February 2006

The sdEffect™: Translating Sustainable Development Into Financial Valuation Measures

A Pilot Analytical Framework

Authored by
Yachnin & Associates,
Sustainable Investment Group Ltd. ,
and Corporate Knights Inc.

Prepared with the Financial support of
the National Round Table on the
Environment and the Economy

YACHNIN & ASSOCIATES

SIG

CORPORATEKNIGHTS

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About *The sdEffect™*

The *sdEffect™* is an initiative aimed at advancing integration of considerations of sustainable development (SD) in investment decision-making. It is focused on further isolating the effect of corporate SD practices on share price performance/company valuations and expressing this effect—*the sdEffect™*—in financial language. In so doing, it helps demonstrate that SD, a business aspect traditionally viewed as "soft" by the financial community, can have a "hard", material and calculable impact on share price and company value.

The initiative is a collaborative effort that brings together diverse stakeholders to advance knowledge and communications in the area of SD and valuation. For the latest insights and participant information, please visit www.sdeffect.com or email info@sdeffect.com.

About the Authors*

Yachnin & Associates

Yachnin & Associates (Y&A) is an Ottawa based policy development and management consulting group. Among the company's core areas of focus are sustainable development and corporate social responsibility. Y&A is very active in helping integrate considerations of SD into investment decision-making and promoting related dialogue.

Sustainable Investment Group Ltd.

Founded in 1995, Sustainable Investment Group (SIG) is a consulting firm that specializes in the area of sustainable development and finance. Its current work is principally focused on exploring the link between SD and the creation of shareholder value. SIG's core competencies include the application of financial analytics to SD-related aspects of business.

Corporate Knights Inc.

Founded in 2002, Corporate Knights Inc. (CK) is an independent Canadian-based media company that publishes the world's largest circulation magazine focusing on corporate responsibility. CK also publishes the annual Best 50 Corporate Citizens in Canada as an insert in Canada's national Globe and Mail newspaper, and the annual Global 100 Most Sustainable Corporations in the World, announced each year at the World Economic Forum in Davos.

*for more information and specific contact details please visit www.sdeffect.com.

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- Michael Hanley, Executive Vice President and Chief Financial Officer, Alcan Inc. for the Afterword; and,
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The views expressed in this document are solely those of the authors.

Foreword

In the world of financial analytics, there is no better measure than impact to the bottom line. Our industry has spent years developing, testing, and re-testing any number of theories, formulas, and ideas with one goal in mind: achieving the most accurate way to determine a company's true value. Every so often, a new concept enters into this arena, and as financial analysts it is our job to consider these new, or sometimes old, notions and establish if they can become part of our financial research tool kit.

Corporate Sustainable Development is a concept that has been around for some time, shifting between being a subject of passing note and that of in-depth study. The challenge is how to translate the concept of sustainable development to the bottom line performance of a company.

The following study lays out a pilot framework for establishing a link between corporate sustainable development performance and financial performance. The report provides the first steps in using financial language to measure the impact of sustainable development on the bottom line.

This report, and its pilot framework, may be able to help lay the foundation in linking sustainable development to company performance and provide another tool for financial professionals to use in their on-going analysis.

Donald F. Reed, CFA

President and CEO
Franklin Templeton Investments Corp.

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Executive Summary

There is growing interest among corporations, governments, non-governmental organizations and financial analysts in the quantitative and financial links between corporate sustainable development (SD) performance and financial performance.

To identify the influence of corporate SD on financial performance, its effect must be isolated from that of other business variables and expressed in quantitative and financial terms. Few studies have addressed the isolation of this effect and expressed it in financial terms.

This report sets out a Pilot Analytical Framework for using traditional financial valuation techniques to isolate the potential impact of SD on company valuation and share price performance. By isolating the valuation effects of corporate SD in "financial language", the report provides a basis upon which to engage the financial community to better integrate considerations of SD in financial analyses and investment decision-making.

More specifically, this report uses company-specific SD performance metrics from the Canadian mining sector to:

- Assess and identify metrics that are predisposed to translation into financial valuation;
- Translate these metrics into financial valuation employing five commonly used financial valuation techniques--Ratio Analysis, Discounted Cash Flow Analysis, Rules of Thumb valuation, Economic Value Added Analysis, and Option Pricing;
- Isolate the additive value of SD in financial terms including on overall corporate valuation.

Ten worked examples of translating SD into financial valuation, based on seven SD metrics, have been developed. These examples and the associated results are presented in the Table below.

EXAMPLES AND ASSOCIATED RESULTS		
SD METRIC	**TRANSLATED INTO**	**RESULTS**
INCO diversion of solid waste from municipal landfill	Discounted Cash Flow (DCF) Valuation Price to Cash Flow Per Share Ratio (P/CFPS)	Waste diversion at INCO saves the company $2.4 million per year, which is equivalent to just over 1 cent per share. These savings are worth $31 million in total shareholder value (using DCF), or between $0.06 and $0.16 per share in total value (using P/CFPS and DCF).
Noranda/Falconbridge Energy Savings/Greenhouse Gas (GHG) Emissions Reductions	DCF P/CFPS	The energy savings program/GHG emissions reduction increases per share value of Falconbridge by $1.62 to $2.44. This is equivalent to an improvement in Nickel prices of US$0.19/lb or an improvement in Copper prices of US$0.05/lb.
Placer Dome Community Involvement	DCF	If the community involvement program can fast track the Cerro Casale project by one year it will add value to Placer Dome stock estimated at US$0.81 per share. This is a 5.5% valuation lift from its current trading price of US$14.70 per share.
Teck Cominco Community and Employee Relations	Rules of Thumb (Price to Net Asset Value)	The risk reduction associated with Teck Cominco's enhanced community and employee relations is estimated to be valued at $859 million or $4.24 per share.
INCO SD Awards	Option Pricing Valuation	INCO's SD track record makes it possible for the company to open a new operation in Voisey's Bay, even though the operation may initially have a negative NPV (-$400 million), because its SD track record results in it being given an option, that would not otherwise exist, of great enough value to the company ($712 million) to make the operation economically viable (NPV of $312 million with mine, smelter and pre-approved option to expand).
Noranda/Falconbridge Improved Reportable Injury Frequency	Economic Value Added (EVA)	The safety program at Noranda/Falconbridge created economic value added of approximately $8.2 million per year (not including insurance claims or long term disability payments) from the period 2002 to 2004. If sustained, this improvement alone translates to incremental value of $65 million or $0.21 per share.
Noranda/Falconbridge Six Sigma Projects	DCF P/CFPS	Noranda/Falconbridge's Six Sigma Projects is equivalent to a US$0.14/lb price improvement in nickel, a US$0.02/lb price in copper, or a US$0.03/lb price improvement in zinc.

This project demonstrates that it is possible to translate the impact of corporate SD practices into financial valuation measures using traditional financial analyses. In so doing, it goes beyond simply supporting the business case for SD and takes the next logical step of translating specialized operating information into usable financial data.

Research for this project reveals limitations in the suitability of existing publicly reported corporate SD metrics data for translation purposes. Based on an analysis of sustainability reports from the Canadian mining sector, two key findings are that:

- Reports are characterized by an absence of specific and quantitative information that limits valuation of 80-90% of a company's reported SD practices;
- Relevant SD data is often scattered and thereby difficult to assemble and analyze for the purposes of ascertaining general additive value and translation into valuation.

It is recommended that companies report key SD metrics and related valuation information in a single summary table; preferably appearing early in their SD reports and related communications.

Regarding further research, two directions are required to advance this field over the immediate term. These include 1) conducting comparable analyses for other sectors and related additional SD metrics, and 2) working with companies to apply the Framework.

Further work is also required in the area of communications. The results of this Framework, and related future research, must be communicated to the broader financial community and other stakeholders.

1.0 INTRODUCTION/CONTEXT

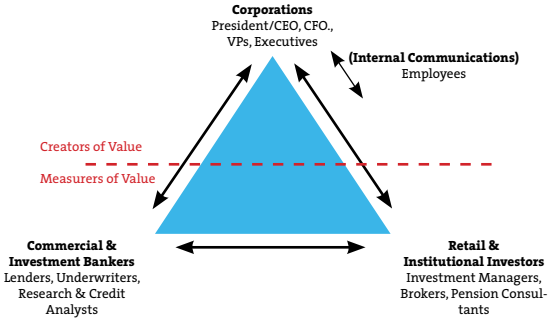
There is growing interest among corporations, governments, non-governmental organizations and financial analysts in the quantitative and financial links between corporate sustainable development (SD) performance and financial performance. This is part of broader marketplace trends in which more attention is being paid to "intangible" aspects of value creation.

This report sets out *The sdEffect™—A Pilot Analytical Framework for Translating Sustainable Development into Financial Valuation Measures.*

1.1 Audience

The primary audience for the report is the "Financial Community", as indicated in Figure 1 - namely the "Creators of Value" - corporations and the executives (departments) within these organizations that deal with investment decisions and the capital markets (e.g. CFO, Investor Relations), and the "Measurers of Value" - commercial and investment bankers and retail and institutional investors. The secondary audience is other stakeholders, including governments and non-government organizations (NGOs) with an interest in SD and finance.

Figure 1 – The Financial Community



This report, and its Pilot Analytical Framework, are intended to better enable companies, and their executives, to assess, measure and isolate the financial value implications of their SD practices and to communicate these both internally and externally in financial language. It is also geared toward helping investors and the broader financial community appreciate the additive value of SD and how specific SD-related factors can influence corporate financial valuations.

1.2 Background

During the last number of years, companies have been increasingly concerned with assessing the business value of their SD practices and communicating about these to the broader financial community. At the same time, the investment community, and particularly institutional investors, have become increasingly interested in the role of SD in value-creation, investment decision-making, and contributing to broader societal benefits.

This report emerges from a series of research, networking and communication activities which, in late 2002-early 2003, resulted in a call for "more work on common analytical frameworks for translating SD into financial valuation and related reporting". For more detail regarding the background to this project, please see the Appendices.

1.3 Rationale

Case study and anecdotal evidence of the business benefits of SD is increasingly available. There is, however, a dearth of rigorous quantitative financial analysis and data regarding these benefits, addressing questions such as "How much, and when, did revenue increase due to SD programs?", and "What specific risks were avoided or reduced and by how much?" Many corporations note difficulties in measuring the additive value of SD as presenting challenges to their commitment and investment. Equally, the absence of such quantitative analysis and data makes it difficult for investors to understand what corporate SD means to valuation. For a brief commentary regarding the limited availability of literature on this subject, please see the Appendices.

In order for corporate SD to be effectively invested in and become a more integral aspect of strategic decision-making, it must be measured and communicated about in financial terms. SD must be treated as rigorously as any corporate investment program including when budgeting and estimating expected payoffs in economic terms. By isolating the effect of SD in financial terms, a company, and its investors, can compare actual results with estimates, using measurement techniques that are sufficient to answer the question "How much value is being created?"

For this to occur, SD needs to be translatable into the same language that is used for all other aspects of corporate finance. Financial methods need to be developed to allow specific opportunities to be evaluated on the magnitude of their ability to create value or mitigate risk.

For publicly traded companies, market value is established, in part, by the collective viewpoints of the investment managers responsible for large pools of institutional capital. These "value" viewpoints are also influenced by research analysts at investment banks and credit agencies that cover these companies.

Financial audiences often are unfamiliar with the environmental and social language of SD, but they are extremely adept at assimilating information when it is

expressed in terms of revenue growth or free cash flow (magnitude of cash flows, timing of cash flows, risk of cash flows). These core valuation drivers are comprised of many components, including some important ones strongly linked to SD (e.g. energy efficiency, waste management, community relations, etc.). Establishing the parameters under which SD impacts a company's financial valuation enables analysts to drill down and better understand the make-up of each company's core valuation drivers. Also, since SD is currently undertaken and reported on asymmetrically, it presents opportunities for differentiating between companies and related investments.

This Pilot Analytical Framework, better enables both the Creators of Value, such as Michael Hanley, the author of the Afterword to this report, and the Measurers of Value, such as Donald F. Reed, the author of the Foreword, to assess SD and communicate about it in financial terms. This opens up the potential for enhanced short- and long-term value creation, greater capital markets appreciation of SD as a value driver, and further integration of considerations of SD in investment decision-making.

The Framework, along with the additional results to be associated with further related research, also helps companies, analysts and others to:

- Show direct causal links between SD and financial factors;
- Demonstrate that the SD investments increasingly advanced as "good business" are indeed true drivers of profitability, productivity, and value creation;
- Understand the valuation implications of SD practices and enhance communication regarding relative value premiums associated with core valuation drivers effected by SD factors;
- Make better strategic decisions regarding SD investments and trade-offs which can lead to greater uptake of SD practices;
- Communicate about the additive value of SD practices and how they can be factored into company risk profiles and valuations;
- Capture the longer-term SD valuation effects that can accrue from SD and thereby facilitate development of a longer-term investment mindset; and,
- Heighten the capacity of Canada's capital markets and its economy to capture this additive value and thereby strengthen the ability to innovate, compete and create wealth.

1.4 The Report

Figure 2 provides a diagrammatic illustration of the Framework. The remainder of this document is devoted to working through the Framework to show how SD can be translated into financial valuation.

Part I of this report is concerned with identifying and assessing example SD metrics for Canadian-based mining companies that offer potential for translation into financial valuation. In this part, the SD performance of five mining companies across 18 commonly reported metrics is described and evaluated for relevance and potential for translation into financial valuation measures. Comments are provided on all of the metrics, performance against them, and their relevance in terms of the business case and their potential as value drivers.

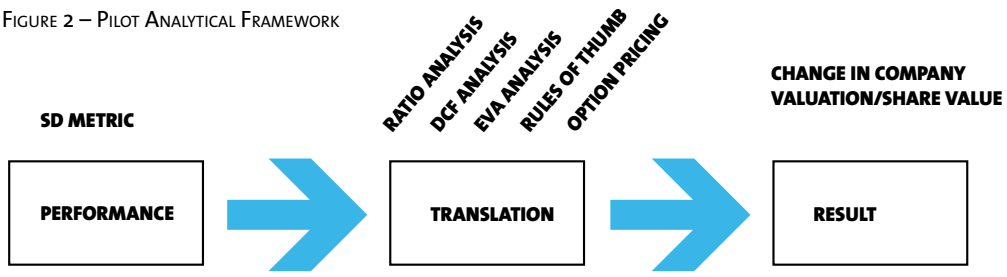
Part II of the report addresses the translation of mining SD performance data into financial valuation. Here, examples of translation are provided for seven metrics; two environmental, four social, and one economic.

Part III of the report provides preliminary guidance on working through the Framework and recommendations for further research and action. This includes an indication of opportunities for SD practitioners to strengthen data collection and reporting to better enable translation into financial valuation.

This report also includes two appendices: a) a brief statement regarding the background to this study and its position within the literature; and, b) an overview of The Mining Sector and SD in Canada.

The analysis that follows clearly demonstrates how corporate SD performance can be translated into financial valuation measures and key requirements associated with it. It also provides a powerful means for communicating the additive value of SD in financial language that can be used to further engage and educate key financial and other stakeholders.

Figure 2 – Pilot Analytical Framework



2.0 PART I – SUSTAINABLE DEVELOPMENT METRICS

The identification of SD metrics to be used in translation to financial valuation involved selecting companies for investigation, reviewing their sustainability reports, and assessing a common group of metrics.

2.1 Company Selection

Five Canadian mining companies were chosen for assessment as part of the development of the Framework The companies include:

- Alcan Inc.
- INCO Limited
- Noranda Inc./Falconbridge Limited
- Placer Dome Inc.
- Teck Cominco Limited

These companies were chosen for reasons related to the fact that they each:

- Have market capitalization of greater than $10 billion;
- Produce a regular, public sustainability report (current in the last year or two);
- Have senior personnel responsible for SD operations and reporting;
- Have a track record of SD reporting/ performance of longer than five years;
- Are Canadian and listed on the Toronto Stock Exchange; and,
- Operate internationally (appealing to the interests of a broader group of stakeholders/investors than companies with more localized operations).

2.2 Sustainability Reports

The most recent sustainability reports produced by these companies at the time of writing include those listed in Table 1.

These reports form the basis for the metrics component of the Framework. While there are many additional sources of metric information that could be useful in the present context, corporate sustainability reports are the most accessible secondary sources [1]. Each report was reviewed to identify the following:

1. SD metrics that are broadly applicable across mining companies;
2. The potential for each of these metrics to affect:
   a. Proven and probable reserves;
   b. Ore production, milling capacity and production- and overall productivity; and,
   c. Operating cash flow.

The methodology used in Step 1 involves the application of a scoring system developed by Feltmate *et al.* 1999 [2]. Using this approach, a metric has been defined as "broadly applicable" if it is reported by 60 per cent of the companies reviewed [3].

Step 2 involves assessing the potential influence of a metric on variables typically considered important by analysts. If an SD metric is deemed to influence one or more of these variables then it may factor into financial valuation techniques typically employed in investment analysis and decision-making. For example, if a company engages an "energy savings" program that results in a 10 per cent savings in electricity cost per year, this "SD/ environmental" metric has direct impact on "cash flow". Since the magnitude, timing and risk of cash flows is central to company valuation, this "SD/environmental" metric may have a material upward effect on the value of the company communicated throughout the financial community.

2.3 Sustainable Development Metrics

The following metrics, widely applied by mining companies, were identified and assessed for their potential for translation into financial valuation measures:

Environment

- Solid waste (Non-Hazardous) Diversion (INCO)
- Land Reclamation (INCO)
- Environment, Health and Safety Audits (INCO)
- Emissions and Effluents (Noranda/Falconbridge)

Table 1. Sustainability Reports

SUSTAINABILITY REPORTS		
COMPANY	YEAR	REPORT
Alcan	2004	Alcan Sustainability Report 2004. Taking the Next Step.
INCO	2003	2003 Environmental, Health and Safety Report.
Noranda/Falconbridge	2004	Meeting the Challenge. 2004 Sustainable Development Report.
Placer Dome	2003	PDG Corporate Sustainability Report. Placer Dome and Our Host Communities 2003.
Teck Cominco	2004	Approaching Sustainability 2004.

- ISO 14001 Certification (Noranda/Falconbridge)
- Energy Efficiency/(Reductions in Greenhouse Gas Emissions) (Noranda/Falconbridge)
- Recycled Metal Processed (Noranda/Falconbridge, INCO)

Society

- Respect for Aboriginal People/First Nations (Teck Cominco)
- Emergency Preparedness (EP) and Fire Prevention (FP) (INCO)
- Awards (INCO)
- Safety/Reportable Injuries (Noranda/Falconbridge)
- Charitable Giving (Noranda/Falconbridge)
- Community Involvement (Placer Dome)
- Diversity Training (Teck Cominco)

Economy

- Participation/Support for Professional Organizations (Teck Cominco)
- Inclusion in SRI Funds/Recognition by SRI Ranking Organizations (INCO)
- Six Sigma Projects (Noranda/Falconbridge)
- Payroll/Benefits by Country [4] (Alcan).

Table 2 details the assessment of the metrics, performance against them, and their potential for influencing financial valuation.

Table 2. Reported SD Metrics, Performance and Relevance

ENVIRONMENT			
METRIC	**COMPANY**	**PERFORMANCE**	**DESCRIPTION/NOTES**
Solid Waste (Non-Hazardous) Diversion	INCO	Non-hazardous solid waste (e.g., wood, concrete, building demolition material) is directed to a disposal site in the midst of the tailings disposal area in Sudbury. Diversion reduces pressure on Sudbury area municipal landfills.	Reducing waste and/or diverting waste from landfills reduces a company's environmental footprint. Annual waste savings from waste diversion at Sudbury saves INCO about $2.4 million/year; this for each year for the past 25 years.
Land Reclamation	INCO	Engaged aerial seeding program, spreading lime, fertilizer and seed on 121 hectares of INCO property in Ontario, for a total 2,550 hectares revegetated in Ontario by the end of 2003.	Land reclamation is a core aspect of environmental stewardship. In many cases, reclamation demonstrates that a company assumes post-operative responsibility for projects, which in turn builds positive brand image.
Environment, Health and Safety Audits	INCO	Completed nine EHS audits at locations in Canada, United Kingdom, United States and Asia in 2003.	Environmental audits help limit future environmental liabilities. Health and Safety audits help limit potential health hazards, lower lost time injury rate and all injury rate.
Energy Savings/ Greenhouse Gas (GHG) Emissions Reductions	Noranda/ Falconbridge	In 2004, production increased by 6%, while energy consumption decreased by 1%. Energy required per unit of output in 2004 was 6% below 2003 energy requirement. Energy consumption in 2004 was 81,370 Terajoules (Tj), and in 2003 consumption was 82,290 Tj.	Increasing energy savings (and reducing GHG Emissions through energy saving programs) is a priority environmental initiative for mining companies (lower energy = lower CO_2, NOx, SO_2 emissions related to energy use). Energy consumption/energy translates to cost savings/ increased cash flow.
Emissions and Effluents	Noranda/ Falconbridge	Reduced releases of arsenic, cadmium, lead, mercury and nickel to air and water, by 87%, relative to 1988 baseline, by 2004.	Reducing air and water emissions is consistent with directives from federal, provincial/state and municipal governments, and non-governmental organizations.
ISO 14001 Certification	Noranda/ Falconbridge	Key facilities are ISO 14001 registered. Four facilities were registered in 2004.	A corporate-wide Environmental Management System, such as ISO 14001, can improve the eco-efficiency of operations, build positive "environmental brand" for a company, and elevate employee morale/productivity.
Recycled Metal Processed	Noranda/ Falconbridge	140,018 tonnes of recycled metal processed in 2004, vs. 142,004 tonnes in 2003.	Processing recycled metal (from cars, electronics, etc.) is environmentally less intrusive than mining raw metal. Recycled may be more cost effective than mining raw material. Use of recycled material may increase "proven reserves".
Recycled Metal Processed	INCO	18,000 tonnes of Nickel containing recycled material processed in Ontario and Manitoba in 2003. 30,000 tonnes recycled in 2002.	Processing recycled metal (from cars, electronics, etc.) is environmentally less intrusive than mining metal.

TABLE CONTINUES ON THE NEXT PAGE

TABLE 2. REPORTED SD METRICS, PERFORMANCE AND RELEVANCE (CONTINUED)

SOCIETY			
METRIC	**COMPANY**	**PERFORMANCE**	**DESCRIPTION/NOTES**
Respect for Aboriginal People / First Nations	Teck Cominco	Recognize traditional lifestyles and adjust work schedules and transportation timetable to respect hunting, fishing and gathering seasons as well as migration patterns of wildlife.	From point of first contact in communities, companies must demonstrate sensitivity to community lifestyle and traditions including toward Aboriginal/ First Nations employees. Positive community and employee relations enhances employee productivity and community assurance and reduces business risk (labour strife, permitting, access to new markets).
Emergency Preparedness (EP) and Fire Prevention (FP)	INCO	Developed programs, or re-enforced existing programs, to ensure emergency preparedness and fire prevention training and programs met high standards. Programs were implemented for Sudbury, Manitoba, UK, PT INCO and Voisey's Bay in 2003.	EP and FP programs limit the risk of emergencies/fires impacting operations while helping to demonstrate adequate/responsible due diligence.
SD Awards	INCO	Received Gold Level Reporter status from Canada's Climate Change Voluntary Challenge and Registry for 5th consecutive year.	Prestigious awards elevate the perception of "superior SD performance". Being identified as a superior SD performer can enhance a company's licence to operate (e.g. by being identified as a partner of choice, greater community acceptance, etc.). It can also translate to "low risk" with banks, insurance companies. Discounts on borrowed capital and insurance premiums may follow.
Safety/ Reportable Injury Frequency (RIF)	Noranda/ Falconbridge	Improved key safety measure, RIF, by 40% since 2002. In 2004, RIF was 3.76 (i.e., 3.76 injuries/200,000 hours worked), a 16% improvement from 2003.	Employee, contractor and community safety are key measures of SD/social performance. Lower RIF increases the productivity time of employees.
Charitable Giving	Noranda/ Falconbridge	Provided donations of $1.8 million to charitable causes in 2004.	Charitable giving helps build "assurance" for company within communities, which can be beneficial when negative events related to operations impact operations.
Community Involvement	Placer Dome	Supports Community Advisory Panels (CAPs) at all mine sites. Program administered by Centre for Innovation Management. (CIM), and does not demand employee's time (consultations are with community). Chief aim of program is to determine community concerns about PD operations, if community is "pleased" with performance, etc.	Community involvement is a key component of SD. Positive community relations can facilitate licensing for expansions, help gain support for new operations/access to new markets.
Diversity Training	Teck Cominco	Supports diversity training for all employees. Aim is to provide a workplace free of discrimination and one that promotes advancement.	A discrimination free environment provides benefits such as employee turnover is lower, employee productivity higher, attraction of new "high potential" employees is greater.

TABLE CONTINUES ON THE NEXT PAGE

Table 2. Reported SD Metrics, Performance and Relevance (continued)

ECONOMY			
METRIC	COMPANY	PERFORMANCE	DESCRIPTION/NOTES
Participation/Support for Professional Organizations	Teck Cominco	Company supports, and is active in, various professional associations: e.g., Prospectors and Developers Association of Canada Environmental Excellence in Education (E3) Program, Mining Association of Canada Tailings Management Guide, MAC's Sustainable Mining Initiative, International Zinc Association's Sustainable Development Action Plan.	Professional associations can develop voluntary programs that can help reduce costs through steamlining and regulatory efficiency. Professional associations can develop initiatives that can produce cost savings for an entire industry sector.
Inclusion in SRI Funds/Recognition by SRI Ranking Organizations	INCO	In 2004, received a "best in class" ranking from Storebrand Social Responsibility Index, and was included in FTSE4Good Index.	Inclusion in SRI funds drives investment in stock (as these funds may be adopted by institutions selling SRI funds). Additionally, recognition by SRI ranking organizations serves as "third party" endorsement for company's SD programs.
Six Sigma Programs	Noranda/ Falconbridge	150 Six Sigma projects completed in Noranda/ Falconbridge in 2004. Over 3,000 employees trained in Six Sigma across Noranda/ Falconbridge. Annualized cost savings of $50.7 million, up from $35.6 million in 2003.	Program involves a step-by-step, statistical approach to continuous improvement and project management through timely project execution and maintenance.
Payroll/Benefits by Country (data provided here for Canada and US only)	Alcan	Payroll for 2001, $646 million in Canada, $599 million US.	Payroll translates into "value add" in communities, and may facilitate License to Operate. Operational expansions/ new licensing may be facilitated by the "value add/good will" created through "payroll".

2.4 Summary

The analysis of the SD metrics for the five mining companies reveals that much of the data is descriptive in nature and only a small proportion is easily used to perform valuation calculations [5]. Of the hundreds of broadly focused descriptive "stories" that reference SD practices and performance in these reports, it is estimated that only approximately 10% provide sufficient quantitative data on SD performance, and business and financial implications to enable valuation calculations. This observation, and related recommendations, will be expanded on in Part III – Guidance and Recommendations, below.

Nevertheless, as will be seen in the next section, this 10% provides adequate input to illustrate that there are techniques which are readily available, and in use, to make the translation of SD metrics into financial valuation possible.

[1] Other examples of useful sources include company internal documents, the knowledge of corporate executives, and SRI reviews.
[2] Feltmate, B.W. *et al.* 1999. *Writing and Evaluating Sustainable Development and Environmental Reports.* Management Accounting Guideline. Society of Management Accounts of Canada.
[3] Typically, mining companies report approximately 200 SD initiatives in SD Reports (Feltmate *et al.* 1999.)
[4] Data provided below for Canada and US only.
[5] Based on the authors' expert knowledge of sustainability reporting practices, a similar situation is believed to exist among other sectors and their reporting practices; more investigation of other sectors is required to explore and communicate about this issue.

3.0 PART II – TRANSLATION INTO VALUATION

For publicly traded companies, market value is established, in part, by the collective viewpoints of the investment managers responsible for large pools of institutional capital. These "value" viewpoints are also influenced by research analysts at investment banks and credit agencies that cover these companies.

Financial audiences are often unfamiliar with the environmental and social language of SD. They are, however, extremely adept at assimilating information when expressed in terms of revenue growth, cost reduction, reduced investment requirements or lowered risk. They use this information to modify valuation models of companies using standard valuation techniques. such as Ratio Analysis, Discounted Cash Flow Analysis (DCF), "Rules of Thumb" valuations, Economic Value Added (EVA™)Analysis and Option Pricing models.

This part of the Pilot Analytical Framework takes example SD metrics from Table 2, above, and translates performance into financial valuation using these established techniques. In so doing, it demonstrates that this type of translation is possible and replicable. The results that follow help demonstrate how companies can better describe, assess and communicate the impact of their SD practices in financial terms. Clearly, they also point to substantial data limitations and areas for further work.

Before addressing the specifics of the quantitative analysis, it is worth reviewing the characteristics of the principal valuation techniques.

3.1 Valuation Techniques

3.1.1 Ratio Analysis

Valuation of a company's common equity price (P) or the entire enterprise value (EV) is established as a ratio of measurable factors in a company's operations such as the following:

- Price/Earnings (P/E);
- Price/Cash Flow (P/CF);
- Price/Book Value of Equity (P/BV); and,
- Enterprise Value/Earnings Before Interest, Tax, Depreciation and Amortization (EV/EBITDA).

These ratios are compared to peers in the company's industry and to ratios from a company's own historical business cycle to determine relative valuation and the likelihood that the company is either overvalued or undervalued in the marketplace and by approximately how much. These techniques are particularly useful for establishing relative valuation, however they are less reliable in establishing absolute valuation.

3.1.2 Discounted Cash Flow (DCF) Analysis

Absolute valuation of a company is best achieved through a DCF analysis. This is typically the most detailed and complex of the valuation methods. It starts with a detailed forecast of a company's future after-tax cash flows resulting from operations. These are then adjusted to reflect capital expenditures necessary to sustain the business. This stream of cash flows is then discounted back to the present time using a discount rate which fairly reflects the risk adjusted weighted average cost of capital of the company. The result is an estimate of the total enterprise value of a company. Deducting the current outstanding debt provides the equity value, which when divided by the number of shares outstanding is an estimate of the fair market value of a company's stock.

3.1.3 Rules of Thumb Valuations

Many industries, including the mining industry, are valued using methods that are very specific to their business operations. Examples of "rules of thumb" valuations for the mining industry include:

- Price/Proven and Probable Reserves;
- Price/Mineral Production.

Typically, a peer group analysis establishes the rule of thumb value for, as an example, an ounce of proven gold reserve. This recognized value is then applied to the total ounces of gold reserves reported by the company to establish a total value of an ore body. This value is then, in turn, combined with the value of other ore bodies owned (or partially owned) by the company, and added to non-operating asset values to establish a Net Asset Value (NAV) of the entire company. Most companies trade at a discount to NAV based upon market conditions and the business cycle.

3.1.4 Economic Value Added (EVA™) Analysis

EVA is defined as the difference between a company's net operating profits (NOPAT) and its total cost of invested capital over a given time period, typically one year. The capital charge is necessary to compensate the providers of debt and equity for use of their capital, at a rate adequate for the risk incurred. If EVA is positive, the company has created value above the minimum return required by investors, and if it is negative, wealth is being destroyed.

The market value of a company is equivalent to its in-

vested capital plus the sum of all future EVA. From this basic relationship, a company's enterprise value can be determined from a forecast of its EVA.

3.1.5 Option Pricing

Certain business activities create value for companies by providing alternatives or choices for the future. These choices or "options" do not necessarily have discrete cash flows but do provide tangible value for a company. Option pricing methods can be applied to these situations to provide a quantitative way to estimate and communicate the economic value of these choices. The technique is also particularly useful when uncertainty of outcomes exists and more than one result is possible.

3.2 Translation Examples

Ten worked examples of translating SD into financial valuation, based on seven metrics, are provided below. These include:

- INCO Solid Waste Diversion translated into
  - DCF;
  - Price to Cash Flow Per Share ratio (P/CFPS);
- Noranda/Falconbridge Energy Savings GHG Emissions Reductions/translated into
  - DCF;
  - P/CFPS;
- Placer Dome Community Involvement translated into
  - DCF;
- Teck Cominco Community and Employee Relations into
  - Rules of Thumb (Price to Net Asset Value);
- INCO SD Awards into
  - Option Pricing valuation;
- Noranda/Falconbridge Improved Reportable Injury Frequency (RIF) into
  - EVA;
- Noranda/Falconbridge Six Sigma Projects into
  - DCF;
  - P/CFPS.

3.2.1 INCO – Solid Waste Diversion (Non-Hazardous)

The assessment of SD performance in Part I of this document reveals that INCO had diverted substantial amounts of solid waste from municipal landfill through the period reflected in its 2003 sustainability report. This diversion represents an annual savings of approximately $2.4 million. This provides a suitable metric for illustrating translation using DCF and P/CFPS.

Table 3 shows the calculations performed for translation using each of these methods. With respect to the DCF valuation it can be discerned that:

- At an estimated weighted average cost of capital

Table 3. INCO Solid Waste Diversion

INCO SOLID WASTE DIVERSION	
Performance:	
Non-hazardous solid waste is diverted from municipal landfill at the Sudbury location	
Translation:	
Cost savings on landfill fees	= $2.4 million per year
Valuation:	
Example A – Discounted Cash Flow (DCF) Valuation i) estimate cost of capital WACC=Rf + ß(Rm-Rf) where; WACC = weighted average cost of capital Rf = risk free rate of return (10-year) ß = stock beta (Rm-Rf) = equity risk premium therefore; WACC = 4.2% + 1.3 (6.5%) WACC	= 12.7%
ii) estimate value of cash flow assuming 5% annual growth in usage or avoided fees DCF = incremental cash flow/(WACC-growth) = $2.4 million/(12.7%-5%) Present value of savings	= $31 million
iii) convert to per share valuation shares outstanding per share incremental value	= 189 million = $0.16 per share
Example B – Price to Cash Flow Per Share ratio (P/CFPS) Peer group P/CFPS multiple Cash flow per share = annual savings per share	= 5.0 – 6.0 X = $0.013
Value per share	= $0.063 per share low = $0.076 per share high
Result:	
Waste diversion at INCO saves the company $2.4 million per year, which is equivalent to just over 1 cent earnings per share. These savings are worth $31 million in total shareholder value (using DCF), or between $0.06 and $0.16 per share in total value (using P/CFPS and DCF).	

(WACC) of 12.7%, and an estimated value of cash flow assuming 5% annual growth in usage or avoided fees, this represents a present value of savings of approximately $31 million;
- With 189 million shares outstanding, this converts to per share incremental value (potential share price appreciation) of $0.16 per share.

With respect to P/CFPS valuation, and with a peer group multiple of 5-6 times, it can be discerned that cash flow per share/annual savings per share is equal to $0.013.

The overall valuation result for INCO solid waste diversion is therefore:

- The $2.4 million in savings associated with waste diversion is equivalent to just over 1 cent earnings per share (EPS).
- These savings are worth $31 million in total shareholder value (using DCF) or between $0.06 and $0.16 per share in total value (using P/CFPS and DCF).

3.2.2 Noranda/Falconbridge Energy Savings (Greenhouse Gas [GHG] Emissions Reductions)

The assessment of SD performance in Part I of this document reveals that Falconbridge had reduced its energy consumption (and associated GHG emissions) by 6% per unit of output during the period between 2003 and 2004. This provides a suitable metric for illustrating translation using DCF and P/CFPS.

Table 4. Noranda/Falconbridge Energy Savings/GHG Reductions

NORANDA/FALCONBRIDGE ENERGY SAVINGS/GHG EMISSIONS REDUCTIONS	
Performance:	
Energy consumption reduced by 6% per unit of output	
Translation:	
Actual energy used in 2004	= 81,370 Terajoules (Tj)
Energy used at 2003 rate of consumption	= 86, 252 Tj
Implied energy savings	= 4, 882 Tj
Cost of energy at	= $ 0.0430 per Kwh
Annual savings of	= $58 million
Valuation:	
Example A – Discounted Cash Flow (DCF) Valuation	
i) estimate cost of capital	
WACC=Rf + ß(Rm-Rf)	
where;	
WACC = weighted average cost of capital	
Rf = risk free rate of return (10-year)	
ß = stock beta	
(Rm-Rf) = equity risk premium	
therefore;	
WACC = 4.5% + 1.4 (6.5%)	
WACC	= 13.3%
ii) estimate value of cash flow assuming no growth	
in perpetuity	
DCF = incremental cash flow/WACC	
= $58.3 million/13.3%	
Present value of energy savings	= $438 million
iii) convert to per share valuation	
shares outstanding	= 179.7 million
per share incremental value	= $2.44 per share
Example B – Price to Cash Flow Per Share ratio (P/CFPS)	
Peer group P/CFPS multiple = 5.0 – 6.0 X	
Cash flow per share = annual savings per share	= $0.32
Value per share	= $1.62 per share low
	= $1.95 per share high
Comparison:	
Falconbridge production levels for 2004	
e.g.	
Nickel 112,000 tonnes	
Copper 395,000 tonnes	
Nickel (US currency)	= $0.43/kg
	= $0.19/lb
Copper (US currency)	= $0.12/kg
	= $0.05/lb
Result:	
The energy savings program/GHG emissions reduction increases per share value of Falconbridge by $1.62 to $2.44. This is equivalent to an improvement in Nickel prices of US$0.19/lb or an improvement in Copper prices of US$0.05/lb.	

Table 4 shows the calculations performed for translation using each of these methods. With respect to the DCF valuation it can be discerned that:

- The energy saved translates into a financial gain to the company of approximately $58 million;
- At an estimated weighted average cost of capital (WACC) of 13.3%, this represents a present value of energy savings of approximately $438 million;
- With 179.7 million shares outstanding, this converts to per share incremental value (potential share price appreciation) of $2.44 per share.

With respect to P/CFPS valuation, and with a peer group multiple of 5-6 times, it can be discerned that:

- The energy savings translates into a cash flow per share/annual savings per share of $0.32 which represents a value per share of between $1.62 share (low) and $1.95 per share (high);
- At production levels of 112,000 tonnes of Nickel and 395,000 tonnes of Copper, this represents a net gain of US$0.43 per kilogram or US$0.19 per pound of Nickel production and a US$0.12 per kilogram or US$0.05 per pound of Copper production.

The overall valuation result for Falconbridge energy savings is therefore:

- An increase per share value of between $1.62 (P/CFPS) and $2.44 (DCF);
- This is equivalent to an improvement in Nickel prices of US$0.19 per pound or an improvement in Copper prices of US$0.05 per pound.

3.2.3 Placer Dome Community Involvement

The assessment of SD performance in Part I of this document reveals that Placer Dome has a well developed community involvement program that includes the use of Community Advisory Panels (CAPs) for stakeholder engagement and community outreach. The assessment also suggests that superior community investment programming, like that of the CAPs employed by Placer Dome, can facilitate licensing for expansions, help gain support for new operations and access to new markets. This provides a suitable metric for illustrating translation.

In order to perform the analysis, an assumption must be made. It must be assumed that Placer Dome's CAPs program leads to a fast tracking of project approval and project "booking" that is one year earlier than expected/initially planned for.

A project must also be selected upon which to model the results of the fast tracking. In the present case, the company's Cerro Casale exploration project has been selected.

Table 5 shows the calculations performed for translating the influence of Placer Dome's CAP programming on the fast tracking of its Cerro Casale project. From the sample calculations, it can be discerned that:

Table 5. Placer Dome Community Involvement

PLACER DOME COMMUNITY INVOLVEMENT	
Performance:	
Community involvement through Community Advisory Panels (CAPs) leads to fast-tracking of new project	
Translation:	
(all values in US$)	
Development project	Cerro Casale
Ownership:	= 51%
Placer Dome's share of Gold:	= 13,000,000 ounces
Placer Dome's share of Copper	= 1,500,000 tonnes
Value of gold resource (unproven) at $200/oz	= $2.6 billion
Value of Copper at $0.50/lb	= $340 million
Total value of project	= $ 2.9 billion
Shares outstanding	= 417 million
Total value of project per share	= $7.05
Valuation:	
Example – Compare present value of project if fast track caused 1 year early opening Commence and "book" project 1 year faster than otherwise possible i) estimate cost of capital WACC=Rf + ß(Rm-Rf) where; WACC = weighted average cost of capital Rf = risk free rate of return (10-year) ß = stock beta (Rm-Rf) = equity risk premium therefore; WACC = 4.5% + 1.3 (6.5%) WACC	= 13.0%
ii) 1 year value	
DCF = value/(1+WACC)	= $2.6 billion
Difference = incremental value	= $337 million
Per share	=$0.81
Result:	
If the community involvement program can fast track the Cerro Casale project by one year it will add value to Placer Dome stock estimated at US$0.81 per share. This is a 5.5% valuation lift from its current trading price of US$14.70 per share.	

- The total value of the project is US$2.9 billion (both Gold and Copper);
- With 417 million shares outstanding, the total value of the project per share is US$7.05;
- At an estimated weighted average cost of capital (WACC) of 13.0% this represents a "fast track' one year incremental value of US$337 million or approximately US$0.81 per share.

The overall valuation result for Placer Dome community involvement, if the CAPs program can fast track the Cerro Casale project by one year, is:

- An increase in Placer Dome valuation of an estimated US$0.81 per share which represents a 5.5% valuation lift from its current trading price of US$14.70 per share.

3.2.4 Teck Cominco Community and Employee Relations

The assessment of SD performance in Part I reveals that Teck Cominco demonstrates substantial respect for Aboriginal peoples/First Nations both in terms of their role as employees and members of the community. This sensitivity is carried through all community and employee relations across diverse projects and communities.

The assessment suggests that this type of relationship management contributes to enhancements in employee productivity and community assurance and attendant reductions in business risk. This provides a suitable metric for translation.

In order to perform the analysis, an assumption must be made. Here, it is assumed that superior employee and community relations contribute to a 10% reduction in risk.

Table 6 shows the calculations performed for translating the influence of Teck Cominco's employee and community relations. From the calculations, it can be seen that:

- A 10% reduction in risk lowers the discount rate at which the company's operations are valued from a WACC of 10% to a WACC of 9%;
- This represents an increase in the Net Asset Value (NAV) of the company, across all of its projects, from $7,497 million, or $37.06 per share, to $8,356 million, or $41.30 per share.

The overall valuation result for Teck Cominco's Aboriginal employee and community relations programming, assuming a 10% reduction in risk, is

- An increase in the value of the company of an estimated $859 million or $4.24 per share.

Table 6. Teck Cominco Community and Employee Relations

TECK COMINCO COMMUNITY AND EMPLOYEE RELATIONS				
Performance:				
Positive community and employee relations enhances productivity, community assurance and reduces business risk (labour strife, permitting, access to new markets)				
Translation:				
Reduced risk reduces the discount rate at which the company's operations are valued.				
Valuation:				
	Teck Cominco's Business Operations Net Present Value (Current)		Teck Cominco's Business Operations Net Present Value (With 10% Less Risk)	
	$Million	$/sh	$Million	$/sh
Pend Oreille 100%	$153	$0.76	$170	$0.84
Red Dog 100%	$1,762	$8.71	$1,958	$9.68
Highland Valley Copper 97.5%	$713	$3.52	$792	$3.91
Antamina 22.5%	$796	$3.94	$884	$4.38
Hemlo 50%	$92	$0.46	$102	$0.51
Pogo 40%	$216	$1.07	$240	$1.19
Elkview 40%	$2,679	$13.24	$2,977	$14.71
Fording Coal Trust 9.1%	$237	$1.17	$263	$1.30
Trail Metallurgical	$1,051	$5.20	$1,168	$5.78
Cajamarquilla Price Participation	$21	$0.10	$23	$0.11
Gross Asset Value	$7,719	$38.15	$8,578	$42.39
Net Corporate Overheads and Capex	$(391)	$(1.93)	$(391)	$(1.93)
Net Debt	$169	$0.84	$169	$0.84
NET ASSET VALUE	$7,497	$37.06	$8,356	$41.30
Difference in Value			$859	$4.24
Result:				
The risk reduction associated with Teck Cominco's enhanced community and employee relations is estimated to be valued at $859 million or $4.24 per share.				

3.2.5 INCO Sustainable Development Awards

The assessment of SD performance in Part I reveals that INCO, in 2003, received Gold Level Reporter status from Canada's Climate Change Voluntary Challenge and Registry; this for the fifth consecutive year. It suggests that such awards can contribute to a company being identified as a partner of choice which may mean better access to markets and the fast tracking of project expansions. This provides a suitable metric for translation using Option Pricing valuation.

In order to illustrate valuation using Option Pricing techniques, a hypothetical extension of the SD Awards example is required. Assume that:

- INCO is considering opening a new mine in Voisey's Bay;
- In order to approve the project, the provincial government of Newfoundland and Labrador require that INCO develop a smelter to process ore on site rather than trucking the ore to another location for processing--this to provide jobs and economic development in the local community;
- The mine on its own has a net present value (NPV) to the company of $2 billion and is economically viable;
- The mine with the smelter has a NPV of (-$400 million) and is not economically viable;
- Because of INCO's SD awards/SD track record, the provincial government gives the company an "option" to expand the mine anytime in the next five years without any of the additional approval or permitting requirements that would normally be required for such an expansion;

The overall valuation result for INCO's SD Awards is:

- INCO's SD track record makes it possible for the company to open a new operation in Voisey's Bay. This is due to the fact that because of its SD track record, it is given an option to expand the mine in the future without any of the additional approvals that would normally be required. This option, worth $712 million to the company, changes the economics of the project from a negative NPV of -$400 million to a positive NPV of $312 million (mine, smelter and pre-approved option to expand) thereby making the operation at Voisey's Bay attractive and viable.

Table 7. INCO Sustainable Development Awards

INCO SUSTAINABLE DEVELOPMENT AWARDS	
Performance:	
INCO's environmental awards elevates the company as a "partner of choice" and provides access to markets and fast tracking of project expansions.	
Translation:	
Option pricing can be used to value enhanced access to a market or project expansion.	
Valuation:	
Assume that INCO is considering opening a new mine in Voisey's Bay. The Newfoundland provincial government has demanded that a smelter operation be built as a requirement of the mine opening.	
Assume that the NPV of the mine alone is:	= $2 billion
Assume that the NPV of the mine and smelter is:	= (-$400) million
Normally the project would not go ahead unless the economics are changed.	
Assume that because of INCO's SD track record, the provincial government gives INCO an "option" to expand the mine anytime in the next five years without any of the additional approval or permitting requirements that would normally be required for such an expansion.	
Assume that the value to the company of the expansion is:	= $3 billion
Assume that the cost of expansion is very uncertain but it is estimated to be:	= $3.2 billion
Variability of the estimate is:	= +/-20%
What is the option value on the expansion?	
Strike price (cost of expansion) is:	= $3.2 billion
Value of expansion:	= $3 billion
Time to expiration:	5 years
Riskless rate of interest:	= 4%
The Value of the Call Option to Expand is:	=$712 million
NPV of mine, smelter and option to expand:	=$312 million
Result:	
INCO's SD track record makes it possible for the company open a new operation in Voisey's Bay, even though the operation may initially have a negative NPV (-$400 million), because its SD track record results in it being given an option, that would not otherwise exist, of great enough value to the company ($712 million) to make the operation economically viable (NPV of $312 million with mine, smelter and pre-approved option to expand).	

3.2.6 Noranda/Falconbridge Improved Reportable Injury Frequency

The assessment of SD performance in Part I reveals that Noranda/Falconbridge Reportable Injury Frequency (RIF) improved by 40% between 2002 and 2004. It suggests that lower RIF can contribute to increases in the productivity time of employees and reduced costs of benefits and settlements. This provides a suitable metric for translation using the Economic Value Added (EVA) method.

In order to illustrate a translation and valuation approach using EVA, an extension of the RIF information is required. Assume that:

- An initial investment in safety training, safety equipment, process redesign and safety audits of $10 million was required in 2002;
- On-going investment in training, equipment and audits of $1 million per year is required to maintain a superior level of worker safety;
- Assume one reportable injury per 200,000 hours worked is equivalent to 250 "actual" injuries in the company (assuming total employees of 25,000);
- Assume each injury costs $50,000 in lost time, reporting and productivity impact (in some cases the injury may cost hundreds of thousands, and in some cases the cost is minimal);

Table 8 shows the calculations performed for translating the influence of Noranda/Falconbridge's improved RIF into financial valuation. From the calculations, it can be seen that:

- A 39% reduction in RIF over the two year period translates into a dollar value of $30,625,000;
- At a WACC of 12.7% , the EVA in 2004 compared to 2002 is $16,510,000 or an average of $8,255,000 per year;
- This converts to a Market Value Added of $65,256,917;
- This, in turn, converts to a per share valuation, on 305 million shares outstanding, of $0.21 per share.

The overall valuation result for Noranda/Falconbridge's improved RIF is therefore:

- The company's safety program has created an economic value added of approximately $8.2 million per year (not including insurance claims or long term disability payments) from the period of 2002 to 2004. If sustained, this improvement alone translates to an incremental value of $65 million, or $0.21 per share.

Table 8. Noranda/Falconbridge Reportable Injury Frequency (RIF)

NORANDA/FALCONBRIDGE REPORTABLE INJURY FREQUENCY (RIF)			
Performance:			
RIF improved 39% from 2002 to 2004			
Translation:			
		1 yr reduction %	2 yr reduction %
Reportable injury frequency in 2002	= 6.21		
Reportable injury frequency in 2003	= 4.49	-28%	
Reportable injury frequency in 2004	= 3.76	-16%	-39%
Annual benefit of RIF improvement from 2002 to 2004 (at $50,000 per unit and 25,000 full time employees)	=$30,625,000		
Valuation:			
i) estimate cost of capital			
WACC=Rf + ß(Rm-Rf)			
where;			
WACC = weighted average cost of capital			
Rf = risk free rate of return (10-year)			
ß = stock beta			
(Rm-Rf) = equity risk premium			
therefore;			
WACC = 4.2% + 1.3 (6.5%)			
WACC	= 12.7%		
ii) calculate EVA in 2004 compared to 2002			
incremental NOPAT			
= Annual Benefit	= $30,625,000		
less Annual Costs	= $1,000,000		
	= $29,625,000		
After Tax (assume 40% tax rate)	= $17,775,000		
Therefore NOPAT	= $17,775,000		
Incremental Capital employed	= $10,000,000		
Cost of capital = WACC*Capital	= 1,265,000		
EVA from 2002 to 2004	= $16,510,000		
Average per year	= $8,255,000		
iii) convert to Market Value Added			
Future value of EVA = EVA/(WACC)	= $65,256,917		
iv) convert to per share valuation			
shares outstanding	= 305 million		
per share incremental value	= $ 0.21 per share		
Result:			
The safety program at Noranda/Falconbridge created economic value added of approximately $8.2 million per year (not including insurance claims or long term disability payments) from the period 2002 to 2004. If sustained, this improvement alone translates to incremental value of $65 million or $0.21 per share.			

3.2.7 Noranda/Falconbridge Six Sigma Projects

The assessment of SD performance in Part I indicates that Noranda/Falconbridge undertook 150 Six Sigma projects in 2004. The company reports that this has resulted in an annualized cost savings of $50.7 million, up from $35.6 million in 2003. This provides an appropriate metric for illustrating translation using DCF and P/CFPS.

Table 9 shows the calculations performed for translation using each of these methods. With respect to the DCF valuation it can be discerned that:

- The Six Sigma projects have resulted in an average annualized cost savings over 2003-2004 of $43.2 million;
- At an estimated weighted average cost of capital (WACC) of 12.7%, this represents a present value of energy savings of approximately $560 million;
- With 305 million shares outstanding, this converts to per share incremental value (share price appreciation) of $1.84 per share.

With respect to P/CFPS valuation, and with a peer group multiple of 5-6 times, it can be discerned that:

- The energy savings translates into a cash flow per share/annual savings per share of $0.14 which represents a value per share of between $0.71 share (low) and $0.85 per share (high);
- At production levels of 113,000 tonnes for Nickel, 1,000,000 tonnes for Copper, and 480,000 tonnes for Zinc, this represents a net gain of US$0.30 per kilogram or US$0.14 per pound on Nickel production, US$0.03 per kilogram or US$0.02 per pound on Copper production, and US$0.03 per kilogram or US$0.02 per pound on Nickel production.

The overall valuation result for Noranda/Falconbridge Six Sigma projects is therefore:

- Equivalent to an improvement in Nickel prices of US$0.14 per pound or an improvement in Copper prices of US$0.02 per pound, or an improvement in Zinc prices of US$0.03 per pound.

Table 9. Noranda/Falconbridge Six Sigma Projects

NORANDA/FALCONBRIDGE SIX SIGMA PROJECTS		
Performance:		
Six Sigma projects produce annualized savings of $50.7 million		
Translation:		
Six Sigma savings in 2004:	$50.7 million	
Six Sigma savings in 2003:	$35.6 million	
Average	$43.2 million	
Valuation:		
Example A – Discounted Cash Flow (DCF) Valuation		
i) estimate cost of capital		
WACC=Rf + ß(Rm-Rf)		
where;		
WACC = weighted average cost of capital		
Rf = risk free rate of return (10-year)		
ß = stock beta		
(Rm-Rf) = equity risk premium		
therefore;		
WACC = 4.2% + 1.3 (6.5%)		
WACC	= 12.7%	
ii) estimate value of cash flow assuming 5%		
DCF = incremental cash flow/WACC-growth	= $43.2 million/(12.0%-5%)	
Present value of energy savings	= $560 million	
iii) convert to per share valuation		
shares outstanding	= 305 million	
per share incremental value	= $1.84 per share	
Example B – Price to Cash Flow Per Share ratio (P/CFPS)		
Peer group P/CFPS multiple = 5.0 – 6.0 X		
Cash flow per share = annual savings per share	= $0.14	
Value per share	= $0.71 per share low	
	= $0.85 per share high	
Result:		
Noranda/Falconbridge's Six Sigma projects create savings worth $0.71 to $1.84 per share using P/CFPS and DCF techniques.		
Comparison:		
Noranda/Falconbridge production levels for 2005		
e.g.		
Nickel 113,000 tonnes	Copper 1,000,000 tonnes	Zinc 480,000 tonnes
Value of Six Sigma savings is equivalent to what price change in the basic commodities of production		
Nickel (US currency)	= $0.30/kg	
	= $0.14/lb	
Copper (US currency)	= $0.03/kg	
	= $0.02/lb	
Zinc	= $0.07/kg	
	= $0.03/lb	
Result:		
Noranda/Falconbridge's Six Sigma Program is equivalent to a US$0.14/lb price improvement in nickel, a US$0.02/lb price in copper, or a US$0.03/lb price improvement in zinc.		

3.3 Summary

The examples above clearly demonstrate that it is indeed possible to translate SD into financial valuation. Examples using Ratio Analysis, DCF, Rules of Thumb, EVA, and Option Pricing show how established financial valuation techniques can be used to measure and communicate about the additive value of corporate SD practices in a financial language. The potential for using this type of analysis to communicate the additive value to the financial community is great. The opportunities for developing more comprehensive data sets that can be used as inputs to this type of analysis is also substantial.

4.0 PART III – GUIDANCE AND RECOMMENDATIONS

Having demonstrated that it is possible to translate the additive value of SD into financial valuation, it is now possible to provide summary guidance and recommendations. In doing so, it is recognized that this Pilot Analytical Framework is a starting point for an important area of further research.

4.1 Key Steps to Translation

Essentially, the Framework for Translating SD into Financial Valuation Measures comprises seven key steps. These are:

1. Identify the SD metric to be analyzed;
2. Establish the scope of the metric including
   a. What operations will be reviewed
   b. What factors are material
   c. What is the timeline
   d. What can be measured and quantified
   e. What must be estimated;
3. Gather data and attempt to quantify as many elements of the SD metric as possible;
4. Consider valuation methodologies that are appropriate for company's industry and apply these methodologies to the SD data;
5. Convert valuation impacts into "per share" impacts, or other basis for communicating additive value in financial terms/language;
6. Aggregate results for individual SD metrics to estimate the overall valuation impact of environmental, social or economic factors; and,
7. Communicate findings within organization and with relevant financial community members.

4.2 Sustainable Development Metrics Predisposed to Financial Valuation

The development of this Framework reveals substantial limitations in the suitability of existing publicly reported corporate SD metrics data for translation purposes.

Two key findings related to the suitability for translation purposes of existing SD metrics emerge from this work. These include that:

- The corporate SD reports reviewed for the purposes of this investigation are characterized by a consistent, noticeable absence of appropriate information that precludes valuation of 80-90% of a company's reported environmental, economic and social practices. For example, many companies discuss their commitments to diversity training and awareness programs as part of disclosing their "social" activities. None of these companies, however, provide estimates or base-line calculations as to how diversity training is contributing to worker productivity, decreased absenteeism and/or lowered employee turnover and training costs.
- Where there is relevant data regarding specific SD metrics in these reports, it is often scattered and thereby difficult to assemble and analyze for the purposes of ascertaining general additive value and translating into valuation.

To facilitate the identification of additive value and translation into financial valuation, it is therefore recommended that companies report key SD metrics and related valuation information in a single summary table; preferably appearing early in related reports and communications. Table 10 identifies the types of information to be included in such a summary.

4.3 Further Research

Two main types of additional investigation are required to advance this field over the immediate term. These include 1) conducting comparable analyses for other sectors and additional metrics, and 2) working with companies to apply the framework. These two activities, in turn, will result in the identification of additional avenues for innovative integration of sustainability and finance.

Several important trends are converging to help facilitate more of this type of analysis in the future. First, as more and more measurement of corporate SD and its impacts takes place, an increasing amount of data suitable for translation is becoming available (e.g. continuously improving sustainability reporting, Corporate Knights Corporate Citizenship Database™, etc.). Second, as stakeholder pressure continues to build to better understand the actual quantitative financial impact of corporate SD practices, and to more fully engage the financial community on SD, additional support is being provided for innovative projects such as this one. Third, global environmental issues such as climate change, which are now being commonly recognized as posing huge financial risks, are forcing unprecedented integration of considerations of sustainability in financial decision-making and in the operation of world capital markets (e.g. EU Emissions Trading Scheme).

More effort is also required in the area of communications. The results of this Framework, and related further research, must be communicated to the broader financial community and other stakeholders to help foster integration.

Table 10. Sustainable Development Valuation Information

SUSTAINABLE DEVELOPMENT VALUATION INFORMATION	
METRIC	**VALUATION INFORMATION**
Reductions in Solid/ Non-Hazardous Waste Diversion from Landfill	Identify volume of waste reduction/diversion Identify type of waste reduction/diversion Identify average $ cost/unit of waste reduction/diversion savings
Land Reclamation	Identify stakeholder recognition for land reclamation Describe impact of land reclamation on company brand/image Estimate $ value of enhanced brand to company – e.g. how enhanced brand impacts fast-tracking of project licensing, expansions, ease of operational start-ups
Environment, Health and Safety Audit(s)	Identify potential $ costs/risks associated with liabilities that may have occurred in absence of audit Estimate $ value of audit on reducing of lost time injuries
Emissions and Effluents	Identify/estimate $ value of savings associated with reductions in emissions and effluents
ISO 14001 Certification	Identify/estimate $ value of EMS – e.g. reductions in fines and future liabilities
Energy Savings/GHG Emissions Reductions	Identify energy savings (GWh/yr) realized through energy efficiency Identify $ value of energy savings
Recycled Metal Processed	Identify total tonnage of recycled metal Identify total $ value of recycled metal
Aboriginal/First Nations Relations	Identify how enhanced aboriginal/first nations relations provides benefit to company – e.g. enhanced worker productivity, fast-tracking project approvals/expansions Estimate $ value of enhanced aboriginal/first nations relations
Emergency Preparedness and Fire Prevention	Identify/estimate $ value emergency preparedness and fire prevention initiatives – e.g. lower insurance premiums and resultant $ value
SD Awards/Recognition	Identify awards Identify/estimate $ value of awards – e.g. enhanced worker productivity, fast-tracking project approvals/expansions
Safety/Reportable and Lost Time Injuries	Identify safety record/reportable and lost time injury frequency – e.g. injuries/200,000 hours worked Identify/estimate $ value of lower reportable injuries/lost worker time
Charitable Giving	Identify $ of charitable giving (distinguish between company-sponsored versus employee-sponsored giving) Identify/estimate $ value of charitable giving – e.g. enhanced worker productivity, fast-tracking project approvals/ expansions
Community Involvement	Identify community involvement programs Identify/estimate $ value of community involvement programs – e.g. enhanced worker productivity, fast-tracking project approvals/expansions
Diversity Training	Identify diversity training initiatives Identify/estimate $ value of diversity training initiatives – e.g. enhanced worker productivity
Participation in/Support for Professional Organizations	Identify professional organization involvement Identify/estimate $ value of professional organization involvement – e.g. participation in sector voluntary initiatives can help reduce costs through streamlining and regulatory efficiency
Inclusion in SRI Funds	Identify how company provides disclosure material to SRI funds Identify/estimate $ value associated with company's potential inclusion in SRI Funds/indices

5.0 CONCLUSION

The development of this Pilot Analytical Framework represents a step forward in the field of SD and finance. The project demonstrates that it is possible to translate the impact of corporate SD practices into financial valuation measures using traditional techniques widely adopted in the financial community. In so doing, it goes beyond simply supporting the business case for SD and takes the next logical step of translating specialized operating information into usable financial data.

Using five mining companies and the data reported in their sustainability reports as a basis for analysis, the Framework highlights strengths and weaknesses in available corporate SD metric data. At the same time, it provides useful insights for companies, financial analysts, and other stakeholders with respect to how SD practitioners can deliver more data that is predisposed to translation into financial valuation.

This project represents an important area of analysis that is worthy of additional attention, communication and stakeholder involvement. Expanding on this research and communicating widely will do much to advance the integration of considerations of sustainability into financial decision-making. Working with more and better metrics, more sectors, specific companies, and representatives of the financial community are among the near term activities that must be undertaken to advance the translation of corporate SD practices into financial valuation measures.

Afterword

Today, many companies are investing financial as well as human 'capital' on corporate sustainability programs. Some do it because it seems like the right thing to do, and others because it is the right thing to do for all stakeholders, including shareholders. The challenge to date has been to demonstrate to the financial community and, indeed, even internal sceptics, that corporate sustainability is an imperative and measurable factor for increasing business value and ensuring a company's future.

At Alcan, we see real potential to develop our value as a business by embedding sustainability-based considerations in our approach to business – the basic principle of which we have followed for decades, but one where our thinking has truly crystallized in the past five years with the development of a sustainability framework tied to our governing objective of Maximizing Value. Sustainability is increasingly becoming an integral and formal part of decision-making and managing-for-value strategies at Alcan – from our capital investment decisions to our everyday operations and relationships with external stakeholders.

As with any new concept, developing the proof points for the sustainability value link requires a nurturing period where many different points-of-view are raised and tested. In addition to efforts within the company to develop an operational approach to sustainability that explicitly recognizes the related business value, Alcan is active in a number of industry and other stakeholder efforts that are exploring this topic. By focusing on key financial metrics that are both applicable to sustainability concepts and considered important by the financial community, this report goes a long way to furthering the business case. The examples show how even the simplest community engagement effort can have a direct impact on total shareholder value and how initiatives such as greenhouse gas emission reductions can create incremental economic value.

Following through on these concepts to "speak the language of the financial community" and establish quantitative sustainability performance indicators will represent a major leap forward in linking investor confidence with a company's sustainability commitment. We view the Pilot Analytical Framework presented in this report as an important step in the evolution of the acceptance of sustainability as a necessary factor in assessing a company's profitability and value-creation potential.

Michael Hanley

Executive Vice President and Chief Financial Officer
Alcan Inc.

APPENDIX A
PROJECT BACKGROUND AND POSITION WITHIN LITERATURE

Project Background

The abbreviated background to this project is as follows:

- In the late 1990s, Ron Yachnin, under the auspices of The Conference Board of Canada (CBoC) and its members, recognizes the need for research and communications to address
  - more and better information on the business case for SD (especially quantitative) and
  - engagement of the financial community in considering SD in investment decision-making.
- In 2001, Sustainable Investment Group Ltd. and Ron Yachnin, with the CBoC, publish *Sustainable Development, Value Creation and the Capital Markets*[1]. Among the key messages of this report was a call for more quantitative data and analysis to
  - better isolate the impact of corporate SD and its elements on financial performance, and
  - identify those SD elements that have the greatest impact on value creation and share price appreciation.
- In 2002, Ron Yachnin, again with the CBoC, organized an Executive Seminar on Linking Sustainable Development and Shareholder Value. A key conclusion of the seminar was a call for more "work on common analytical frameworks for translating SD/CSR into financial valuation and related reporting".
- In 2004, the Translating Sustainable Development into Financial Valuation Measures project was launched.

Literature

The literature on SD and finance has grown substantially in recent years. Whereas five years ago there were only a small number of articles on this subject, today there are many hundreds.

Despite this, the body of research that deals with quantitative aspects of the relationship between corporate SD performance and financial performance is still relatively small. The research that deals with SD performance as it relates to share price appreciation is smaller still. And the research that deals with the impact of specific corporate SD initiatives and their impact on valuation and share price appreciation is extremely small, perhaps a handful of studies. Most significantly, at the time of writing, the authors are not aware of any other work that employs company-specific SD data and traditional financial valuation techniques to isolate impact on company valuations and share price as does the current study.

The "Literature Review on Corporate Responsibility (CR) and Responsible Investment (RI)" recently compiled by the NRTEE provides one of the best snapshots available of the current literature. It reveals the following key points:

- In general, capital markets participants do not fully accept that environmental and social risks are material to company performance. Consistent findings in the literature point to a need to further develop internationally credible quantitative research on the financial materiality of CR information, including sector specific issues, in order to improve the understanding of investment implications of CR risks and opportunities.
- Although the literature does highlight the growing belief among companies in the business case for CR, further research is required to strengthen the link between better CR performance and shareholder value.
- There are positive indications that mainstream analysts and investors are beginning to understand, accept and effectively incorporate CR into capital allocation decisions. The literature is not, however, conclusive as to whether investors are putting a premium on CR. The major form of capital allocation from the markets to CR/RI is through allocations to SRI funds. The challenge is to drive adoption of CR principles into the mainstream investment world.
- Presently, the communication and interaction between CR proponents and the mainstream investment community is limited. CR needs to be better articulated and described in terms that are meaningful to mainstream analysts and investors. Globally significant issues such as climate change are proving to be catalysts for creating general agreement that CR relates to investment risks or adds value.
- Internationally, and in Canada, new disclosure legislation has required companies to progressively disclose more information to financial stakeholders. Company reporting on CR issues has not, however, been sufficiently refined to meet the specific information and risk assessment needs of investors. Further research is needed to assess the adequacy of related regulations and voluntary initiatives, including performance measures, to help drive additional quality financially relevant CR disclosures from

[1] Dr. Blair W. Feltmate, Brian A. Schofield, Ron W. Yachnin, 2001. *Sustainable Development, Value Creation and the Capital Markets.* Conference Board of Canada Report No. 324-01.

companies and sectors.

- There are no universally agreed upon metrics used by companies and investors to recognize and measure the financial impact of CR or its elements. More research needs to be done in the development of credible, robust tools and benchmarks which evaluate and quantify CR performance and risks. Additional research is required into how to capture, define and quantify the benefits arising out of intangible values such as reputation, brand and human capital.
- Addressing the issue of education and effective communication is fundamental if companies and investors, particularly mainstream investors, are to have a common understanding of CR issues and an effective dialogue in order to recognize and reward CR.

Clearly, the current study is positioned within the literature so as to address many of key information and communication gaps that currently exist. These include those related to: financial materiality, understanding investment implications, linking SD/CR performance and shareholder value, articulating benefits in financial language, providing for the specific information and risk assessment needs of investors, developing measures to help drive financially relevant SD/CR disclosures, engaging the mainstream financial community, developing robust tools and benchmarks which evaluate and quantify SD/CR performance, risks and benefits, and providing for better communications. As such, the current study represents an important contribution to existing literature, and as noted earlier, an important area for further research.

APPENDIX B
THE MINING SECTOR AND SUSTAINABLE DEVELOPMENT IN CANADA

The mining sector is an integral part of the Canadian economy. Among the facts that illustrate the sector's overall national importance are that it [1]:

- Contributes $40 billion to the economy, or 4% of GDP;
- Accounts for one in 41 Canadian jobs, and one in ten jobs in goods production;
- Provides an engine of growth for many rural communities (i.e. ~1,100 Aboriginal communities located within 200 kilometres of mining projects);
- Accounts for 13% of total Canadian exports ($47 billion);
- Represents a global centre for mine financing and exploration ranking second in the world in exploration expenditures ($4.2 billion in 2002) and accounting for 45% of total global equity raised for the sector;
- Accounts for a 30% of all shares traded on the TSX and a substantial proportion of market capitalization (13 of the top 100 market capitalization companies);
- Contributes substantially to Canadian R&D with seven of the top 100 R&D investors.

The Mining Association of Canada (MAC) is the umbrella industry association for the mining and minerals sector in Canada. Its current members include: Albian Sands Energy, Aur Resources Inc., Barrick Gold Corporation, BHP Billiton Metals Canada Inc., BHP Diamonds Inc., Breakwater Resources Ltd., Cambior Inc., Canadian Zinc Corporation, De Beers Canada Exploration Inc., Diavik Diamond Mines Inc., Dynatec Corporation, Falconbridge Limited, HudBay Minerals Inc., Inco Limited, INMET Mining Corporation, Iron Ore Company of Canada, Kinross Gold Corporation, Newmont Mining Corporation of Canada Limited, Noranda Inc., Placer Dome Inc., Quebec Cartier Mining Company, Royal Canadian Mint, Suncor Energy Inc., Syncrude Canada Ltd., Teck Cominco Limited [2].

The Canadian mining sector's commitment to SD is reflected in its Towards Sustainable Mining (TSM) Initiative. Announced in May of 2004, it represents a move on the part of the industry as a whole to better align with the values of diverse stakeholders. Initially, the initiative is focused on tailings management, energy management, stakeholder outreach (including reporting), and crisis communications. Over time, it is expected to address other sustainability issues [3].

An indication of commitment to SD at the level of the individual company can be found in company-specific sustainability reports. According to recent national surveys, 12 Canadian mining companies produced sustainability reports in 2003; this up from seven in 2001 [4]. They include: Barrick Gold Corporation, BHP Billiton Limited, Boliden, Cameco Corporation, Diavik Diamond Mines, Hudson Bay Mining and Smelting, Inco Limited, Iron Ore Company of Canada, Noranda inc./Falconbridge Limited, Placer Dome Inc., QIT/QMP, and Teck Cominco Limited. A number of these companies are among the pioneers in sustainability reporting having produced such reports for a number of years.

[1] Mining Association of Canada, 2004, "Facts and Figures"; Toronto Stock Exchange, 2005, TSXTRA, 4(1).
[2] Mining Association of Canada, 2005, "List of Members".
[3] Mining Association of Canada, 2004, "The Mining Association of Canada Focuses on Sustainable Mining", Press Release, May 10.
[4] Stratos STS, 2003, *Building Confidence – Corporate Sustainability Reporting in Canada*.

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