A SOCIAL COST BENEFIT ANALYSIS OF EXTENDING AN EXISTING RECYCLING PLANT TO ACCOMMODATE THE RECYCLING OF THE PLASTIC FRACTION OF CABLE SCRAP

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- This paper investigates the economic efficiency of extending an existing cable waste recycling plant to accommodate the recycling of the plastic fraction of cable waste
- It shows that when a cost benefit analysis (CBA) is carried out to determine the aforesaid, the decision-making criteria generate, conflicting results
- More specifically, the net present value (NPV) is greater than zero, the internal rate of return (IRR) is less than the social discount rate, and the benefit cost ratio (BCR) is less than unity
- Based on these results one is unable to provide unqualified support for the project

1 INTRODUCTION

- The Basel Convention is the key driver in the promulgation of European Union (EU) environmental legislation
- One of the principal aims of the Basel Convention is to promote the safety of human health and sustainable development
- To this end, many governments have instituted legislation that advocates cleaner production and responsible waste management practices
- One of the main features of the legislation is limiting the amount of waste going to landfill sites and promoting the mechanical recycling of plastic
- In line with international standards, the South African Government has issued a White Paper on Integrated Pollution and Waste Management for South Africa
- This is a policy document on pollution prevention, waste minimisation, impact management and remediation

- In 2002, the South African cable manufacturing industry produced electrical and communication cable to the value of R2.4 billion
- The industry generates in excess of 500 tons of insulated telecommunication cable scrap per annum. This scrap contains, on average, about 60% metal and 40% plastics. The conducting material in this scrap is primarily copper
- The value of the metal conductor (copper or aluminium), used in the manufacture of electrical and telecommunication cable, ensures that it will always be recovered from the cable scrap
- The plastic insulation and sheathing material contained in the telecommunication cable scrap can be disposed of by landfill or incineration, or recycled by mechanical means
- Adherence to international protocols requires the South African cable manufacturing industry to recycle waste instead of land filling it

Cost Benefit Analysis (CBA)

- The existing plant can be viewed as the "without" scenario while the extension is the "with" scenario.
- The net benefit arising from the project will simply be the difference in net benefit between the "with" and "without" scenarios.
- The approach taken, to achieve this aim, entails identifying and estimating (where possible) the social costs and social benefits that will arise from the extension of an existing cable waste recycling plant in order to allow recycling of the plastic component of cable waste.

Cost Benefit Analysis cont'd

- Cost-benefit analysis (CBA) is a standard method used to determine and compare the social costs and social benefits of an investment project
- The measured costs and benefits are weighed up against each other to establish criteria for decision-making: Normally, one or more of the following decision-making criteria are used:
- The Net Present Value (NPV) of a project expresses the difference between the discounted present value of total benefits and the discounted present value of total costs. The Net Present Value (NPV) is represented by

$$NPV = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+i)^t}$$

  - Where
    - NPV = net present value
    - B_t = benefit in year t
    - C_t = cost in year t
    - $(1+i)^t$ = discount factor used to discount B_t and C_t to present values
    - n = length of the project
    - i = discount rate

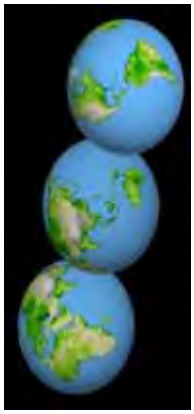
Cost Benefit Analysis cont'd

- The internal rate of return (IRR) is that discount rate that, when applied to the net benefit stream, will cause the NPV of a project to equal zero. The IRR rule, for the acceptance of a project, requires that the IRR be greater than the social discount rate. The IRR is shown as the discount rate i in the equation below.

$$\sum_{t=0}^{n} \frac{B_t - C_t}{(1+i)^t} = 0$$

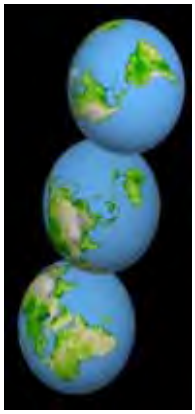
- The benefit cost ratio (BCR) of a project is the ratio of the present value benefits to the present value costs, and can be formally expressed as follows:

$$BCR = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}}$$



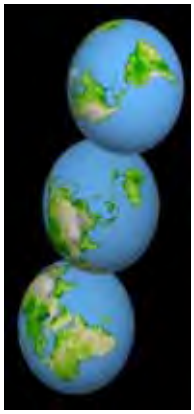
Time considerations

- All the estimated social cost and social benefit flows derived in this study are captured in per annum periods and expressed at 2005 price levels. A distributional weighting of one was used for all cross-sectional costs and benefits over the full project period. This weighting assumes that a rand benefit is worth the same to all members of the population affected by the project in question. The project period of time horizon of the project was set at 20 years.



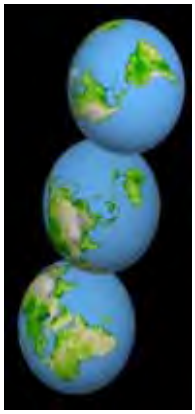
The social costs of recycling the plastic fraction of cable scrap

- The social costs comprise primary and secondary costs
  - Primary costs
    - Capital costs
    - Operating and maintenance costs
  - Secondary costs
    - Costs related to the generation of greenhouse gases and asthma



The social benefits of recycling of the plastic fraction of cable scrap

- **Primary benefits**
  - The primary benefit is the revenue generated by the re-use of granulated PVC and PE for the manufacture of fence poles at the facility
- **Secondary Benefits**
  - The increase in the prices of houses situated in close proximity to a landfill, due to the recycling of the plastic component of cable waste
  - The avoidance of landfill cost



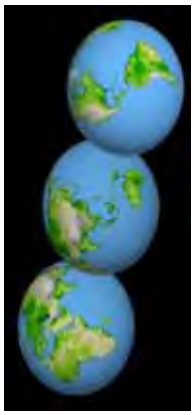
The social discount rate

- The net benefits of a project that occur over time must be converted into a standard of comparison
- This is achieved by determining the present values of all present and future net benefits
- A discounting formula, which incorporates a discount rate, is used to estimate present values. More formally, this formula can be expressed as follows:

$$PV = \sum_{t=0}^{n} \frac{NB_t}{(1+i)^t}$$

- Where:
- PV = present value of all net benefits.
- NB = net benefits accruing from the project in time period t.
- t = time period t.
- i = discount rate

- Two types of discount rates can generally be distinguished: the social time preference rate and the social opportunity cost of capital rate
- The social discount rate needs to be derived from a number of sources of funding to reflect both the SOCC and the STPR



The social discount rate cont'd

- Based on the above the social discount rate can be estimated from the equation below.

$$i = t[(1-s)(X_1 - p) + (s)(X_2 - p)] + [(1-t)(X_3 - p)]$$

- Where:
- t = fraction of public expenditure financed by tax and duties.
- (1-t) = fraction of public expenditure financed by borrowings.
- s = fraction of disposable income saved.
- (1-s) = fraction of disposable income consumed.
- X_1 = the average of the prime overdraft rate and the term lending rate, also known as the hire-purchase credit rate.
- X_2 = the average dividend yield and capital growth of all listed shares on the JSE.
- X_3 = the average of the government loan stock yield (ten years and over) and the Eskom bond rate.
- p = the inflation rate
- Using the above formula the real social discount rate was estimated at 6.72%.

SUMMARY RESULTS OF APPLYING THE DECISION-MAKING CRITERIA

- When the estimates of costs, benefits and the social discount rate were incorporated into the equations for the three CBA decision-making criteria (NPV, IRR, BCR) over a twenty-year period, the following results were obtained

	CBA criteria Social discount rate 6.72%		
Cable waste recycling project: recycling of plastic	NPV	IRR (%)	BCR
	R143434.40	5%	0.91

Summary of results

- For the project assessed in this paper, the NPV was greater than zero, the BCR was less than 1 and the IRR was less than the social discount rate. Due to the ambiguity of the results caution should be applied so as to not provide unqualified support for the project.

CONCLUSION AND RECOMMENDATIONS

- The authors are inclined to want recycling projects to go ahead and still feel this way about the cable waste recycling project dealt with in this study. However, the cost-benefit analysis of extending an existing recycling plant so as to accommodate the recycling of the plastic portion of cable waste, only offers qualified efficiency support.
- In terms of the measures of project worth, the cost-benefit analysis provides ambiguous and conflicting results: the NPV is positive, the IRR is less than the social discount rate, and the BCR is less than unity.