** IIGCC, INCR and IGCC have collaborated on the development of sector-specific disclosure guidelines for industries such as oil & gas, which have been incorporated into Carbon Disclosure Project questionnaires. INCR has also coordinated hundreds of shareholder resolutions aimed at improving corporate disclosure and governance of climate risks and opportunities among US companies.

Investors can encourage policymakers to:

- **Provide long-term certainty on policy direction** towards reducing externalities and protecting natural resources at national, regional and international levels.
- **Implement incentives or regulation** to correct market failures and encourage internalisation of costs.
- **Require companies to report systematically on environmental impacts.** Regulators and accounting standards bodies should be encouraged to develop more robust guidance on evaluating the materiality of environmental issues for inclusion in financial reporting.
- **Incorporate valuations of natural capital assets into economic analysis and decision-making** to address distortions between the market value of goods and the value of related damages from natural resources use, pollution and waste.
- **Implement science-based precautionary measures** that aim to avoid sudden, high-impact changes from the use of ecosystem services.

> "The assessment of the external costs generated by their investments enables investors for the first time to properly quantify in financial terms the environmental impacts of their portfolios. Reducing these costs will increasingly become a core part of investment analysis, corporate governance and policy dialogue."

Nick Robins, Head, Climate Change Centre of Excellence, HSBC

Universal Owners can use shareholder engagement to influence corporate behaviour and address financial risks from externalities

Seeking changes to market conditions is a crucial means to reduce externalities. However, in the absence of appropriate policy frameworks investors can also influence companies to reduce the environmental damage they cause. Universal Owners have clearly defined rights and responsibilities in relation to equity ownership, and can use company engagement, shareholder resolutions and active proxy voting policies to reduce risk from externalities related to their investments.[138]

CASE STUDY:

CORPORATE SUSTAINABILITY INITIATIVES

- **World Business Council for Sustainable Development Vision 2050:** Provides a platform for businesses to contribute to exploring changes in governance, structures, economic frameworks, business and human behaviour to develop more sustainable companies by 2050.[139]
- **World Economic Forum Task Force on Low-Carbon Economic Prosperity:** Over 80 business leaders are helping to develop proposals to accelerate private sector investment and innovation to address greenhouse gas emissions.[140]
- **UN Global Compact:** Initiatives such as Caring for Climate or the CEO Water Mandate provide frameworks for business leaders to improve performance and support public policies on water and climate change.
- **The World Resources Institute Markets and Enterprise Group:** Encourages businesses to incorporate environmental and social opportunities into business strategies.[141]

Institutional investors can engage with portfolio companies to seek pollution reductions and more efficient resource use. Targeting laggards in a sector can create significant progress across an industry. Investor interviews also highlighted the benefit of engagement with industry leaders – by influencing the largest companies, and encouraging them to engage with their suppliers, investors can help to raise the bar across a sector. Targeting companies that contribute most to externalities, such as those in key sectors identified in this study – Electricity, Oil & Gas Producers, Industrial Metals & Mining, Food Producers and Construction & Materials – could create a ripple effect across industries and within supply chains. Over time this can reduce portfolio exposure to externality costs.

Investors can also encourage industry bodies or multi-stakeholder initiatives to raise standards in environmental governance and performance through codes or guidelines at a sectoral or multi-sectoral level. This can help to resolve collective problems for which companies are hesitant to internalise environmental costs without their peers doing so. For example, to reduce externalities related to deforestation caused by growth in commodity production, investors could engage with multi-stakeholder roundtables such as the Roundtable on Sustainable Palm Oil or the Roundtable on Responsible Soy, to help ensure codes and standards are robust and encourage their take up by companies across supply chains. Investors can also encourage companies to participate in voluntary industry initiatives, which can drive improvements in environmental performance and help share best practice and innovation (see "Corporate sustainability initiatives").

Investors may also wish to engage with companies on how they seek to influence public policy. Investors should encourage companies to disclose their lobbying efforts, and engage with companies where lobbying positions are counter to the long-term interests of Universal Owners. As noted, there is some scope for investors and companies to work together to encourage policymaking that strengthens measures to reduce externalities.

138. Marathon Club (2008) Responsible Ownership for the Long Term: Briefing Paper for Trustees.
139. World Business Council for Sustainable Development (2010) Vision 2050: The new agenda for business.
140. www.weforum.org/en/initiatives/ghg/index.htm, last accessed 2 February 2011.
141. www.wri.org/markets, last accessed 2 February 2011.

> "Due to our size we own the whole market so the connection is fairly simple for us. We've always taken the Universal Owner idea as we have to use our leverage as owners of the companies – partly because we have limited ability to sell, and also because there is little we can do to integrate externalities into the investment process because it does not necessarily affect the valuation of the companies when they externalise their costs. The way to deal with externalities is through engagement and by improving the governance process. We are becoming more convinced that collaboration is necessary – investors have more power collectively when addressing issues with companies."

John Wilson, Director of Corporate Governance, TIAA-CREF

Effective collaborative engagement

Engagement programmes that are backed by the value of combined assets can have more impact than engagement by individual investors that have relatively small stakes in listed companies and are acting alone. Engaging collaboratively provides opportunities to pool resources and expertise and share tasks, making collaboration a cost-effective way for asset owners and managers to address environmental externalities. Collaboration can also make it easier for companies or policymakers to engage in dialogue by providing the opportunity for them to interact with a single group of institutions. However, the negotiation process requires the commitment of resources to identify and agree on a common position among a diverse group of investors. Collaborative efforts also require administrative and monitoring costs to coordinate activities and limit free riding. The following are recommendations for effective collaborative engagement with companies and policymakers:

- **Agree a common position:** Develop a common vision among investors, to provide a main point of reference during the engagement process.
- **Persistence and long-term commitment:** Focus on key policy changes or environmental risks to be addressed, and keep the group committed to work toward these over the long term.
- **Two-way dialogue:** Consider dialogue as an opportunity for investors to express opinions, hear different views and constructively discuss potential solutions.
- **Business case:** Communicate the materiality of the issue to portfolios in terms of exposure to environmental costs and risks, as well as opportunities. Demonstrate the business case for companies to meet basic investor expectations on disclosure or performance.
- **Commitment from the top:** Secure commitment at a senior level (e.g. CIOs, CEOs) within financial institutions taking part in engagement.
- **Clear communication within the group:** A third-party coordinator can help resolve collective action issues and ensure that the workload is shared.
- **Monitoring implementation:** Investors can continue to engage with companies and policymakers on the implementation of commitments made as a result of dialogue.
- **Escalation process:** For engagement with companies, investors can adopt an escalation strategy for companies with unsatisfactory responses. Escalation methods can include filing shareholder resolutions, issuing a public statement or press release, or, as a last resort, divesting.

Engaging to address specific externalities

Universal owners can incorporate external environmental costs into collaborative engagement initiatives. Key findings from this study and others, such as the TEEB review, can inform shareholder engagement by helping investors to identify the materiality of environmental costs to their portfolios. Data on externalities can reveal sources of financial exposure to environmental costs, where externalities come from and who "owns" them. Investors could establish whether companies that externalise environmental costs pose financial risks to other portfolio assets such as bonds, property, infrastructure and commodities. This data can be used to analyse the implications of specific externalities for market trends and sectors. For example, Hermes Equity Ownership Services uses an analysis of externalities associated with companies in investment portfolios to help identify the most significant issues to engage on in the long-term interests of asset owners.

Universal Owners can identify holdings that have the greatest potential to reduce resource use and pollution, and collaborate with other shareholders on engagement programmes to reduce those impacts. As with policy engagement, investor collaboration can provide a cost-effective means for investors to pool resources and expertise, and can enhance influence in dialogues with investee companies.

Universal Owners can integrate carbon costs into engagement programmes to help address climate risk. Universal Owners could address the most substantial environmental externality identified in this study – greenhouse gases – by modelling carbon cost scenarios to identify the potential materiality of emissions from portfolio companies over time. Carbon data can be used to understand which companies, sectors and regions are contributing most to climate risk. Investors could then design collaborative engagement programmes to mitigate emissions from portfolio companies on a regional or sectoral basis.

Initiatives such as the Carbon Disclosure Project (CDP) encourage corporate disclosure on climate change and can provide a useful basis for collaborative investor engagement. To date, many investor engagement initiatives have focused on improving the quality or level of companies' climate disclosures through the CDP. For example, through the PRI Engagement Clearinghouse, investors have requested companies disclose their emissions and emissions reduction programmes. There is scope to use CDP and other climate data as a basis to seek absolute emissions reductions among companies in carbon-intensive sectors, which could help reduce risk exposure for Universal Owners.

CASE STUDY:

ENGAGEMENT THROUGH THE CARBON DISCLOSURE PROJECT

- CDP is the largest investor initiative on an environmental issue – with over 500 institutional investors annually requesting the world's largest companies to disclose details on climate change strategy and performance.
- CDP provides a standardised framework for reporting climate change risks and opportunities, which makes it an ideal platform for additional investor engagement.
- Since 2008 the PRI and CDP have facilitated joint collaborative engagements using CDP data. A coalition of 34 investors, with US$ 3.7 trillion assets under management, has engaged with 92 companies in emissions-intensive industries to encourage them to disclose emissions data, along with reduction targets and plans. In 2010-11 the group pursued further dialogue with a subset of the companies to encourage continued improvement in reporting.
- There is scope for further collaborative investor initiatives based on company disclosures. For example, applying shadow carbon costs or projected carbon market prices to companies' emissions data, seeking emissions reductions in carbon-intensive sectors, and improving disclosures among companies in emerging markets.

Jack Ehnes, CEO of California State Teachers' Retirement System said: "CDP data is essential for our corporate governance engagement to boost the long-term value of the teachers' pension fund. Our use of data... targets companies and market sectors for efficient resources. We depend on credible, solid CDP data for voting our proxies and as a screen for our performance-based focus list that we do each year."

More information: www.cdproject.net

> "Public policy has not caught up with the real-world dynamic and therefore investors have a role to play in taking leadership to drive the progression of issues such as use and ownership of local water resources. In the case of ownership issues around the watershed, investors should encourage the companies they invest in to use relevant public policy engagement tools."
>
> Lara Yacob, Senior Engagement Specialist, Robeco

The PRI Engagement Clearinghouse

PRI signatories implement six high-level, aspirational principles, including a commitment to work with other investors to be active owners and incorporate environmental, social and corporate governance issues into ownership policies and practices. The PRI Engagement Clearinghouse, established in October 2006, is a private online forum that enables PRI signatories to collaborate to seek changes in company behaviour, public policies or address systemic issues. Since its inception, more than 270 collaborative initiatives have been proposed, and almost 250 PRI signatories have participated. By working with other like-minded investors, signatories can create a stronger and more representative shareholder voice, and can pool resources to make active ownership more affordable and effective.

There are opportunities for engagement on waste and pollutants – SOx, NOx, PM, VOCs and heavy metals. Shareholder engagement has been used to address some specific waste and pollution issues. For instance, an Investor Statement on Sustainability Reporting in Emerging Markets in April 2010 highlighted the importance of disclosing environmental performance data for investors to evaluate competitive positions based on firms' compliance with regulations and standards that aim to address hazardous waste from electronic and electrical equipment.[142] Several investors have also filed shareholder resolutions to identify risks from mercury pollution[143] and engaged with companies to raise concerns about potential liabilities from air, land and water pollution due to practices to develop unconventional energy sources.[144]

However, limited investor initiatives to reduce pollution and waste present an opportunity for innovation in future engagement programmes. Investors could identify externalities from polluting companies to assess the financial implications of potential liabilities or abatement costs for portfolios. Information on exposure to external costs for air pollution and waste could be used to support collaborative engagement programmes.

Reducing externalities related to water abstraction and natural resources at a company level requires more comprehensive reporting by companies. The complexity of ecosystem services, and a lack of agreed metrics and indicators, makes it more difficult to apply external costs to corporate water and natural resource use and to measure companies' performance in a comparable way. Limited data and disclosures, and the need to assess natural resource impacts and risk within local contexts, can present barriers to developing engagement. Investors can support the development of indicators and metrics that can be used as a basis for improved disclosure and future engagement.

Investors can share knowledge through commissioned research to inform active ownership practices. For instance, JP Morgan, Merrill Lynch, Citi and Morgan Stanley released water-focused reports in 2008. Ceres produced an in-depth assessment and ranking of the water disclosure practices of 100 publicly listed companies in eight high-risk sectors in February 2010. UBS and Bloomberg Professional provided analytical and data support to help showcase best practice and key gaps and trends in water reporting, and provide recommendations for companies and investors.

Investors can engage to seek improvements in management of natural resources. While it is more difficult to apply external environmental costs to water and natural resource use, Universal owners can identify gaps in companies' policies and practices and engage to encourage improvement in their management of ecosystem services impacts and dependence. For example, through the PRI Engagement Clearinghouse, investors have collaborated to encourage companies to sign up to the CEO Water Mandate, a UN Global Compact initiative which aims to help companies develop, implement and disclose water sustainability policies and practices (see case study).

142. socialinvest.org/projects/iwg/emdp.cfm, last accessed 14 January 2011.

143. www.iehn.org/resolutions.shareholder.detail.php?pageid=69, last accessed 14 January 2011.

144. asyousow.org/health_safety/Frack.shtml, last accessed 14 January 2011.

CASE STUDY:

ENGAGEMENT ON THE CEO WATER MANDATE

SUMMARY

- The CEO Water Mandate is a public-private initiative created by the UN Global Compact.
- In December 2008, a US$ 1.5 trillion investor coalition of PRI signatories asked CEOs of 100 of the world's biggest companies to join the CEO Water Mandate.
- As a result, 21 companies or roughly 29% of all Mandate endorsers joined the initiative by November 2010. They include major companies such as Nike, Cadbury, GlaxoSmithKline and Bayer AG.

KEY FEATURES

- **The increasing importance of water issues:** The Mandate provides companies with a platform to exchange views and best practice on issues that go beyond basic water disclosure, such as integrated watershed management and public policy.
- **Relationship building:** Securing buy-in from water or CSR experts was crucial. Investors also added the issue to on-going discussions to build on existing shareholder engagements. Response rates were higher where investors had existing relationships with companies.
- **Long-term, persistent engagement:** Since 2008, steering committee members Connecticut Retirement Plans and Trust Funds, Robeco and Calvert have continued to engage with the remaining companies via webinars and conference calls.

More information: www.unglobalcompact.org

Universal Owners such as Norges Bank Investment Management (NBIM), which manages the US$ 464 billion Norwegian Government Pension Fund-Global, are outlining expectations for companies on governance, management, and strategy in relation to issues such as water management and climate change. To promote best practice and compliance with existing standards, NBIM based its water programme on initiatives including the UNESCO World Water Assessment Programme and the UN Global Compact CEO Water Mandate. NBIM assesses all companies in high-risk sectors and regions and identifies the 450 largest holdings in order to target the worst performers. It then engages with up to 30 of these companies on their water management and water risk policies. The fund owns approximately 1% of the world's companies and influencing their water management practices could have a significant impact.

Investors can also support collaborative initiatives that aim to improve companies' transparency and policies, strategies, and management of impacts on natural resources. Initiatives such as CDP Water Disclosure, Forest Footprint Disclosure (FFD), and the Natural Value Initiative (NVI) Ecosystem Services Benchmark encourage companies to identify risks and opportunities and disclose their policies, strategies and practices in relation to ecosystem services.

These initiatives can drive companies to better understand their impacts and dependence on ecosystem services, which can reduce risk and lead to performance improvements. Table 4 highlights some of the strengths, challenges and opportunities related to current initiatives on ecosystem services.

CASE STUDY:

NBIM INVESTOR EXPECTATIONS ON WATER MANAGEMENT

- Have a clear strategy regarding water management.
- Conduct water footprint and risk analysis.
- Have a preventive and corrective action plan for identified risk.
- Implement supply chain management systems.
- Establish monitoring systems for environmental and social impacts of activities with regards to water, including sustainable water measures.
- Consult and/or collaborate with stakeholders.
- Set out a clear policy on water management.
- Establish a transparent and well-functioning. governance structure.
- Measure and report performance.

TABLE 4.
COLLABORATIVE INVESTOR INITIATIVES ON ECOSYSTEM SERVICES

	Summary and key features	Challenges and further opportunities
CDP Water Disclosure	■ Building on the CDP framework, CDP Water Disclosure asks companies for information on water-related risks and opportunities, including water management plans and supply chain risks. ■ Focuses on a subset of approximately 300 companies that are exposed to water risk. ■ CDP Water Disclosure achieved an impressive response rate of 50% in its first year.	■ **Gathering more investor support**. More mainstream investors are starting to address water-related risks. ■ **Eliciting information disclosures**. CDP and PRI are planning a collaborative engagement that will encourage non-responding companies to participate in the future. ■ **Aligning initiatives** such as CDP Water Disclosure and CEO Water Mandate's Communication on Progress – Water can help address "questionnaire fatigue".
Natural Value Initiative (NVI)	■ The Natural Value Initiative Ecosystem Services Benchmark (ESB) helps investors to assess companies' responses to ecosystem services risks and opportunities.[145] ■ The benchmark has been applied to the food, beverage and tobacco sectors, along with the mining and energy sectors. ■ It addresses risks arising from dependence on ecosystem services as well as companies' impacts. ■ The NVI and the ESB have helped to build understanding and capacity of investors and participating companies in the emerging area of ecosystem services.	■ **Additional engagement is needed to improve companies' practices.** Results from the initial benchmark were poor, with only one company falling in the "best practice" category.[147] ■ **Poor disclosure is an obstacle.** Lack of disclosure, particularly in emerging markets, poses a challenge to the research process. ■ **Performance metrics and indicators are needed.** The ESB focuses on policies and processes as a proxy, as metrics and indicators to understand companies' performance are still being developed. This is a barrier to further engagement. ■ **Benchmark results are not publicly disclosed.** This may improve company participation, but limits application of findings.
Forest Footprint Disclosure (FFD)	■ Similarly to CDP, FFD requests information on companies' approaches to risk assessment, traceability, standards and target setting, reporting, and governance in relation to deforestation impacts. ■ The questionnaire is sent to over 200 companies in key sectors, including agribusiness, building materials, commodities, chemicals, biofuels, clothing & footwear, retailers, food, consumer goods, and forest & paper. ■ Raises awareness of supply chain risks and opportunities. The FFD reporting process can help companies identify deforestation risks and supply chain opportunities. ■ Companies' responses are available to participating investors, and provide a basis for further engagement. The public *Annual Review*[146] also identifies best practice case studies.	■ **Potential for further engagement.** The relatively low response rate (16%) among targeted companies in the first year suggests that there is further scope for investors to engage with companies on this issue. ■ **Stand-alone approach to deforestation.** The FFD focuses on deforestation and its links with climate change. A step-by-step approach may help investors and companies engage in a manageable way, but over time this should be integrated as part of a broader approach to ecosystem services and biodiversity. ■ **Benchmark results are not publicly disclosed.** However, they are available to endorsing investors.

145. http://www.naturalvalueinitiative.org/download/documents/Publications/EcoSysBenchmark.pdf, last accessed 2 February 2011.

146. Campbell, K.T., Crosbie, L., Howard, R., Mitchell, A. and Ripley, S. (2010) The Forest Footprint Disclosure Annual Review 2009, Global Canopy Programme.

147. Grigg, A., Cullen, Z., Foxall, J., and Strumpf, R. (2009) Linking shareholder and natural value, Managing biodiversity and ecosystem services risk in companies with an agricultural supply chain, Fauna & Flora International, UNEP FI and Fundação Getulio Vargas.

CASE STUDY:

F&C ENGAGEMENT ON PALM OIL AND DEFORESTATION

Stronger management of deforestation reduces risks associated with illegal deforestation and strengthens the sustainability of palm oil production, a raw material used in a variety of consumer products. F&C has engaged with companies in the palm oil industry as well as with global public policymakers, pressing for solutions to curb deforestation in South East Asia. F&C has encouraged Unilever, Kraft Foods and Nestlé to establish robust policies to protect land with forest cover and to require suppliers to implement the Roundtable on Sustainable Palm Oil certification scheme. F&C has also pressed emerging markets suppliers of palm oil, such as Golden Agri, IOI Corp and Sime Darby to manage deforestation risks from expanding plantations in order to fulfil and protect contracts with global brands. Following allegations of poor practice, Golden Agri has strengthened monitoring of high conservation value forests and is conducted an independent investigation into the allegations.

Fund managers such as F&C have developed engagement programmes to manage emerging risks and opportunities on issues such as deforestation. To reduce risks, F&C has engaged with public policymakers as well as companies involved in the palm oil supply chain (see case study). Sagarika Chatterjee, Associate Director, F&C Investments, said: "Protecting ecosystem services is a significant long-term challenge for the global economy, and one that companies will increasingly need to confront. In the next 10 years, they will come under political scrutiny for their impacts on ecosystem services – and also foot the bill for degraded services not necessarily of their own making."

Universal Owners can develop innovative new collaborative initiatives to reduce companies' contributions to externalities

The examples of engagement initiatives included in this paper are just some of the initiatives that investors can join or undertake to address externalities. While many collaborative initiatives have focused on improved disclosure among companies, there is scope for investors to call for performance improvements and reduced impacts in areas such as greenhouse gas emissions, pollution and waste. Investors can support the development of comparable performance metrics and disclosure of more comprehensive information on ecosystem goods and services, and can call for more sustainable use of declining natural resources such as fish, timber and other commodities.

Universal Owners can encourage portfolio companies to:

- Build knowledge and expertise on material environmental risks and opportunities in the context of their own companies and industry sectors.
- Measure impacts and dependence on natural resources and assess related business risks and opportunities.
- Report on emissions and natural resource use connected with business activities and operations.
- Establish targets to reduce emissions and use natural resources more efficiently. Review these measures on a periodic basis to assess progress.
- Develop mitigation policies and align environmental management systems with international standards.
- Internally price natural resources and pollutants.
- Engage proactively with public policymakers, local governments and local communities to address environmental issues, and disclose lobbying positions.

Stronger mandates for asset managers can support engagement on externalities

Stronger mandates for asset managers can provide frameworks for more effective consideration of environmental externalities within investment processes. Including environmental criteria in statements of investment principles, requests for proposals (RFPs), investment management agreements and periodic manager reviews can help ensure externalities are integrated into the investment process. RFPs and annual performance reviews could require asset managers to have the capability to engage with companies on climate change, pollution, water, biodiversity and impacts on ecosystem services. Asset owners can also consider encouraging asset managers to participate in sustained dialogue with policymakers on addressing these long-term challenges. Investor interviews highlighted several actions that could change market practices:

- Request regular monitoring and reporting on how investment managers are addressing environmental externalities and ecosystem services risks and opportunities. Investment managers should report on the goals and outcomes of engagement activities with companies and policymakers and could measure or estimate the environmental impacts of portfolio companies.
- Build capacity by sharing tools and knowledge, and by supporting quantitative and qualitative research to improve understanding of the relationship between corporate externalities, ecosystem impacts, company financial risk and portfolio returns. Recent examples include research by Ceres and the Pacific Institute on risks to businesses and investors from water scarcity and climate change,[148] and a study on the implications of climate change for strategic asset allocation supported by Mercer's Responsible Investment team, some 14 institutional asset owners and managers, the Carbon Trust and International Finance Corporation.[149]
- Fiduciary responsibilities could include looking at the implications of the most material externalities for portfolio assets. Encourage credit rating agencies, sell-side analysts and fund managers to incorporate factors such as risks and opportunities from both the pricing of externalities and costs of changes in ecosystem services into financial analysis.[150]

148. Pacific Institute (February 2009) Water Scarcity & Climate Change: Growing Risks for Businesses and Investors, commissioned by Ceres.

149. www.mercer.com/climatechange, last accessed 15 February 2011.

150. Brown, A. (October 2007) An Investment Perspective on Climate Change, Schroders.

Recommendations and next steps

Universal Owners can take a number of measures to help mitigate externalities and ultimately deliver stronger economic and financial outcomes:

1. **Evaluate impacts and dependence of investee companies on natural resources.** Identify financial exposure to environmental costs, where externalities come from and who "owns" them. This would enable engagement to focus on the companies and sectors that cause the greatest environmental costs.

2. **Incorporate information on environmental costs and risks into engagement and voting initiatives and seek to reduce environmental impacts of portfolio companies.** Investors can engage with companies to influence corporate behaviour and address financial risk from externalities. By influencing the largest companies that contribute most to portfolio-wide externalities, and encouraging them to engage with their suppliers, investors can help to raise the bar across a sector and within supply chains. Investors can also encourage industry bodies or multi-stakeholder initiatives to raise standards in environmental governance and performance through codes or guidelines. Future collaborative engagement programmes could address issues related to air pollution, waste and heavy metals, as well as risks to biodiversity and ecosystem services.

3. **Join other investors and engage collaboratively with companies through platforms such as the PRI Engagement Clearinghouse to address key issues.** Collaborative shareholder engagement strengthens the weight of influence, tends to increase the effectiveness of active ownership programmes and provides a cost-effective way for asset owners and managers to address environment-related risks to returns.

4. **Engage individually or collaboratively with public policymakers and regulators to encourage policies that promote the internalisation of costs and establish clear regulatory frameworks.** Investors could reduce risk and protect future fund returns by supporting the implementation of effective environmental regulations and public policies that protect natural capital and reduce environmental externalities. Government action and market reform could address structural inefficiencies that contribute to over-exploitation of natural resources and inferior outcomes. Platforms such as the PRI Engagement Clearinghouse and Public Policy Network, UNEP FI and investor networks on climate change, such as INCR, IIGCC, and IGCC, can help facilitate dialogue with policymakers.

5. **Request regular monitoring and reporting from investment managers on how they are addressing fund exposure to risks from environmental costs and how they are engaging with portfolio companies and regulators.** Stronger mandates for asset managers can provide frameworks for effective consideration of environmental externalities within investment processes. For example, environmental costs can be addressed in statements of investment principles, requests for proposals, investment management agreements and periodic manager reviews. RFPs and annual performance reviews could require asset managers to have the capability to engage with companies and policymakers on climate change, pollution, water, and biodiversity and ecosystem services.

6. **Encourage rating agencies, sell-side analysts and fund managers to incorporate environmental costs into their analysis.** Ensure corporate environmental costs are analysed alongside financial data to identify the most material externalities for equity portfolios. Investors could establish whether companies that externalise environmental costs are causing the value of other portfolio assets to fall and assess risks to investments in other asset classes including bonds, property, infrastructure and commodities.

7. **Support further research.** Further research and tools are needed to build capacity and improve understanding of the relationship between corporate externalities, ecosystem goods and services, company financial risk and portfolio returns.

Further research opportunities

The findings in this study could form the basis for further research into linkages between environmental externalities, the economy, capital markets and investors. Suggestions for further research include:

- Examine the risks and opportunities presented by links between corporate environmental performance, capital markets, and portfolio financial performance. Specifically, how do externalities affect the absolute or relative returns of specific portfolios over time?
- Explore the potential correlation between long-term economic growth, external costs in the economy and capital market returns.
- Explore the dependence of certain sectors on natural resources and ecosystems goods and services, future trends in the availability and quality of these resources, and related direct and indirect corporate exposure to financial risk across indices (through operations and supply chains).
- Explore how environmental externalities are passed between sectors, and between companies and investors over the long term.
- Conduct a regression analysis of a relative market return variable against sector or company externalities to compare different pollution control scenarios.
- Assess the costs that Universal Owners would be willing to pay (e.g. abatement costs) to address these externalities, relative to the value of benefits they could receive from reducing environmental costs.
- Conduct further research into the strategic implications of declining natural resource commodities and rising externalities for asset management.

Appendices

Appendix I

Case studies: Environmental externalities and economies

Case studies on three environmental issues – pollution, fisheries and forestry – explore links between ecosystems, externalities and economies.

Cutting air pollution saves health costs

Potentially lethal air pollution has accelerated in growing large cities in Asia and South America in recent decades. Ozone precursors such as nitrogen oxides (NOx) interact with non-methane VOCs to increase levels of ground-level or tropospheric ozone, damaging forests and human health. The long-range transport of industrial air pollution from areas of economic growth in Asia and South America can have negative effects in regions far beyond national boundaries.[151]

Air pollutants can reduce crop yields and have serious health impacts. Total health damage costs from particulate matter and ozone in Europe are projected to rise to € 189-€ 609 billion (US$ 258-US$ 832 billion) annually from 2020.[152] Global ozone pollution alone could cause millions of premature deaths by 2050 if left unchecked, with associated health costs of US$ 580 billion.[153]

Many governments are strengthening policies to address the health and environmental effects of air pollutants, using measures including emissions limits and trading schemes. Restrictions introduced in Europe after acid rain impacts emerged in the 1980s have cut concentrations of sulphur dioxide significantly. EU legislation to reduce air pollutants is expected to result in € 87- € 181 billion (US$ 119-US$ 247 billion) per annum in health benefits.[154] Reduced emissions would also benefit forests and other ecosystems.

Measures to address greenhouse gas emissions, such as switching from fossil fuels to lower-carbon fuels, could reduce other air pollutants and result in up to € 550-€ 1,350 billion (US$ 773-US$ 1,898 billion) in related annual economic benefits.[155] The EU has targets to reduce greenhouse gas emissions by 20% from 1990 levels and for 20% of energy to come from renewable sources by 2020. Achieving these would cut air pollution control costs by around €10 billion (US$ 14 billion) per annum, from expected levels in a business-as-usual scenario of around € 83 billion (US$ 116.7 billion).[156]

151. http://www.wilsoncenter.org/index.cfm?topic_id=1421&fuseaction=topics.item&news_id=218780, last accessed 2 February 2011.

152. European Commission (2005) Impact Assessment, Commission Staff Working Paper, Annex to The Communication on Thematic Strategy on Air Pollution and The Directive on "Ambient Air Quality and Cleaner Air for Europe.

153. http://environmentalresearchweb.org/cws/article/research/41253, last accessed 2 February 2011.

154. http://ec.europa.eu/environment/archives/cafe/general/keydocs.htm, last accessed 2 February 2011.

155. http://ec.europa.eu/clima/policies/brief/eu/index_en.htm, last accessed 2 February 2011.

156. Ibid.

Fish stocks need urgent protection

The global market value of fish products totalled more than US$ 100 billion in 2008, with around 145 million tonnes of fish harvested through capture fisheries and aquaculture in 2009.[157] Around one-third of fish stocks are over-exploited, depleted or recovering, yet demand is expected to increase 1.5% annually in coming decades.[158] A further 50 million tonnes of catch are discarded at sea as "bycatch" of unwanted species.

Evaluating the scale of environmental damages caused by fisheries can prove difficult due to interactions with other anthropogenic effects such as pollution, habitat degradation and climate change. Land-based human activities such as nutrient releases can contribute to eutrophication and oxygen depletion, damaging marine life in areas including the Baltic Sea and the Black Sea. However, recent studies suggest that excessive fishing is the main factor destabilising ecosystems, directly through removals and indirectly through related impacts.[159] Bottom trawling is one of the most common and destructive methods used to catch fish. Impacts severely affect the resilience of ecosystems that support fisheries.

Mismanagement, lack of enforcement and subsidies totalling over US$ 27 billion annually have left almost 30% of fish stocks classed as "collapsed" – yielding less than 10% of their former potential, according to a UNEP study on the Green Economy.[160]

A number of economically important fisheries, such as the Atlantic cod of Newfoundland, have collapsed abruptly under intense fishing pressure, causing significant, social, economic, and ecological disruption. Some 80% of the world's commercial fish stocks are depleted or have been fished beyond their biological carrying capacity, according to a UNEP report (2010).[161] One of the main drivers of over-exploitation is government subsidies. Certain companies and sectors are already experiencing the direct impacts of reduced availability of fish for food or feed. Most capture fisheries are at or near their limit and production will be unable to meet demand for fish in 2050.[162]

157. Food and Agriculture Organization (FAO) (2011) The State of World Fisheries and Aquaculture 2010.

158. UNEP (2007) Global Environmental Outlook: environment for human development (GEO-4).

159. Jackson, B.C. et al. (2001) Historical Overfishing and the Recent Collapse of Coastal Ecosystems, Science, Vol. 293, No. 5530: pp. 629-637.

160. http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=624&ArticleID=6566&l=en&t=long, accessed 2 February 2011.

161. UNEP (December 2010) Fisheries Subsidies, Sustainable Development and the WTO.

162. http://www.fao.org/docrep/007/y5648e/y5648e05.htm last accessed 2 February 2011.

A World Bank/FAO study suggests that unsustainable exploitation of living marine resources causes US$ 50 billion in global economic losses per year, with a cumulative loss of over US$ 2 trillion since 1974.[163] However, the estimate excludes the value of biodiversity losses, any compromise to an ocean carbon cycle, and the effects of illegal fishing and weak fisheries governance. The study concludes that stronger governance in the fisheries sector could reduce losses significantly, while generating additional economic growth in the marine economy and other sectors. The Marine Stewardship Council proposes a more sustainable approach to fishing using incentive structures that benefit fishermen, fish processors, traders, retailers and consumers. Benefits from sustainable fishing would include:[164]

- Good long-term economic prospects and more stability for those who access fisheries.
- Fishermen would be able to make profits over the long term despite short-term variations in fish stocks.
- The value of landed fish would be maximised.
- Economic returns from fisheries to society.

Trade measures are increasingly being used to tighten fishing controls. FAO Guidelines adopted in 2008 aim to help states and regional fisheries management organisations to sustainably manage deep-sea fisheries.[165]

The FAO report recommends an ecosystem approach to fisheries, balancing societal objectives with the state of the fishery and its natural and human environment. Improved fisheries management would deliver economic benefits globally as well as at a local level. Investing around US$ 8 billion a year in rebuilding and greening the world's fisheries could raise catches while delivering US$ 1.7 trillion in benefits to industry, consumers and the global economy over the next 40 years.[166]

Timber harvests fuel deforestation

The world lost more than 125 million hectares of forests between 1990 and 2005. Forests are set to continue shrinking as more wood products and energy are produced and consumed. Although around 40% of the world's forests have management plans, only about 12% are legally protected from harvest or exploitation, and 3% are certified by one of the major forest certification programmes.[167]

Using forest resources unsustainably will cause timber harvests to decline and impair environmental services such as watershed protection and carbon sequestration. Knock-on effects will increase flooding and climate change, with significant economic consequences.

Deforestation accounts for 17-20% of global GHG emissions.[168] Burning forests and other biomass to clear land for cattle ranching, soy plantations and highways in countries such as Brazil results in significant CO_2 emissions. Cattle ranching accounts for 80% of deforestation in the Amazon region, where up to 120 billion tonnes of carbon are stored. Companies that source goods from deforested areas face reputational risk. This contributed to commitments from clothing manufacturers such as Nike, Timberland and Clarks in 2009 to source leather only from suppliers that are not linked to recent deforestation for cattle ranching in the Amazon. Large beef companies including JBS-Friboi, Bertin and Minerva have said that they will no longer buy cattle from newly deforested rainforest areas.[169]

Forest policies and legislation, as well as the allocation of forests for use by local communities and for the conservation of biodiversity and other environmental services, have helped reduce the rate of deforestation from 8.3 million to 5.2 million hectares each year between 2000 and 2010.[170] The IPCC has estimated that reducing deforestation, regenerating forests and developing plantations to sequester carbon could cut CO_2 emissions by 12-15% from projected levels in 2050.[171] Forests store some 289 Gt of carbon in trees and vegetation and international attention on the value of forests as a carbon sink is growing. For instance, 36.5 million hectares of prime rainforest and conservation areas in Indonesia have an estimated economic value of US$ 105-US$ 113.7 billion in carbon trading schemes. Adding the country's 38.7 million hectares of productive timber forests could more than double the total value of Indonesia's forests as a carbon sink.[172] Forests provide a largely untapped opportunity for the insurance industry: insuring the "permanence" of forest carbon could pave the way for innovative solutions and partnerships (e.g. public-private).[173, 174]

163. The World Bank and FAO (2009) The Sunken Billions: The Economic Justification for Fisheries Reform, in Agricultural and Rural Development Department.

164. Department for Environment, Food and Rural Affairs, UK Government (2007) Fisheries 2027 – a long-term vision for sustainable fisheries.

165. http://www.fao.org/docrep/013/i1820e/i1820e.pdf, last accessed 2 February 2011.

166. http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=624&ArticleID=6566&l=en&t=long, last accessed 2 February 2011.

167. Siry, J.P., Cubbage, F.W. and Ahmed, M.J. (2005) Sustainable forest management: global trends and opportunities, Forest Policy and Economics, Vol. 7, Issue 4: pp. 551-561.

168. FAO, UNDP, UNEP (2008) UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Development Countries (UN-REDD) Framework Document; van der Werf, G.R., Morton, D.C, DeFries, R.S., Olivier, J.G., Kasibhatla, P.S., Jackson, R.B., Collatz, J.G. and Randerson, J.T. (2009) CO2 emissions from forest loss, Nature Geoscience, Vol. 2: pp. 737-738.

169. http://www.greenpeace.org/international/news/global-cattle-giants-unite051009, last accessed 2 February 2011.

170. http://www.fao.org/news/story/en/item/40893/icode/, last accessed 2 February 2011.

171. IPCC (2007).

172. http://www.scidev.net/en/climate-change-and-energy/news/forest-loss-yields-meagre-financial-benefits.html, last accessed 2 February 2011.

173. UNEP FI (November 2008) Making forests competitive, Exploring insurance solutions for permanence, A concept paper.

174. UNEP FI (2007) Insuring for sustainability – Why and how the leaders are doing it, The inaugural report of the Insurance Working Group.

Appendix II: Discount rates affect valuations

Discount rates drive the present day value of future externalities

Environmental externalities accumulate as they continue over time. For all externalities, costs will rise as ecosystem services become scarcer.[175] Valuations vary significantly with different discount rates used to calculate the present day value of future externalities. Discount rates are a major source of variation in estimates of the social cost of carbon, since most avoidable climate change impacts would occur a long way into the future and involve uncertainties. There is no consensus about which discount rate is most appropriate.

Many studies use market discount rates of 3-5% to value the intergenerational benefits of ecosystem services. However, this undervalues their future rising value.

The UNEP report on the economics of ecosystems and biodiversity (TEEB) suggests that discount rates should be zero in order to give ecosystems the same value in the future as they have today.

Trucost calculated two possible present values of externalities in 2050 using discount rates of 1% and 4%. Results show that a year's damage in 2050 (US$ 28.48 trillion) would equate to US$ 3.1-US$ 8.1 trillion in 2008, as shown in Table 5 below. Higher or lower discount rates would change valuations, but would not alter the outcome that environmental damage and ecosystem depletion are economically unsustainable.

TABLE 3:
The annual cost of a year's damage in 2050 valued today

Discount rate	Description	*Present value (2008) of projected externalities in 2050*	*External cost relative to global GDP in 2008*
4%	Based on a descriptive approach to represent a market discount rate. This considers the time value of money or the rate at which society chooses between consumption at different times to relate the present value of a future cash flow to its future value.	US$ 3.1 trillion	5.2%
1%	Based on an ethical approach to represent a social discount rate. This considers the value of future generations' utility relative to the current generation's utility and the rate at which preserving resources will enhance future generations' utility.	US$ 8.1 trillion	13.5%

175. Costanza, R. et al (May 1997) The Value of the World's Ecosystem Services and Natural Capital, Nature, Vol. 387: pp. 253-260.

Appendix III: Trucost methodology to analyse companies, indices and portfolios

Trucost has developed a comprehensive approach to calculating quantitative environmental impacts across organisations, supply chains and investment portfolios.

Company analysis

Data on the companies analysed are included in Trucost's database of corporate environmental impacts. Trucost has analysed the environmental performance of more than 4,500 companies worldwide since 2000. The database includes data on over 720 environmental impacts, including GHGs, water abstraction, particulate emissions and heavy metals.

The database includes company-specific environmental data reported to Trucost through engagement with companies, or disclosed publicly on company websites or in annual or environment reports. Where reported, data on GHG emissions from operations and purchased electricity, under Scopes 1 and 2 of the Greenhouse Gas Protocol corporate accounting standard, are included in Trucost's database. Trucost might standardise or normalise disclosed data where necessary. Where companies only disclose use of resources such as fuel consumption, analysts use this information to derive environmental data where possible.

Trucost's environmental profiling model is used to calculate the direct environmental impacts of companies that do not disclose adequate data, as well as upstream impacts from supply chains. These include GHG emissions from the production of purchased goods and services, under Scope 3 of the Greenhouse Gas Protocol. The input-output model examines interactions between 464 sectors to calculate each company's likely direct and supply chain environmental impacts. It combines quantitative government census and survey data on natural resource use through economic interactions between sectors with information on pollutant releases from national emissions registries. Information on company revenues in different industries is used to map environmental impacts from business activities. Calculations incorporate disclosed quantitative data on industrial facilities' actual resource use and pollutant releases where available.

Analysed companies are invited to provide additional information and to verify environmental profiles created by Trucost. Analysts quality check any further disclosures made, which are exclusive to Trucost and further augment the database.

Most companies have relatively low environmental impacts. Where some companies supply other firms analysed, the study may include an element of double counting. However, the approach ensures that the study assesses the environmental costs of business activities – such as extraction, production, transport and logistics – outsourced to companies excluded from this analysis. For companies which outsource resource-intensive or polluting production processes, external direct costs may be lower than indirect costs. In many sectors, indirect environmental impacts are significantly higher than direct impacts. It is important to take into account the external costs of suppliers as these may be passed on down the value chain.

Greenhouse gas emissions

Trucost maintains the world's largest and most comprehensive database of standardised corporate greenhouse gas emissions data. GHG emissions for each company analysed are measured in tonnes of carbon dioxide equivalents (CO_2e). Nine GHGs are included in the analysis, including the six covered by the UN Kyoto Protocol. Each GHG has a different capacity to cause global warming. Trucost's conversion of GHGs to CO_2e is based on the Global Warming Potential (GWP) index published by the Intergovernmental Panel on Climate Change, which assesses the effect of the emissions of different gases over a 100-year time period relative to the emission of an equal mass of CO_2.

Environmental costs

Once Trucost has calculated the quantities of a company's environmental impacts, an environmental external cost is applied to each resource and emission to generate an environmental external cost profile. Different costs are apportioned to each environmental impact. The costs represent the quantities of natural resources used or pollutants released multiplied by their environmental damage costs to society. By applying prices to resource use and pollutants, based on related environmental and health impacts, Trucost is able to evaluate the environmental performance of each company and sector in monetary terms.

Trucost's approach is strongly quantitative. Expressing all impacts in financial terms enables comparison between a company's environmental costs and traditional financial performance measures. External costs can be measured against revenues to identify potential materiality and compare the impacts of companies of any size or sector.

For the company analysis in this report, Trucost has applied environmental costs identified through the literature review conducted specifically for this study. The costs provide a proxy for potential exposure to policy measures that seek to apply the "polluter pays" principle. Companies are increasingly required to contribute to external costs through regulations or economic instruments, which often "internalise" costs per unit of resources used and emissions released (i.e. through landfill taxes or emissions trading schemes).

Calculating portfolio environmental and carbon footprints

To help understand how equity portfolios might be exposed to environmental or carbon costs, institutional investors and fund managers use Trucost environmental or carbon "footprints" as a quantitative risk assessment. Footprints indicate environmental or carbon "intensity" and enable comparison of funds irrespective of size and investment style. The smaller the footprint, the lower the portfolio exposure to environmental costs.

Environmental footprints are measured by allocating environmental costs from each constituent company to a portfolio on an equity ownership basis. The proportional environmental costs allocated to holdings are summed to calculate the total related to the fund. This total is then normalised by sales to calculate its environmental footprint, expressed as environmental costs per million US Dollars (or other currency unit) of investment.

The footprint includes environmental costs from both the direct and supply chain impacts of companies held, so that the analysis takes account of exposure to environmental costs passed through value chains.

Because indirect costs from suppliers to one company could also be the direct costs of another, the total external costs allocated to a portfolio may contain an element of double-counting. Nevertheless, this does not affect the comparison between portfolios and benchmarks since the same approach is used to calculate their environmental footprints.

Carbon footprints are based on standardised GHG emissions data. The equity fund carbon footprint is calculated by measuring each constituent company's GHG emissions in metric tonnes of carbon dioxide-equivalents (CO_2e). To limit double counting of GHG emissions in carbon footprints, Trucost analyses only direct GHG emissions from operations and those emitted by direct (first-tier) suppliers for each company in a fund. Direct first-tier direct suppliers to a company can include electricity and logistics providers.

CO_2e emissions from holdings are allocated to the fund in proportion to equity ownership and aggregated to form an emissions profile for the portfolio. Total GHGs are normalised by sales to calculate the fund's carbon footprint, expressed as metric tons of CO_2e emitted by companies held per million US Dollars of revenue.

A similar analysis is conducted for indices to enable assessment of portfolio environmental performance and risk against benchmarks. Trucost's quantitative approach enables comparison of portfolios and indices of different sizes.

Attribution analysis allows fund managers to understand how sector allocations and stock selections contribute to a portfolio's environmental footprint, measured against its benchmark. Asset managers can use this information to reduce exposure to environmental costs without changing sector weightings or investment styles. The financial interpretation of environmental impacts provided by Trucost can be used to tilt or re-weight indices to incorporate environmental performance into investment decisions and reduce risk. The data and analysis can also be used to select companies for engagement and issues to engage on.

Appendix IV: Links between externalities, GDP and portfolio future cash flows

Basic investment theory states that the value of any asset is the net present value of its future cash flows. The price of an asset (P_a) equals the sum of "the asset's future cash flows (C_{at}) divided by the appropriate discount rate (r_t)" as shown in equation (1) (Bodie, Kane and Marcus 2005; Ross, Westerfield and Jaffe 2005).[176]

(1)
$$P_a = \frac{C_{at}}{r_t}$$

Consequently, the price of an equity portfolio (P_p) equals the sum of "the portfolio's future cash flows (C_{pt}) divided by an appropriate discount rate (r_t)", as shown in equation (2).

(2)
$$P_p = \frac{C_{pt}}{r_t}$$

The price of a Universal Owner's portfolio (P_{OU}) hence equals the portfolio's portion ($Portion_{UO}$) of the sum of all corporations' future cash flows ($C_{allcorpt}$) divided by an appropriate discount rate (r_t) as shown in equation (3). For instance, if a Universal Owner holds 0.05% of shares of all companies in an economy with overall value of US$ 80 trillion, then the Universal Owner portfolio value will be about US$ 40 billion.

(3)
$$P_{OU} = \frac{Portion_{UO} \times C_{allcorpt}}{r_t}$$

From a long-term perspective, economic theory and empirical evidence from a century of data show that an economy's future cash flows can be approximated as the economy's future GDP_t (Fama 1990; Schwert 1990).[177] A large and relatively stable proportion of an economy's GDP derives from corporate value generation ($GDP_{percentcorp}$). Hence, the sum of all corporations' future cash flows ($C_{allcorpt}$) can be said to be a relatively stable proportion of the economy's future GDP_t as shown in equation (4).

(4)
$$C_{allcorpt} = GDP_t \times GDP_{percentcorp}$$

Substituting equation (4) in equation (3), we see that the long-term price of a universally-owning institutional investor's portfolio represents the Universal Owner's part of the appropriately discounted sum of all future GDP proportions of corporations as shown in equation (5).

(5)
$$P_{OU} = \frac{Portion_{UO} \times (GDP_t \times GDP_{percentcorp})}{r_t}$$

Equation (5) shows that the relationship between GDP and the price of the portfolio of a Universal Owner is linear in the long term.[178] (Fama 1990; Schwert 1990).

176. For simplicity, we use the perpetuity based model with one constant cash flow here. A variable cash flow model based on annuities (and a final perpetuity) would lead to more complex equations but the same implications.

177. Over the long term, the temporary accounting differences between income and cash flow can be said to converge towards zero.

178. Measurement and market imperfections can lead to a non-linear relationship between the price of a universally owning institutional investor's portfolio and GDP in short observation intervals, but in long observation intervals economic theory and mathematical logic strongly expect this relationship to converge towards linearity.

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- The most efficient approach to measuring GHG emissions and wider environmental impacts across organisations, supply chains and investment portfolios;
- Clear identification of prioritised focus areas for reducing environmental impacts;
- Validation of source data, including completion of gaps in data which are not currently being tracked or reported on;
- Comparison of environmental performance against peers, sectors and investment benchmarks;
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The Principles for Responsible Investment, an investor-led initiative convened by UNEP FI and the UN Global Compact, was established to help investors achieve better long-term investment returns and sustainable markets through improved analysis of environmental, social and governance issues. The Initiative has over 870 signatories from 45 countries with more than US$ 25 trillion of assets under management.

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About the United Nations Environment Programme Finance Initiative (UNEP FI)

UNEP FI is a unique public-private partnership between UNEP and the global financial sector. UNEP works with over 180 banks, insurers and investment firms, and a range of partner organisations, to develop and promote linkages between sustainability and financial performance. Through its comprehensive work programme encompassing research, training, events and regional activities, UNEP FI carries out its mission to identify, promote and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

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