Sustainability in Project Analysis[1]

By Mark E. Smith, PE
Susan A. Joyce, MSc.

Sustainable development in mining is sometimes considered an oxymoron – a moniker that is sometimes well deserved. More often, however, mining is an essential ingredient in a developing country's long range vision. A reliable way to earn hard currency, a means to import key technology, a tool for improved access to social infrastructure such as hospitals, schools and so forth. Despite the economic engine provided by mining in countries such as Brazil, Peru and Chile, the question "How can mining bring sustainable development" is one the industry is only now beginning to address. More fundamentally, what does sustainability mean in the context of exploitation of non-renewable resources and how can we incorporate this into our evaluation and design processes?

As industry struggles to stay viable in difficult times while also addressing new social expectations, sustainable development will become manageable to the engineer or geologist in the field only if it becomes part of how they think, how they do business. This same hurdle was faced with environmental performance some 20 or 30 years ago, and industry succeeded in making environment management part of how they do business. We hope to contribute to that process in a series of articles over the next year to look at practical applications and taking sustainability into some of the core decisions for project analysis and mine development.

What Does Sustainable Development Mean?

As we know, mining is a difficult 'fit' within the rubric of sustainable development, for both proponents and opponents of the industry. We propose a simple approach to understanding it – based on extensive work by others[2] – which is that sustainability is the persistence over time of quality of life, or those characteristics that contribute to human and ecosystem well-being. Sustainable development is taking action to improve that quality of life through a project, an investment, or a planned process of change.

Two additional points need to be made in particular for mining industry readers, because of the prevalence of certain attitudes in our industry. First, the definition of well-being changes from person to person and from place to place, and cannot be imposed or predetermined. Thus what appears as a benefit to a mine manager may not be so for a local farmer. Secondly, sustainable development has both an inter-generational and an intra-generational aspect[3] – the needs of people today must be addressed - at the same time we should not compromise the ability of future generations to achieve well-being as they define it, such as through environmental damage.

---

[1] Published in The Latin American Mining Record, July/Aug. 2003.

[2] These definitions are based on the extensive work of R. Anthony Hodge, Anthony Hodge Consultants Inc. See Sustainability and the Proposed Tulsequah Chief Project, May, 2001.

[3] See Joyce and Thomson, 2002. Two Cultures of Sustainable Development, PDAC Communique. Toronto, Canada.

Mining is a temporary but powerful economic development activity in what are frequently isolated and poor areas. It contributes to sustainable development to the extent that it contributes to improvements in human and ecosystem well-being that persist beyond the life of that particular activity, while not harming either in a way that would undermine well-being in the long term.

Since we, and others before us[4], argue that sustainability needs to be integrated into the way the industry does business, there are many angles to investigate as to how to apply the concepts. In practice, however, the practical, on-the-ground decisions to improve the sustainability of a project's contribution to an area are often constrained by the big picture decision-making framework, whether that is used in head offices in Lima or London. Specifically, the use of Net Present Value (NPV) or Internal Rate of Return (IRR) analyses guide the development of a new mine, or the expansion of an existing one, at nearly every step. Thus, this paper starts our series on sustainability with a critical commentary on NPV analyses.

Sustainability and NPV Analysis

Project financial viability is nearly universally analyzed using either net present value or internal rate of return methods. These are essentially two sides of the same coin; thus, we'll focus on NPV in this discussion. The concept is simple enough: one dollar ten years from now is not worth as much as one dollar today. The challenge comes when considering very large expenses in the distant future: NPV analysis can give a distorted view of the economics in these situations. Consider that:

- A liability of US $1 billion in 30 years has an NPV of $33 million (at a discount factor of 12% per year);
- A liability of $10 billion in 50 years is "worth" only $9 million now (discounted at 15% per year).

So, faced with investing $100 million now or a future clean-up cost of $10 billion in 5 decades, any NPV analysis will determine that the future liability is the most profitable approach. Now, more often than not, sanity prevails and companies do not knowingly take on such large liabilities regardless of how distant in time they are. Nevertheless, the result of NPV analysis leads to exactly this scenario. Future liabilities are so heavily discounted as to not significantly affect the overall project feasibility. Because of this, much less engineering time is invested in something like closure 20 years from now than that dedicated to costs to be incurred in the first 5 years of the project. Thus, future costs are not only heavily discounted and not escalated, they are poorly understood. This skews decision making and encourages pushing off things until later. More often than not, when later arrives the cost is much higher than thought.

[4] Sir Robert Wilson, "Sustainable Use and Management of Natural Resources," speech given to Business Action for Sustainable Development, World Summit for Sustainable Development, Johannesburg, SA. Sept. 1, 2002. www.riotinto.com\news\uploads\speeches\RPWS%20BASD%20Roundtable_WSSDspeechEarthSummit.pdf

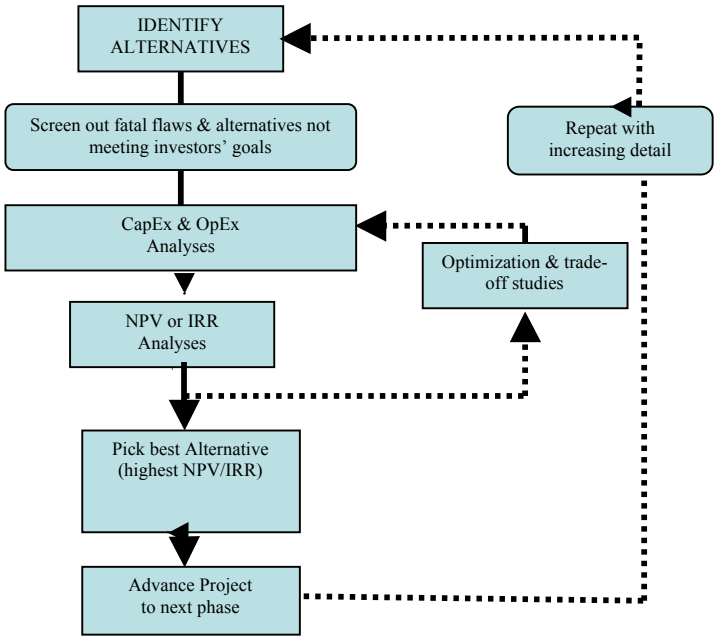
NPV analysis has another limitation, when considered from the viewpoint of sustainable development. It considers only the economy of the mine. There is no provision in modeling to consider the regional economy, neither its 'idiosyncrasies' as we say in Peru, its growth potential, nor the combined potential of multiple actors within that economy. Nor is this the job of the mining company.

Nevertheless, sustainable development must be considered in the context of the regional economy, the roles and responsibilities of other players, and the very long term. Sustainable development by its very definition focuses on long term benefits. "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*." Promoting community based enterprises, providing for viable post-mining land use alternatives, building social capital as well as social infrastructure require investments now for gains that are difficult to quantify, don't accrue to the mining company's balance sheet and are years away.

How can we reconcile the apparently mutually exclusive goals of maximizing NPV and sustainability? Ultimately, perhaps we need a different tool, something to replace discounted cash flow analysis. Or perhaps a hybrid model will emerge. In the short term, however, NPV and IRR analyses are the accepted tools; they are what we know and understand, what our shareholders look for and banks rely on. Can we make adjustments to these traditional mechanisms that result in better overall project evaluations? Perhaps.

The Traditional Model

A simple version of the traditional model looks something like this flowsheet. This applies first to the project as a whole, answering questions such as Does it get mined and what's the mine life? Is it a mill or heap leach? Open pit or underground or both? Later it gets applied to the decisions within the overall project. Dynamic or conventional heap? Floatation or vat leach? Best site for the tailings impoundment? And so on through all of the big ticket items, repeated at the pre-feasibility, feasibility and basic engineering stages.



In terms of issues like long term liabilities, sustainable development and other "soft" costs, this model presents a couple of limitations.

Future costs are rarely escalated, and when they are very low values for inflation are applied. The logic is that future metal prices are unknowable and thus any escalation is unreasonably optimistic. That's probably sound logic for overall feasibility, but for trade-off studies it further skews the process towards under estimating future liabilities. This is compounded by the inherently low reliability of future cost estimates. Consider that over the past decade average mine closure costs have more than tripled while copper prices have actually declined.

The "Best" alternative can, often does, include large and even unmanageable future costs. Discounting, especially without escalation, makes these cost "acceptable" from a balance sheet viewpoint. While some companies deal with this by creating funds for these future liabilities (either on paper or in bank accounts), most do not. And those funds are rarely generous - When was the last time a mining company issued an announcement that it was reducing accrued environmental liabilities?

Revising Our View of Project Evaluation

So although we have no quick fix to the apparent standoff between NPV/project evaluation methods and sustainable development objectives, we believe there is hope. We propose, over the course of the next year, to tease apart the traditional model of project evaluation and find where, and how, modifications can be made to it and to other

critical decision making processes, to move beyond that standoff and incorporate the multiple objectives we have attempted to lay out in this first discussion.

We are aware that the lack of a concrete answer may frustrate a number of readers. Ironically enough, having to accept uncertainty, and that answers evolve over time (through learning, consultation, improving our own and others' capacities) is probably going to be part of a modified model, or approach to decision making. Can the mining industry live with that?

We do it all the time!

Seven Questions to Sustainability[5]	
Engagement	Are engagement processes in place and working effectively?
People	Will people's well-being be maintained or improved?
Environment	Is the integrity of the environment assured over the long term?
Economy	Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better off as a result?
Traditional and Non-market Activities	Are traditional and non-market activities in the community and surrounding area accounted for in a way that is acceptable to the local people?
Institutional Arrangements and Governance	Are rules, incentives, programs and capacities in place to address project or operational consequences?
Synthesis and Continuous Learning	Does a full synthesis show that the net result will be positive or negative in the long term, and will there be periodic reassessments?

[5] From: Seven Questions to Sustainability: How to assess the contribution of mining and minerals activities, by Mining, Minerals and Sustainable Development North America, 2002 (www.iisd.org/pdf/2002/mmsd_sevenquestions.pdf)

Sustainable Development Principals[6]

Economic Sphere

- Maximize human well-being
- Ensure efficient use of all resources, natural and otherwise
- Seek to identify and internalize environmental and social costs
- Maintain and enhance the conditions for viable enterprise

Social Sphere

- Ensure a fair distribution of the costs and benefits of development
- Respect and reinforce the fundamental rights of human beings
- Seek to sustain improvements over time; ensure that depletion of natural resources will not deprive future generations

Environmental Sphere

- Promote responsible stewardship of natural resources and the environment, including remediation for past damage
- Minimize waste and environmental damage along the whole supply chain
- Exercise prudence where impacts are unknown or uncertain
- Operate within ecological limits and protect critical natural capital

Governance Sphere

- Support representative democracy, including participatory decision-making
- Encourage free enterprise within a system of clear and fair rules and incentives
- Avoid excessive concentration of power
- Ensure transparency
- Ensure accountability for decisions and actions
- Encourage cooperation in order to build trust and shared goals
- Ensure that decisions are made at the appropriate level

[6] From: Breaking New Ground, the Report of the Mining, Minerals and Sustainable Development Project, Earthscan Publications Ltd, 2002 (www.earthscan.co.uk)

Mark Smith, a civil engineer with 25 years in mining, is general manager of South American operations for Vector Engineering, Inc. and is based in Lima, Peru. smith@vectoreng.com
Susan Joyce is a consulting sociologist specializing in managing impacts of resource development projects. Susan is based in Lima, Peru. susanajoyce@shaw.ca