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Journal of the Asia-Pacific Centre for Environmental Accountability

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Editorial

In this third edition of the *Journal of the Asia-Pacific Centre for Environmental Accountability* two feature articles are published, reviewed as usual independently of the editors.

The *first feature article* by Jean Raar contributes to the social and environmental accounting education literature. The author contends that current accounting graduates may not be aware of the need for incorporation of environmental risk issues into capital budgeting and outlines a range of techniques that could be utilised with a focus on cash flow methods, uncertainty and risk and methods/techniques of analysis such as real options and game theory.

In the *second feature article*, Tuyet Dam, John Pisaniello and Roger Burritt use the case study of a rural commune in Vietnam (Tan Moc) to examine the prevalent safety problems associated with small dams in Vietnam and their contributors. Surveys and semi-structured interviews with key stakeholder groups show that all the dams were at high risk of failure because of physical and management inadequacies. Floods and human factors were perceived as the key contributors to the safety of dams.

The edition is completed with **Environment Extra!** and a **Call for Papers**.

Notes for contributors

Manuscript requirements

Articles should be submitted in a word document, Times New Roman, 12 point, single spaced, single column, and attached to an email. References should be in the UniSA Harvard referencing style, available from the following link:

<http://www.unisa.edu.au/ltu/students/study/referencing/harvard.pdf>

As a guide to authors, articles should be no more than 6,000 words unless negotiated with the editors. The submission of shorter articles is particularly welcome. Each article should be preceded by an abstract of no more than 100 words.

To ensure anonymous review, authors should not identify themselves directly or indirectly in their manuscript. A separate cover page should show the title of the manuscript; the author(s)'s name(s); position(s); affiliation(s); and contact details.

The reviewing process

Feature articles are independently reviewed by members of the Editorial Board in accordance with the requirements for classification as a C1 journal article in Australia: 'For the purposes of the HERDC, an acceptable peer review process is one that involves an assessment or review of the research publication in its entirety before publication by independent, qualified experts. Independent in this context means independent of the author'.

Each article published in the *Journal of the Asia Pacific Centre for Environmental Accountability* is blind reviewed by at least two members of the Editorial Board. The journal is listed on the ARC's ERA 2010 journal list which is considered acceptable as evidence of peer review for HERDC purposes.

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Editorial objectives

The objectives of the journal are, first, to encourage investigation of environmental and social accounting, reporting, accountability and assurance. The second objective is to promote environmental, social and sustainability accounting, accountability, reporting assurance, and related taxation research to professional and academic accountancy and finance academics, professional bodies and governments. The editors are amenable to quality research in any paradigm including, for example, field or experimental investigations, archival or survey research, interpretive or critical studies and case study research.

Editorial criteria

Major criteria used to evaluate papers are:

- subject matter must be of importance to the accounting discipline;
- research questions must fall within the journal's objectives;
- research must be well designed and executed; and
- presentation is well written and in conformance with the journal's style.

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Teaching capital budgeting for climate change

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Abstract:

The paper adds to the environmental accounting education literature by providing an overview of current techniques which assist in capital budgeting decisions addressing corporate environmental issues. The premise of the paper is that accounting graduates may not have insights to and knowledge of the specific techniques required to integrate into project appraisals, the diversity of benchmarks associated with the environmental issues, risk, and economic issues. Benchmarks stem directly from the corporate strategic plan and goals, and thus strategy is an over-arching input into this decision process. The literature was examined to offer both a critical perspective and a systemic approach to capital budgeting techniques, and their propensity to assist management in considering this diversity of benchmarks in the environmental context.

Key words:

Capital budgeting, accounting and finance education, environmental risk, cash flow estimation

1. Introduction

Graham and Harvey (2001) suggested that business schools have been adept at teaching capital budgeting, as financial executives appear to have a sound understanding of net present value and the capital asset pricing model. Both of these methods underpin the maximisation of economic benefits. In 2000 Schaltegger and Burritt explored the role of real options and capital budgeting analysis, while Darabaris (2008, p. 77) reiterated that in the appraisal of investments with associated environmental benefits:

the objective is to provide investment analysts with quantifiable environmental information that can be translated into hard financial data, which can be accomplished through discounted cash flow analysis or real option analysis techniques. Real option analysis may involve establishing the firm's competitive advantage as

defined by brand reputation value, and its impact on the 'social license to operate.

Deegan (2008) and Burritt et al. (2009) used case studies to examine the information contained in environmental management accounting and costing systems of individual firms, including capital budgeting methods. Stout et al. (2008) provided a teaching example of the information flexibility offered by the use of real options for capital investment appraisals, and argued for inclusion in accounting curricula.

The aim of the paper is to promote deliberation over the integration of environmental-related risk associated with capital budgeting analysis into tertiary accounting and finance courses, and management training programmes. While the paper does not purport to prescribe a 'one way fits all' approach, it does expand on the literature by adding an overview of the appraisal techniques, and provides a systemic approach to the capital budgeting process. The focus of the discussion includes:

- (a) cash flow methods
- (b) uncertainty and risk
- (c) methods/techniques of analysis, including real options and game theory.

Support for the paper was drawn from a range of literature topics, for example Nehrt (1996) who found that firms who invest earlier in equipment to reduce pollution have higher profit growth; Klingelhöfer (2008) who found that tradable emissions permits may not encourage investment in environmentally beneficial equipment; Chen (2008) who examined the use of discounted cash flow techniques in relation to nonfinancial measures in capital budgeting; the individual case studies undertaken by Burritt et al. (2009) and Deegan (2008) each of which included discussion on environmental issues associated with capital investment appraisal; the paper by Stout et al. (2008) recommending the inclusion of the topic of real options as a tool for capital budgeting into the curricula of accounting courses, and the evidence on capital budget decision techniques adopted by Canadian firms (Bennouna et al. 2010).

The paper is organised as follows: the first section outlines the background and fundamental reasons for emphasis on this aspect of capital budgeting. The next section provides a systemic process including insights into risk and cost information and is followed by detailed discussion and critical discussion on net present value, real options and game theory techniques. The final section of the paper concludes with an overview of the issues associated with educating

future business professionals about integration of risk and environmental issues in capital budgeting decisions.

2. Background

Many firms have identified and communicated their environmental and social activities, and recognized that efficient environmental management information and systems can be beneficial to both financial and environmental performance (for example, White & Savage 1995; Nehrt 1996; Schaltegger & Synnestvedt 2002; Jasch 2006; and Nakao et al. 2007). It is now understood that business financial performance, even business survival, has an environmental dimension (Darabis 2008, p. 6; Molina-Azorin et al. 2009).

Socially responsible investment funds (SRI) represent the capital market's segregation of firms that are considered to have their operations underpinned by sound social and environmental practices. If the firm's strategic objective is simply to maximise economic performance in the short term, management may ignore the intangible benefits that accrue to shareholder value in the longer term.

As Cucvara (2009, p. 34) points out, perception is an important part of being a sustainable business and a firm's competitive advantage or disadvantage can arise as a result of the content of its report (Course & Lockie 2009). Lee et al. (2009, p. 21) studied leading and lagging corporate social performance (CSP) firms and found that leading CSP firms were trading at a returns discount premium and, hence, are valued by the markets. This suggests that management's proactive strategic stance is consistent with an 'ability to obtain a lower cost of equity capital'.

Business commitment to climate change and environmental responsibility also includes continuous improvement in energy reduction, pollution output, procurement and use of natural resources, including a proactive management approach (Watson et al. 2004; Darabaris 2008). For example, it may be necessary to reduce pollution emissions by 'x' per cent to avoid potential regulatory penalties. Alternatively, firms electing to adopt a 'least cost' alternative to environmental responsibility in the shorter term may find they are faced with environmental risk that eventual flows into a financial outlay in the longer term (Darabaris 2008). As Nehrt (1996) pointed out, the strategic stance of the individual firm will influence the investment in technology. A taxonomy of the relationship between strategy, environmental issues and capital investment appraisals is provided (see Appendix 1).

The need to manage risk and maintain a competitive strategy which incorporates reduction of pollution, presents management with a

significant challenge in the appraisal of capital investments¹. Strategic commitments can be diverse in terms of their goals, processes and context, and the capital investment analysis methods employed will support these commitments and anticipated performance. Bennouna et al. (2010) found a trend towards more sophisticated appraisal techniques, although in their study the majority of firms still utilised net present value (NPV).

The traditional perception was that initial investments in technology to reduce a firm's carbon footprint may, in the shorter term, reduce profit levels. Cucvara (2009) highlighted the link between financial performance and emissions reduction suggesting a reduction in corporate costs and sustainability is not a difficult 'tightrope to walk', and emphasised the role of technology in achieving this duality. If 'cost-reducing or sales-enhancing technologies exist' a 'first-mover' firm can be in a relative position of competitive advantage and higher profit growth (Nehrt 1996, p. 546). Provided that a firm invests in pollution-reduction activities prior to its competitors, it can gain a competitive advantage. To gain or maintain a competitive advantage in emissions abatement and carbon trading investment in technology is a variable in any strategic plan.

However, it is not necessary for a firm to adopt a competitive 'first mover' approach to emissions reduction to benefit financial performance as research efforts indicate corporate management have gone beyond regulatory environmental requirements (Sharma 2000; Buysse & Verbeke 2003).

While literature highlights specific elements along the process of capital investment appraisal, there is a scarcity of literature that offers management a holistic perspective on the alternatives available that add support to and align with their strategic needs, including environmental issues.

3. A systemic approach

In practical terms, management will determine quantifiable objectives associated with strategic goals for both economic and environmental benchmarks. For pollution prevention investments, the benchmarks may differ from those used to evaluate the economic life of the project, or potential equipment to be acquired.

¹ It is accepted that other factors may influence competitive advantage, such as producer differentiation, corporate, size, etc.

3.1 Strategic risk

It is important to identify, at the strategic level, the alternative opportunities, together with their associated levels of environmental risk. For example, the decision to reduce pollution emissions by 'x' may include alternatives, (a) to discontinue the manufacture of product AB, and close plant XYZ, or (b) modify the production process in the current plant, or (c) maintain the status quo, or close plant XYZ and build a new plant. A failure to integrate environmental issues with financial risk which may not be transferable to a third party can expose a firm to potential future claims and penalties. In a worst case scenario, the long-term viability of the firm may be at stake, particularly for smaller firms, as any increase in financial risk and uncertainty may also increase owner-manager risk. When undertaking project profitability analysis, changes to time horizons can influence the type of cost information required, and the profitability indicators chosen.

Given the dynamic and longer-term aspects associated with environmental issues and the associated risk management, the tracing of the materials flow, activities and waste are the basic issues. Undertaking this materials flow may form part of a Total Quality Management (TQM) system (de Bakker 2008) which can assist management in the identification of environmental costs alongside pollution prevention opportunities (Watson et al. 2004).

3.2 Cash flows

Decision-makers need to gain insights into cash flows over the investment's entire life (Kumaran et al. 2001), which necessitates a system that can track all costs and their associated uncertainties. Any estimation specifically involves uncertainty, environmental issues with regard to impacts, costs and cost savings in relation to their timing, amount and occurrence. Environmental impact uncertainty relates to outcomes resulting from management decisions and activities undertaken in the present time. In order to facilitate current decision-making, it is in these areas, i.e. timing of the induced costs and associated cash flows, discount rate, cost of present action versus cost of future action that uncertainty is of concern (Brooks et al. 1993; Henn & Fava 1994; Klingelhöfer 2008). A series of steps adapted from (Raar 2005) form the basis of the systemic process outlined below:

1. The first step in the capital investment process is an emissions assessment. Initially it is necessary to ascertain the life span of

the investment under consideration. The potential for environmental risk including accidents and emissions over the relevant life span can then be ascertained (SETAC 1990). These risks can then be ranked according to their probability of occurrence. A score or grade can be applied according to the level of emissions or contamination. Deegan (2008) provided the ranking for opportunities and threats, based on a five level Likert scale ranging from level 1 = Low to level 5 = Extreme. The ranking of scores is then followed by sensitivity analysis (Caspray 2008).

For those firms required to report under the Australian Government's *National Environment Protection (National Pollutant Inventory) Measure* (NPI NEPM, 1998), benchmarking may be primarily concerned with thresholds relating to greenhouse gas (GHG) emissions, energy production and consumption (Course & Lockie 2009). Schaufele and Zumoff (1993, pp. 157-158)² also suggested that the specific source of the emissions be considered.

Although specific details fall outside the scope of this paper, methods to assist in determining the source of the emissions can include: environmental audits and life cycle assessments (SETAC 1990; UN 1999; ISO 19011, 2002; ISO 2006). For example, Caspray (2008) provided information on strategic impact assessment (SIA) and cumulative impact assessment (CIA) as secondary methods to gain insights and assist in impact assessment. An example of the use of life cycle in relation to the reduction of GHG emissions through renewable energies was included in the study of Sarkis and Tamarkin (2008); and total emissions in Schaufele and Zumoff (1993, pp.157-158).³ With a brief adaptation of their calculations and exponential model formula, the following information can assist firms to determine their emissions from a number of sources.

Let $S(t)$ = the original total emissions function for one of the sources of carbon dioxide emissions = $S(t) = CO_2 A(t)$; for energy, $S(t) = TCE(t)$; and for fuel consumption $S(t) = CDF(t)$.

² The simple and understandable mathematical calculations necessary calculations of CO₂ emissions and indeed for the atmospheric concentrations of the source emissions can be found in Schaufele and Sumoff (1993).

³ Schaufele and Sumoff (1993) and Harper Collins College Publishers copyright permits 'brief quotations embodied in critical articles and reviews'

Let $Y(t)$ = the exponential approximation to $S(t)$.

As capital investment decisions are being undertaken, it is necessary to consider predictions, so $S(t)$ is computed for the years 2007 and 2017. Set an x -range with x at the minimum level for the t value of 2007, and x set at maximum corresponding to the t value for 2017. The $Y(t)$ for the specific time period will closely approximate $S(t)$.

Adjusting (t) to equal zero in 2007, the new exponential function is $Y_0(t) = a_0b^t$ where $(t = 0)$. This function is then used as a basis to determine the growth rate for the source of the emissions, and then the total emissions from the specific source can be determined for the period by the geometric series

$$Y_0(0) + Y_0(1) + \dots + Y_0(10). \quad (1)$$

Once the total emissions are determined, the potential for environmental risk is established.

2. Then the second step is to ascertain the monetary inflows/outflows which are associated with environmental risk or opportunities, over the life of the specific investment, the '...cash flow should only include those costs (or savings) specifically identifiable with the investment' (Raar 2005, p. 12). These costs can include the ongoing costs/benefits, including the uncertain financial imposts that are associated with the risk of non-compliance with regulations. Probabilities can be assigned to the costs and benefits (Henn & Fava 1994). Probabilities of occurrence, estimated outcomes, and expected costs can then be determined at a specified level of statistical confidence.

The importance of tracing and tracking environmental costs according to their particular strategic and longer-term time horizons was highlighted in the literature (Brookes et al. 1993; White et al. 1993; Henn & Fama 1994; Parker 1997). Tools to assist in establishing the interplays between the reduction of waste and pollution, and monetary cash flows are life cycle costing (LCC) (Frieberg 2007), or a similar method termed total cost assessment (TCA)⁴ (see Appendix 2). These are techniques to identify, track and accumulate total project or investment costs, over longer time horizons, which can offer an improvement in productivity, at a reduced cost.

⁴ Refer White et al. (1993) for more detailed discussion on Total Cost Assessment analysis compared with Net Present Value.

Adopting an 'umbrella' perspective to the management of environmental issues, LCC is the accumulation of the total costs associated with the entire life of an object, or a system (Long 1983). In relation to environmental issues LCC has differing perspectives. Firstly, it aligns with a life cycle Assessment in relation to meeting environmental risk and regulatory requirements (Hornigren et al. 2011). That is, the physical stages in the life of the investment or product, the analysis of environmental concerns from a multi-functional perspective (Kumaran et al. 2001). Secondly the LCC allows managers to identify and manage the costs associated with an investment or a product. Lastly, LCC supports continuous improvement in the use of resources and emissions reduction within the firm's activities (Woodward 1997).

Adopting a life cycle or total cost approach to project and investment decision-making will encourage managers to track and allocate the environmental costs that:

- (a) may not be separately identified, or
 - (b) arise over a longer-term time horizon, or
 - (c) are the 'hidden' environmental costs accumulated in overhead costs pools to the project initiating the outlay. For example LCCs can include: regulatory costs (permits, fines), remediation costs (aesthetic costs), recycling and waste disposal costs, efficiency control costs, research and development costs, plant, equipment and facility costs, environmental management and control system costs, public image costs (White, Savage & Becker 1993).
3. The next step is to estimate and determine the specific cash flows associated with the time-horizons. One popular method for conducting cost estimate risk analysis is Monte Carlo simulation, which is associated with abstract populations where sampling is not economically feasible. With the objective of estimating the total system cost, and associated uncertainty, the Monte Carlo technique is used to generate a sample value, where cost factors and coefficients are assigned probabilities and are used as inputs to a cost model. A frequency distribution is determined from the set of output indicators resulting from the cost model. The frequency distribution displaying the simulated results can highlight normal or skewed shapes.

However, Long (1983) suggested that when undertaking LCC a risk analysis should be conducted on the cost drivers. This

view leads to a link with activity based costing (ABC) which assists managers to identify cost drivers, allocate costs to cost objectives, and provide performance benchmarks, either financial or nonfinancial (Kreuze & Newell 1994).

4. The next step involves the choice of techniques to be used to appraise the capital investment opportunity. Traditional evaluation of projects competing for limited or scarce capital resources is undertaken by the use of capital budgeting techniques. However, as White et al. (1993) emphasised the use of short term orientated techniques may distort outcomes, with the result that pollution prevention projects may confront a systematic bias in decisions relating to the allocation of capital resources, resulting in a potential chronic underinvestment. It is this short term aspect that is consistent with the financial tools taught in tertiary courses, such as the internal rate of return, payback period, net present value. Real options (Stout et al. 2008) and game theory offer flexibility and a longer time horizon to management's decision-making process.

Three capital appraisal techniques are briefly discussed below:

- (a) net present value (NPV)/discounted cash flow (DCF)
- (b) real options, and
- (c) game theory.

4. Appraisal techniques

4.1 Discounted cash flow

The discounted cash flow method involves the addition of cash flows associated with investment alternatives and opportunities over the life of the investment. These involve estimations and, as such, introduce a degree of uncertainty (Flaig 2005); NPV includes a sensitivity analysis of the cash flows and accordingly includes a risk factor in the calculation. Expected present values of the investment's future cash inflows (\tilde{Y}), less the cash outflows or sunk costs of investment outflows (I), $(\tilde{Y} - I) =$ net present value. Therefore if $NPV = (\tilde{Y} > I)$ the firm would undertake the investment opportunity.

NPV is a popular method for capital investment appraisal (Ryan & Ryan 2002; Gilbert 2005). Alternatively, concerns over the criticism of the NPV method, expressed in a 'sizeable literature on the theoretical aspects of discounting' (OECD 1995, p. 126) emerged as to the use of the discounted cash flow method to evaluate alternative environmental-related projects, albeit from a predominantly macro-

economic aspect. These concerns are based on: social rate of time preference; opportunity cost of capital; risk and uncertainty; intergenerational interests; and pure time preference (OECD 1995; Maas & Jantzen 1999).⁵

Criticisms of NPV include the use of assumptions which may not reflect reality (Grasselli 2007). In addition, the DCF technique is considered unreliable in the determination of a true estimate of the investment value (Phelan 1997). In relation to emissions, Farzin and Kort (2000) found that raising the discount rate can decrease the investment in abatement capital. Anderson (2006, p. 101) considered that 'the number of regulations deemed appropriate by cost benefit analysis decreases as the discount rate increases' while Siebert (2008) indicated that lower discount rates will favour future generations, and raise the costs for current users.

If the manager uses a social rate of time preference it may not correlate with the firm's short term financial costs and benefits. That is, NPV may offer the firm economic cash flow advantages in the shorter term, yet it may reduce management's longer-term investment opportunities, by ignoring the strategic value of a project.

This aspect was also emphasised by White et al. (1993), see Appendix 2. These authors argued that pollution prevention investments were disadvantaged in terms of competition for limited capital, inasmuch as the benchmark for financial risk analysis for such projects is short-term orientated, instead of long-term. The problem was highlighted as follows:

Because some economic returns to prevention projects tend to materialize in diverse and indirect forms, and occur over a longer time horizon, conventional project analyses may underestimate or omit altogether their returns to the firm. Such is the case, for example, when avoided liability reduced staff time for compliance, and enlarged market share owing to a 'green' product image are not incorporated into a project analysis. The result is that prevention projects as a group may confront systematic bias in capital allocation decisions. Resulting in potential chronic under investment in such projects (White et al. 1993, p. 2)

The literature has highlighted advantages of using a DCF method in capital investment appraisal; it incorporates a risk/return perspective, and supports a framework to consider alternative investment opportunities (Wouters 2006). Although Lin and Herbst (2004) suggested a risk neutral approach to the use of NPV for capital budgeting purposes to allow for strategic flexibility, DCF has also

⁵ The discussion focused on macro-economic applications.

been criticized because of the unavailability of data when making decisions about strategic alternatives (Adler 2006).

When using DCF, a manager makes a valuation decision at a particular point in time. The key indicators relating to the investment are evaluated upfront, when the analysis is undertaken and the investment decision is made. To offset risk, the analyst makes an adjustment to the discount rates applied, and/or adjusts cash flows to reflect perceived risk, but the probabilities attached to cost estimates may be too broad. The risk aspect of DCF analysis has been the subject of a number of studies relating to probabilistic extension, a summary of which was undertaken by Carmichael and Balatbat (2008).

Once the investment decision is made, potential uncertainties in competitive markets and environmental issues are ignored. For example, risks may change or opportunities may arise to further reduce emissions. DCF does not offer management the opportunity to delay the investment, or use nonfinancial evaluation criteria. So, when including environmental issues in the capital budgeting analysis, management decisions require data and tools that offer a more robust and flexible approach (Long 1983; Rodrigues undated). Survey evidence suggests that DCF methods (a) do not play a decisive role in the decision process when competitive environments and relevant strategic reactions are considered (Gilbert 2005), and (b) that firms with higher product standardization (Chen 2008), and also larger firms have a greater tendency to adopt a DCF than smaller firms (Graham & Harvey 2001).

In reviewing the body of literature addressing the use of DCF techniques Chen (2008) identified that the use of nonfinancial measures has generally been ignored. Chen's study added value to the literature by: comparing the use of nonfinancial measures with the use of DCF, and identifying the appropriateness of DCF or nonfinancial techniques to specific conditions (Chen 2008, p. 14).

Therefore, non-financial issues require consideration, as they relate to the trade-off between the effectiveness of the investment alternatives in terms of environmental outcomes, against the financial cost outlays and benefits. A reduction in emissions may be beneficial in that it reduces the potential for the risk of regulatory non-compliance, and the propensity for environmental impact risk. However, the financial analysis may not be advantageous.

The use of real options to value capital investments offers managers the opportunity to adopt more flexibility into their decisions, and is particularly relevant as the discount rates and the risk of the project can change (McDonald 2006). Thus, real options offer managers

more flexibility and a greater opportunity to develop the 'fit' between their resources related 'strategic choices' (Sirmon & Hitt 2009).

4.2 Real Options and Game Theory

Real option valuation techniques are similar to those used for financial options in the capital markets, representing the right to invest, but not the obligation. Real options form part of the analysis techniques, they are not traded in the capital markets. Real options and DCF are not mutually exclusive, but the use of real options in capital budgeting offers management flexibility, that is the opportunity to mitigate risk – to delay, reduce or reject the investment until any risk or uncertainty is resolved (Bailey & Sporleder 2000; Rodrigues undated). The flexibility offered by the technique of real options for purposes of value and appraisal, allows the integration of a number of sources of decision uncertainty (Lindinger 2006).

Luehrman (1998) provided a framework to undertake strategic investment opportunities using real options, by linking the option pricing with discounted cash flow calculations. He emphasised that option pricing should be complementary to, rather than a substitute for, other appraisal systems. Real option valuations require input to the decision making process of potential future changes and their associated level of uncertainty (Weeds 2002; Lindinger 2006). For practical insights and recent examples of real options in investment appraisal, there are practical examples of the binomial decision tree approach in Stout et al. (2008), who suggest this topic be included in accounting courses, and in Ferreira et al. (2009) who include competitive pressures in their real option analysis. Studies suggest firms are using a real options model to assist in the inclusion of GHG emissions trading information into their investment appraisals (Sarkis & Tamarkin 2005, 2008), and for modelling investment risks and uncertainties including climate policy (Yang & Blyth 2007).

Smith and Trigeorgis (2004, p. 106) consider the use of real-options as a 'helpful tool for making strategic investment decisions', insomuch as it 'enhances NPV to capture managerial decision flexibilities' and includes management's option to defer the investment. This option to defer is particularly important when there is uncertainty. Once undertaken the investment decision may not be reversible. However, if management continually default at the various stages of deferment, the investment could eventually be abandoned. Using the prior discounted cash flow example, the firm with an opportunity to invest will do so when $= (\tilde{I} - C) > \tilde{E}$.

- Where \tilde{E} = the option to invest, and
- \tilde{I} = the value of project or asset;

- C =strike price or investment sunk cost (adapted from Grasselli 2007).

There may be a lag or delay factor, insomuch as there is a value in waiting until the option to invest is favourable.

Management can consider the basic binomial option model,⁶ particularly when there are a number of decision steps (Jankensgård 2001; Klingelhöfer 2008). Smit and Trigeorgis (2004, p. 110) suggested that a deferral investment opportunity be considered as a call option. However, any investment opportunity will compete with itself in terms of the time deferment, as well as compete with other projects (Ross 1995). For example, if management undertakes a strategic decision to upgrade and install the new technology to reduce emissions immediately, then there is an opportunity cost, as the firm loses the option to defer. The company also incurs the financial outlays in order to pre-empt regulatory requirements. If the NPV is at $t = 0$, there is no gain on undertaking the investment immediately, but more to be gained from deferral.

Notwithstanding, in the current global competitive environment, an investment deferral may prompt competitors to undertake their own investment to reduce emissions, advance their process of continuous improvement in emissions reduction, as well as reduce the propensity to the risk of incurring regulatory penalties, and take advantage of consumer environmental values and increase their market. Research by Nehrt (1996, p. 535) found that for earlier investors who undertake emissions reducing equipment, their growth in profit is higher than for later investors. This introduces the issue of competitiveness into the capital budgeting process. In relation to the influence of environmental regulations on investment in pollution reduction equipment, the findings were not significant. According to Nehrt (1996, p. 545), when the investment in new technology is cost-reducing or sales-enhancing, the differing environmental regulations between countries are irrelevant.

The competitive situation may also introduce an opportunity cost in the deferral of an investment which has no specified time limit (Weeds 2002) thus allowing competitors time to undertake an investment in emissions reduction equipment. Therefore, the action of

⁶ Examples of real options and capital budgeting can be found in Luerman (1998); Sarkis and Tamarkin, (2008); Smits and Trigeorgis (2004); and for teaching purposes, Stout et al. (2008).

competitors in relation to emission reduction may influence management's decision. As business conditions and relevant investment decision choices change over time, the use of another analytical technique, game theory, can offer management the information and opportunity to introduce competitive effects into the decision-making process. Game theory is a study of interactive decision-making between interdependent players (Weeds 2002; Smit & Trigeorgis 2004). Essentially it is

a tool to model and thereby analyse situations involving interactions, and possibly, cooperation, between several rational and intelligent decision makers (Ray 2000, p. 3).

...Game theory is concerned with the strategic impact of investment decisions in situations where firms are aware that their strategy affects the value of investment opportunities... (Smit & Trigeorgis 2004, p. 171).

Literature supports the application of real options and game theory models to analyse investment opportunities, particularly research and development alternatives (Lindinger 2006) and to those investment opportunities which have underlying strategic interactions (Weeds 2002).⁷ Combining game theory with real options Smit and Trigeorgis (2004) introduced strategic competition into investment valuation. According to Lindinger (2006, pp. 5-6) this highlighted the flexibility versus commitment trade-off 'is often neglected in real options models which recommend waiting too long'. Lindinger also suggested that the use of option games allows analysts to 'enable the quantification of qualitative strategic thinking and merge the internal (resources, capabilities) and external (industry, competition) views of the firm'. For the purposes of this paper, this context has been extrapolated to include the external environment or climate change emissions. In a competitive situation, the introduction of emissions abatement targets may prompt individual firms to develop technology which is consistent with its strategic stance. Depending on the resources available, research capabilities, and the strategic stance, each firm can undertake a dominant or a low cost strategy (Lindinger 2006).

Ray (2000) highlighted the use of game theory as a modelling tool, which can assist management to model the interactive decision making associated with environmental problems. The decision makers are the 'players' in game theory, while the decisions are 'the

⁷ A detailed discussion on the history and principles of game theory can be found at: <http://www.referenceforbusiness.com/encyclopedia/For-Gol/Game-Theory.html> (accessed 27th August 2011).

game'. In relation to environmental issues, Ray (2000) examined the reduction of global emissions, albeit from the perspective of two countries. The abatement involves a cost, and the marginal environmental damage will result from the total cost functions.

Prior research has also modelled real options valuation and game theory in relation to asymmetric costs (refer Smit & Trigeorgis 2004); strategic investment (Huisman et al. 2003); and investment strategies (Smit & Ankum 1993)⁸. A practical example of the process was demonstrated by Ferreira et al. (2009).

Combining the above discussion and adapting the models of Grasselli (2007) the very simple investment decision rule is as follows:

$$(\tilde{I} - C) + \tilde{Y} > \tilde{E}. \quad (2)$$

where

\tilde{I} = the present value of future cash flows

C = the sunk cost of the investment

$NPV = \tilde{I} - C$.

At this stage of the analysis the investment decision would be made when $\tilde{I} > C$. Adding the tool of real options, \tilde{E} = the option to invest, provides management with the decision rule where $(\tilde{I} - C) > \tilde{E}$, then adding a competitive effect and assigning a strategic value (\tilde{Y}) to alternative investment decisions.

5. Discussion

Each firm will have diversity in strategic choices, and investment alternatives. As discussed earlier, DCF can add to risk and uncertainty, as the method reduces the flexibility for managers to delay their decisions. Similar to a call option in the capital markets, the use of the real options technique in investment analysis can offer management a more sophisticated and flexible 'right' to (a) invest in a project immediately, (b) alternatively wait and reduce uncertainty, or (c) even abandon the project or investment completely, if the risk is perceived as too great.

It is recognised in the business community that the public image and profit (Nehrt 1996, p. 535) of a firm can be enhanced if it undertakes

⁸ The interested reader is referred to the papers by Lindinger (2006) and Grasselli (2007) for more detailed insights into the topical research efforts combining real options pricing and game theory modelling.

expenditure in abatement projects. This introduces the issue of competitiveness into the investment decision. In game theory a set of strategies or equilibrium can offer management a best response to competitive strategies. Game theory and real options are techniques that can incorporate flexibility and competitiveness into analysis. However, game theory requires expertise in mathematics, and the costs of obtaining the information may be high.

6. Limitations

The paper introduces a conceptual and a systematic approach towards analysis of the trade-off between economic benefits and emissions reduction in capital budgeting analysis. Managers will then adapt these alternatives to their specific decision-needs. As this study is based on a literature review, it does not include case study support for the analytical techniques discussed. In consequence, the paper does not offer a method of linking these interdisciplinary techniques with decisions relating to environmental emissions, for their specific decision-needs require information that also represents business reality in terms of the trade-off between emissions reduction and financial outcomes. The techniques employed to assist in the provision of such information cross interdisciplinary boundaries. However, this is not new, as uncertainty in cash flows and estimation techniques have long been topics in management accounting educational programmes.

The paper highlights a range of capital budgeting analysis techniques. The coverage of these techniques is generic, although it is recognised that their individual depth and range is varied. In so doing it emphasises that the application of the characteristics of these techniques to environmental issues in capital budgeting, requires an associated need to broaden the education and training of accounting professionals. Therefore, the paper offers opportunities for further research efforts to equate these techniques and the knowledge, to specific environmental-related circumstances.

7. Conclusion

Increasingly business communities are recognising that natural resources are not plentiful and inexhaustible, and that emissions and associated externalities are no longer isolated from the economic and financial aspects of business operations. Estimations regarding cost savings, cost effectiveness, cost avoidance, discount rates and risk management and environmental issues are necessary input to investment appraisals. Without relevant awareness and training future managers may fail to optimise decisions, even to the extent of exposing the firm to uncertain future liabilities.

The traditional NPV does not appear to support management benchmarks fully and the associated cash flows which intersect environmental and economic benefits. In this paper a particular emphasis was placed on cash flows, and the differing outcomes associated with methods used to estimate financial cash flows associated with investment alternatives.

The paper draws upon a range of interdisciplinary literature and techniques, for example life-cycle costing methods; capital budgeting techniques, (management accounting); Monte Carlo method to include uncertainty; real options (finance); and game theory (economics). Systemic insights are provided to assist management in reducing uncertainties in the growing international impetus to increase corporate environmental responsibility and reduce carbon emissions. Although business decision-makers may be familiar with specific aspects of the techniques discussed in the paper, the interaction of fundamental and baseline concepts stemming from various disciplines reflects the ongoing significance of sound management decisions on the firm's reputation.

It is suggested that accounting and finance education courses, and staff training programmes on capital appraisal, resource allocation, and cash flow analysis consider the interdisciplinary relationships associated with both environmental and financial performance benchmarks: including associated risk and uncertainty aspects. The use of real options and game theory will add versatility and more exactitude than the DCF analysis alone. It will however require expertise in mathematics, finance and management accounting. The use of total cost or life cycle costing (refer Appendix 2) can map the characteristics, and generate more insights into the risk aspects of a project. To assist trainers and educators, a potential course outline is provided in Appendix 3. Thus, the challenge to the business education and training curriculum is to provide practitioners with the skills to recognise the mechanisms necessary to provide management with the relevant information to assess risk and reduce uncertainties in this evolving climate of corporate environmental responsibility. In the future failure to adapt may reflect critically on the educational institution, the relevant professional bodies, and business decisions.

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Appendix 1

A taxonomy: environmental emissions

integrates with

Strategy: proactive or reactive - identifies environmental and financial opportunities and risk

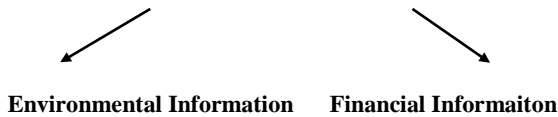
links to

The theoretical expectation underpinning emissions reduction is that firms will implement systems that will support both compliance and continuous improvement in the firm's use of environmental resources.

influences

Motivation for capital expenditure. Theoretically, organisations that believe their activities may contribute to environmental problems will have implications for expenditure patterns.

dictates type of information and appraisal methods



Information systems will support the estimation of environmental and cash flows over the time span of the investment

includes

Capital investment appraisal process and methods.

Management decisions to provide a circular effect on shareholder value

Appendix 2

Pollution prevention investment analysis: a comparison of financial evaluation approaches

	Project 1			Project 2		
	Traditional Analysis	Total Cost Assessment	Diff.	Traditional Analysis	Total Cost Assessment	Diff.
Total Capital Costs	\$893,449	\$923,449	3%	\$19,659	\$19,733	0%
Financial Indicators						
Annual Savings (BIT)**	\$118,112	\$79,127	-33%	\$4,583	\$5,234	14%
NPV Years 1-10	(\$314,719)	(\$480,512)	-53%	\$3,860	\$6,227	61%
NPV Years 1-15	(\$203,643)	(\$394,625)	-94%	\$9,332	\$12,436	33%
IRR Years 1-10***	6%	0%	-6%	17%	20%	3%
IRR Years 1-15***	11%	6%	-5%	20%	23%	3%
Simple Payback	7.6 years	11.7 years	54%	4.3 years	3.8 years	-12%

Source: 'Evaluation approaches to the Financial Evaluation of Industrial Pollution Prevention Investments', White, A. L., Savage, D., Becker, M. (1993) Risk Analysis Group, Tellus Institute, p.10 *Printed with permission A.L. White.*

Extract.

** Before Interest and taxes

***Differences are expressed as percentages.

Appendix 3

Suggested Course Outline: Third year: Post Graduate Unit

<i>Content</i>	<i>Suggested Readings</i>
Module 1 Strategic investment in environmental protection.	
Topic 1.1: Role of environmental accounting in business strategy. Corporate sustainability management and emissions trading.	Schaltegger and Burritt (2000); Parker (1997); Yakhou & Dorweiler (2004) Hesselbarth (2008).
Topic 1.2 Product-orientated environmental management.	de Bakker (2008); Burritt, Herzig & Tadeo (2009).
Topic 1.3 Environmental costing and investment: <ul style="list-style-type: none"> • Life cycle analysis • Materials flow cost accounting. 	Brooks, Davidson & Palmides (1993); White, Savage & Becker. (1993); White, Savage & Dierks (1995); Kreuze & Newell (1994); Woodward (1997); Jasch (2006); Schaltegger & Synnestvedt (2002); Caspary (2008); Horngren et al. (2011); Atkinson et al. (2012).
Module 2 Environmental assessment: tools	
Topic 2.1 Environmental audits: life cycle assessments; risk analysis.	Kumaran et al. (2001); EPA (Victoria) (2007); Deegan (2008);
Topic 2.2 Pollution abatement investment. Regulation uncertain <ul style="list-style-type: none"> • Timing and intensity • Emissions trading. 	Nehrt (1996); Farzin & Kort; (2000); Klingelhöfer (2008).
Module 3 The Role of Real Options in Capital Budgeting Analysis	
Topic 3.1 Teaching capital budgeting. Why not DCF:NPV <ul style="list-style-type: none"> • Budgeting practices • Non financial measures. 	Adler (2006); Wouters (2006); Chen (2008); Carmichael & Balatbat (2008); Truong, Partington & Peat (2008); Bennouna, Meredith & Marchant (2010).
Topic 3.2 Incorporate real-options analysis into Capital investment decisions <ul style="list-style-type: none"> • Teaching case study • Analysis and examples. 	Lin & Herbst (2004); Lindginer (2006); McDonald (2006); Stout et al. (2009); Sarkis & Tamarkin (2008); Ferreira, Kar & Trigeorgis (2009).
• Real options and emissions trading	Sarkis & Tamarkin (2008).
Module 4 Real Options and Game Theory	
Topic 4.1 Game theory and environmental issues	Ray (2000)
Topic 4.2 Real options and game theory	Jankensgard (2001); Weeds (2002); Hauisman et al. (2003); Grenadier (2004); Smit & Trigeorgis (2004); Grasselli (2007).

Small dam safety problems in Vietnam and associated responsibility and accountability: evidence from a rural commune

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Abstract:

This paper examines the prevalent safety problems associated with small dams in Vietnam and the contributing factors to the problems using a rural commune in Vietnam as an indicative case study. Ten on-site dam surveys were conducted in Tan Moc commune. Fifteen semi-structured interviews were conducted within five key stakeholder groups. The surveys suggested that all ten dams surveyed were rated 'High' hazard and were at high risk of failure because of physical and management inadequacies. The interviews indicated that floods were the dominant cause of dam safety deficiencies and dam failures. Human factors were seen as important or as more important for dam safety than the impacts of natural extremes.

Key words:

Environmental responsibility, environmental accountability, small dams, triangulation method, Vietnam

1. Introduction

Although dams have made a substantial contribution to storing and managing water – the vital resource needed to sustain human development (ICID 1999; WCD 2000) - the safety of dams is a great global concern. A large number of dams all over the world are classified as ‘high’ hazard and are at high risk of failure. For example, about one third of over 80,000 dams surveyed in the National Dam Safety Program in the United States (US) pose a ‘high’ or ‘significant’ hazard to lives and property in downstream areas (FEMA 2009). Results of a World Bank dam safety assessment indicate that thousands of people are at risk of death downstream from the 25 hazardous dams surveyed in India (Rao 2008). According to a survey conducted by International-Rivers, safety maintenance and management is under invested worldwide (IR 2009). Many dams in the world are getting old but neither information nor statistics on funds for dam safety maintenance exists (IR 2009). About 5,000 dams around the world were built over fifty years ago based on safety criteria available at the time. Most of these aging dams have not been built to adapt to erratic changes of infrastructure and hydrological patterns caused by climate change (IR 2009). Increased weather extremes and severe floods can also trigger dam bursts thereby reinforcing concerns about ongoing maintenance and close supervision of dam safety condition and the execution of proper repair (WCD 2000; IR 2009).

Dam safety is a matter of high importance because dam failures are seen as being potentially as destructive as earthquakes, hurricanes, air crashes, fires and explosions (Smith 1989; DSE 2007). Dam failures can cause great harm to life and human health as well as adverse social, economic and environmental impacts (WCD 2000; UNEP 2004, 2006; He et al. 2008; WB 2008; Pisaniello 2009, 2010; Pisaniello et al. 2011). Many notable dam failures have occurred throughout the world. For example, Shimantan and Banquia dams failed in 1975 in Henan province in Central China because of the cumulative failure of 60 small dams in the upstream catchment area. Around 230,000 people were killed, more than 1 million hectares of land were inundated and over 100 km of the Beijing-Guangzhou railway line damaged in this disastrous cumulative dam failure (Fu & Qing 1998; Fuggle & Smith 2000). In 1993, more than 1,200 lives were lost as the Gouhou dam failed in Qinghai Province (Fuggle & Smith 2000). He et al. (2008) provide an extensive review of failure consequences from 1954 to 2003 in the three highest failure rate countries namely China, Spain and the US. In general, a wide range of dam failure disasters have occurred and have caused numerous fatalities and considerable economic losses. For example, 3,481 dam failures happened in China over the 50-year period examined; 30,000

people were killed, 5 million houses destroyed and 1 million hectares of farmland inundated (He et al. 2008). Within Europe, the failure of the Maupassant dam in southern France in 1959 claimed over 450 lives (Smith 1989). In addition, the Stava tailings dam failure in Italy in 1985 killed 268 people, destroyed 62 buildings and caused serious environmental damage (Chandler & Tosatti 1995).

Much of the current attention is paid to the safety of large dams where the consequences of failure would be devastating for the downstream community, property and environment. Although small dam safety poses equally significant threats (Pisaniello & McKay 2005, 2007), there are insufficient data for small dam safety management. According to ICOLD (2007), dams of 15 metres and higher in height, or dams of 10 to 15 metres in height and a storage capacity of over 3000 ML are defined as large dams. Small dams are all other dams. Small dams are often not properly designed and constructed based on engineering criteria (WB 2008). The operation and management of small dams are also not closely regulated (WB 2008). As a consequence, small dams represent higher risks of individual failures or cascade/cumulative failures than large dams (Pisaniello & McKay 2005, 2007; WB 2008). In fact, the failure of small dams occurs far more frequently than that of large dams (Pisaniello & McKay 2007; He et al. 2008; WB 2008). For instance, over 96% of the total failures (3,356 out of 3,481) in China were small dams during the 50 year period between 1954 and 2003 (He et al. 2008). Moreover, the annual total cost of small dam failure can be more serious than the cost associated with large dam failure (Pisaniello & McKay 2007). Hence, there is a need for research into the safety and regulation of small dams. The purpose of this paper is to investigate the physical signs of problems associated with small dam safety in Vietnam – a country with a considerable small dam population, and to explore factors contributing to the current dam safety problems in Vietnam.

2. Small dam safety in Vietnam - literature review and research questions

Vietnam offers an appropriate context for researching small dam safety management because the country has one of the largest dam systems in the world along with China and the US (Dao et al. 2000). The dam network in Vietnam comprises over 750 medium and large dams and thousands of small dams (Silver 1999; Dao et al. 2000; WB 2004). Small dams are mainly used for local drainage and irrigation. Some of them are also supplying water for industry, domestic use, tourism and aquaculture. A few dams are also able to generate hydro-electricity (Le 2005).

Small dams are often situated in close proximity to residential areas, and have direct impacts on productivity and the livelihoods of downstream communities. Farmer/user associations or committees of local people are responsible for the operation and management of these dams to assure food security and supply for living activities. Small dams therefore make a substantial contribution to the water resources development as well as socio-economic development of Vietnam, particularly in rural areas where 70-80% of the population makes a living from agriculture (Silver 1999; Luu 2005). The Vietnamese Ministry of Agricultural and Rural Development specifies that small dams are a fundamental part of hunger eradication and poverty reduction in poor rural provinces in Vietnam (MARD 2009). For these reasons, the management of small reservoirs and dams needs to be considered as equally important as to that of large dams.

The safety of small dams however is a key challenge to dam catchment management in many rural provinces across Vietnam. There is currently no national dam safety program or an overall strategy for the safety management of dams in general and small dams in particular (Nguyen 2007). The majority of small dams are owned by the government and are currently operated and managed by farmer or user associations or local people's committees (NAV 1998; GVN 2007). The current regime has created the situation that no specific individuals or organisations take legal responsibility for proper dam safety management and dam failures (Tran & Nguyen 2008). The problems associated with public ownership but no public control are based on opportunities for organisations and individuals to gain the benefits from dams while overlooking responsibility for adequate surveillance and maintenance.

At present, Vietnam has no national record of either small dams or their problems (Nguyen 2007). Nearly 100% of small dams are soil/earth dams which were built since the 1970s and during the Vietnamese war (WB 2004; Nguyen 2007). A majority of dams were built with inferior design and poor construction standards because of the lack of adequate design knowledge, construction equipment, materials such as cement and concrete, and construction technology (WB 2004; Nguyen 2007). For many years, maintenance of and investment in safety has been insufficient (Adger 1999). This deficiency can be seen through soil erosion and sediment accumulation over time which have decreased storage capacity and blocked runoff and water flows. The risk of dam failure disasters in a number of catchment areas therefore remains high. High population density, the tropical climate, mountainous terrain and proximity of dams will also exacerbate the consequences of any failure (WB 2003).

There has been no systematic collection of data on dam failures and there have been no specific approaches to determine associated impacts or economic losses of failure (Nguyen 2007). Many dam safety problems and notable dam failures have occurred in various provinces in Vietnam but have often been unreported. These failures have taken hundreds of lives and have caused devastating impacts on property and environment (Silver 1999; Nguyen 2003; 2007). For example, the 2,000 mega litre (ML) reservoir of Nha Tro dam failed in Nghe An province in 1978 causing the death of 27 people and damaging thousands of hectares of rice fields. In 1986, the overtopping failure of Dau Tieng dam damaged 3,452 hectares of mature rice (ready for harvesting), 1,144 hectares of early rice (not ready for harvesting), 1,197 hectares of farming products and 871 hectares of fruit, flooded 3,114 houses and disrupted 47 houses. The failure of the 500 ML Buon Bong dam storage killed more than 30 people and caused thousands of dollars of damage. In 2002, Am Chua dam in Khanh Hoa failed but no records of damages and losses were available (Silver 1999; Nguyen 2003; 2007). In 2009, the 250 ML reservoir of Z20 dam failed and about 200 m of railway embankment was destroyed. A number of trains from the North to the Central and the South were cancelled (Nguyen 2010).

For the reasons discussed above, the safety of small dams and responsibility and accountability for their management in Vietnam are matters of great concern. However, the degree and scope of the safety issues are unexplored because little information has been recorded and reported publicly. The responsibility and accountability associated with unacceptable hazardous dams and/or dam failures remains to be examined. In order to begin filling the gap in the understanding of small dam safety management in Vietnam two research questions are addressed:

What are the physical signs of problems associated with small dam safety in Vietnam?

What are the factors contributing to small dam safety problems in Vietnam?

In this paper, dams refer to water storage dams that can be used for irrigation, drainage, water supply, flood control and hydropower. Small dams are all dams of less than 15 m in height and with a storage capacity of less than 3000 ML (GVN 2007). This definition of small dams is similar to ICOLD's definition (2007).

3. Research methodology

3.1 Research design and data collection methods

The research was designed in the following two stages.

Stage 1: Fifteen qualitative semi-structured interviews were conducted within five key stakeholder groups. Stakeholder interviews were conducted face-to-face between 10 September and 21 October, 2010. The interviews involved 3 stakeholders in each group including:

- Group 1: Policy regulators, members of Water Resources Administration, Ministry of Agriculture and Rural Development or members of Vietnamese government's policy and laws Board on dam safety management, who take the most responsibility for dam safety management at the macro level.
- Group 2: Researchers and consultants, who are working in the dam safety management field in national research institutions and international organisations in Vietnam.
- Group 3: Local authorities, members of Bac Giang province's Water Infrastructure Management Department, Luc Ngan district's Department of Agricultural and Rural Development and Tan Moc commune People's committee.
- Group 4: Local dam managers who are operating and managing dams in Tan Moc commune.
- Group 5: Members of the local community who are living close to dams and bearing the dam safety threats in Tan Moc commune.

Stage 2: An embedded case study was conducted containing ten on-site surveys, which were conducted on purposively selected dams in Tan Moc commune, Luc Ngan district, Bac Giang province - Vietnam (Figure 1). All dams selected for on-site surveys in the field work had to satisfy the following two criteria: (1) dams of less than 15 m in height and with a storage capacity of less than 3000 ML (small dams) (GVN 2007); (2) 'Significant' or 'High' hazard dams based on an initial assessment of the dam size, living activities and economic development in the downstream inundation area (ANCOLD 1994, 2003). The dam surveys were undertaken between 28 September and 2 October, 2010.

3.2 Research context

All dams for on-site surveys were selected in Luc Ngan district, Bac Giang province about 50 km from Ha Noi - the capital city of Vietnam. Luc Ngan district is located between 21015' - 21035'N and 106033' - 106052'E in the northeast of Bac Giang province in Vietnam (DWIM 2006). The district covers an area of 1,012.2 km² and its population in 2004 was 196,516 (Figure 2).



Figure 1 Ten sample dams that were conducted in on-site surveys

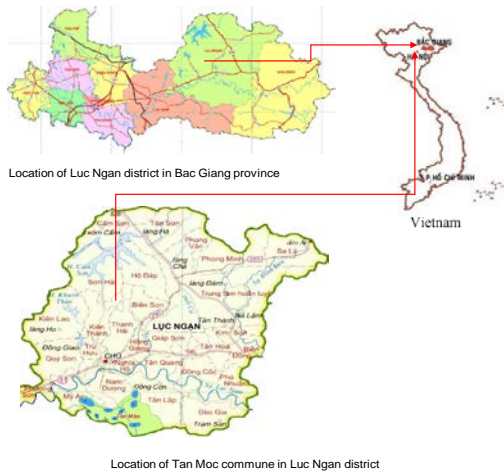


Figure 2 The study sites and their locations in Vietnam

The reason for selecting Bac Giang province as an overall indicative case study in this research is that Bac Giang is one of the provinces having a large number of dams, mostly small dams, in Vietnam (DWIM 2006, 2009; MARD 2009). Available data show that dam failures occur every year and have caused severe property and environmental damage in the province (Nguyen et al. 2009; Tran 2009; Nguyen 2010). ‘Luc Ngan's topography is hilly and steep with an average height ranging from 400-600m (DWIM 2006, p. 3).’ The topography is divided by many hills and rivers thereby creating a number of deep valleys where many reservoirs and dams are located (DARD 2004; DWIM 2009). This steep topography exacerbates probability and severity of dam failures to the local community who live and are accommodated in immediate downstream areas. Some recent historical dam failures in Luc Ngan district, Bac Giang province are listed in Table 1.

Table 1 Historical dam failures in Luc Ngan district, Bac Giang province, Vietnam

Dam failure	Commune	Year of failure	Cost of dam repair	
			Vietnamese Dong (1000 VND)	Equivalent US dollar (USD)*
Non khuat	Hong Giang	2008	5,000,000	312,500
Ran	Tan Moc	2008	400,000	25,000
Ia	Tan Moc	2008	200,000	12,500
Chao	Giap Son	2008	5,000,000	312,500
Da Mai	Giap Son	2008	600,000	37,500
Bau	Giap Son	2008	700,000	43,750
Hoa Quang	Nam Duong	2008	6,000,000	375,000
Deo Gia	Deo Gia	2008	3,000,000	187,500
Bien Dau	Bien Dau	2008	300,000	18,750

Note: * In 2008, 1 USD = 16,000 VND on average over the entire year.

Source Records were provided by one of the local authority participants (G3.3)

3.3 Data analysis methods

For Stage 1, the constant comparative method (Glaser 1965; Tesch 1990; Sivesind 1999; Boeije 2002; Carter 2010; Hammersley 2010) was used for interview data analysis. Comparison was constantly used as data was coded and analysed. Answers by each interviewee were scrutinised and compared to evaluate consistency as well as conflicts in their conversations. In addition, answers to each question were scrutinised and compared across interview participants to identify similarities and differences among different stakeholders.

For Stage 2, an extensive set of photos were taken and stored separately for each individual dam. In addition, on-site survey assessment of each dam was written on a dam inspection checklist developed from two publications that are: (1) ‘Your dam - your responsibility: A guide to managing the safety of farm dams’ by the Victorian Government Department of Sustainability and Environment (DSE 2007); and (2) ‘Dam safety guidelines: inspection and maintenance of dams’ by the Water Management Branch, Ministry of Environment, Lands and Parks, British Columbia (MELP 1998). The two publications are dam safety management guidelines in line with international acceptable practices for small earthen dam review and inspection (Pisaniello 1997, 2010; Pisaniello & McKay 2005, 2006). All photos taken in the on-site dam surveys were analysed by the photo-interpretation method which is widely used to assess objects or semiotics (Slater 1998; Demeritt 2001; Rose 2001; Brewer et al. 2005).

4. Results

4.1 Results for Research Question 1: Physical signs of problems existing with small dams in the study area examined in Vietnam

From the stakeholder interviews, the most prevalent safety problems of small dams in Vietnam include: erosion, seepage, structural cracking, inability to store design water capacity, vandalism, inappropriate spillways, traffic damage, settlement, sinkholes, animal burrows and excessive vegetation (see Table 2 for greater details).

Table 2 Common problems of small dams in Vietnam cited by key stakeholders

ID	Problems of small dams in Vietnam	No. of participants	Percentage of participants*
1	Erosion damage	14	93%
2	Seepage	14	93%
3	Cracking	11	73%
4	Inability to store design water capacity because of silting and/or leakage	10	67%
5	Blocked spillway	10	67%
6	Inappropriately designed spillway	10	67%
7	Vandalism damage	10	67%
8	Damaged by traffic	9	60%
9	Outlet leakage	9	60%
10	Outlet broken	9	60%
11	Settlement	6	40%

12	Damage from animal burrowing	5	33%
13	Excessive vegetation and/or trees	5	33%
14	Sinkholes	3	20%
15	Slides and/or slumps	2	13%
16	Low area on the crest of dams	2	13%

Note *On the basis of fifteen participants

Results from the on-site dam surveys demonstrate that all ten dams surveyed in Tan Moc commune, Luc Ngan district in Bac Giang province are seriously degraded and poorly maintained. 100% of the dams surveyed are highly hazardous and have the potential to fail with disastrous consequences. The current condition and associated maintenance levels of the sample dams are extremely poor and unacceptable. Characteristics of the ten sample dams are summarised in Table 3.

Table 3 Characteristics of ten sample dams

Dam No.	Year built	Height (m)	Storage capacity (ML)	Purposes of dam	Hazard rating	Year repaired and/or maintained
1	1963	4	600	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	2007
2	1970	6	800	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	1986 and 2008
3	1973	4	500	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	2007

4	N/R	5	500	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	N/R
5	1975	6	2500	Irrigation and drainage for Tan Moc and Phi Dien communes	High because many dwellings are located downstream of and in close proximity to the dam.	2008
6	1972	5	2000	Irrigation and drainage for Tan Moc and Phi Dien communes	High because many dwellings are located downstream of and in close proximity to the dam.	It has never been repaired or maintained until now
7	N/R	5	600	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	2008
8	1969	2.5	350	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	It has never been repaired or maintained until now
9	1986	2	300	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	2007
10	1964	3	1000	Irrigation and drainage for Tan Moc commune	High because many dwellings are located downstream of and in close proximity to the dam.	N/R

Note: N/R = Not recorded

Source Records were provided by dam managers G2.1, G2.2, G2.3 and local authority G3.3

All ten dams surveyed are in critical need of repair and maintenance (see Tables 4 and 5 for details of problems at the ten dams surveyed in Tan Moc commune; and Figures 3 to 6 for typical problems).

Table 4 Problems that exist with the ten small dams surveyed in Tan Moc commune

Dam No.	Height (m)	Storage capacity (ML)	Hazard rating	Main problems associated with dam safety	Acceptable or Unacceptable*
1	4	600	High because many dwellings are located downstream of and in close proximity to the dam.	Excessive vegetation on the upstream face, downstream face and crest of the dam. The crest is uneven. Upstream and downstream faces are substantially eroded. Spillway is concrete and in good condition.	Unacceptable
2	6	800	High because many dwellings are located downstream of and in close proximity to the dam.	The top crest is damaged by traffic: dip on the crest. Slide on the upstream face. Excessive vegetation on the downstream face. Traffic damage and slide on the downstream. Spillway is in good condition.	Unacceptable

3	4	500	High because many dwellings are located downstream of and in close proximity to the dam.	The top crest is damaged by traffic: dip on the crest. Slide on both the upstream and downstream faces of the dam. Spillway is in good condition. Excessive vegetation and trees.	Unacceptable
4	5	500	High because many dwellings are located downstream of and in close proximity to the dam.	The top crest is damaged by traffic. Traffic damage on the downstream face. Slide on both the downstream and upstream faces. The crest is uneven. Two large holes on the top (serious). A lot of cracking on the top. Low area on the top. Spillway is appropriate.	Unacceptable
5	6	2500	High because many dwellings are located downstream of and in close proximity to the dam.	Failed in 2008, about 20 houses flooded away. Cracking on the crest. Slide on both the upstream and downstream faces of the dam. Animal burrows. Spillway is in good condition.	Unacceptable

6	5	2000	High because many dwellings are located downstream of and in close proximity to the dam.	Dams No. 5 and 6 caused a cumulative failure in 2008. Cracking. Excessive vegetation and trees on both downstream and upstream faces. Spillway is appropriately designed and built of concrete.	Unacceptable
7	5	600	High because many dwellings are located downstream of and in close proximity to the dam.	Slide and cut on the top. Small and very old outlet. Cracking. Crest is uneven. There are a number of large trees. There is no spillway.	Unacceptable
8	2.5	350	High because many dwellings are located downstream of and in close proximity to the dam.	The top is damaged by traffic. The crest is uneven, low areas on the top. Large hole on the crest. Slide. Small outlet and very small spillway (under-standard). Spillway is blocked by large trees.	Unacceptable
9	2	300	High because many dwellings are located downstream of and in close proximity to the dam.	Failed in 2008 and repaired in 2009. Rice fields were damaged because of the failure in 2008. Slide. Cracking. The top is damaged by traffic.	Unacceptable

10	3	1000	High because many dwellings are located downstream of and in close proximity to the dam.	The top is damaged by the traffic. Uneven crest and low areas on the top. Slide on the downstream. Excessive vegetation on both the downstream and upstream. Outlet is broken, very old and cracking. Spillway is too small and blocked.	Unacceptable
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Note: * Based on a dam inspection checklist developed from Ministry of Environment, Lands and Parks - Water Management Branch, British Columbia (1998) "Inspection & maintenance of dams - dam safety guidelines" and Department of Sustainability and Environment, the Victoria Government (2007) "Your dam - your responsibility: a guide to managing the safety of farm dams".

Table 5 Current physical safety problems associated with the ten dams surveyed

Dam components	Actual problems	Details of problems	% of dams*
Reservoir	Inability to store design water capacity	Sediment accumulation Irrigation gate leakage Spillway leakage	100%
Crest	Overtopping	Inaccurate estimation of hydrographical parameters Spillway is blocked Flooding is over the design flood capacity The top is constructed lower than designed	60%
	Settlement on the crest	Traffic damage Animal burrowing activities Instability of the embankment	80%
	Transverse cracking	The dam foundation is depressed Instability of the embankment Shrinkage of surface materials Materials are low quality	20%
	Longitudinal cracking	Water in the reservoir increases or decreases suddenly. This sudden change of water level creates depression on the top The dam foundation is depressed Slide occurs on the embankment	40%

	Ruts along the crest	Traffic damage The movement of foundation	30%
Upstream slope	Seepage under the foundation	The quality of material is low. Hence, water is eroding the material Rodent activity Geological assessment is inaccurate	20%
	Slide and slump	The lack or loss of embankment material Rodent activity Erosion Traffic damage Downstream slope is too steep	80%
	Sinkholes	The movement of foundation create holes Material is seeped Animal burrows	20%
Downstream slope	Seepage through the embankment	Rodent activity creates open pathway through embankment The abutment is not properly designed and constructed	70%
	Seepage at the abutment	The abutment is not properly designed and constructed Plants/trees are not removed completely in construction	30%
	Slide and slump	The lack of or loss of embankment material Rodent activity The downstream slope is too steep	80%
Spillway	Eroded spillway	Erosion The gradient of the channel is too steep	20%
	Blocked spillway	Soil and stone erosion Trees and plants Inaccurate design	50%
Outlet	Eroded outlet	Outlet is too small Conduit is eroded Foundation movement	20%
	Leaking and breaking	Valve is broken Vandalism Outlet is too old	40%

Note: * On the basis of ten dams

In summary, the small dams surveyed in Tan Moc commune, Luc Ngan district, Bac Giang province in Vietnam are now in seriously deficient condition and in critical need of upgrades and maintenance. The current condition and associated maintenance levels of the sample dams are extremely poor and unacceptable.

Dam No.1



Figure 3 Excessive vegetation and trees on both the upstream and downstream slopes

Dam No.2



Figure 4 Severe traffic damage on the crest

Dam No.6



Figure 5 Inability to store design water capacity because of leakage

Dam No.8



Figure 6 Piping failures resulting from construction or material defects and inappropriately designed spillway

4.2 Results for Research Question 2: Factors contributing to small dam safety problems in Vietnam

According to the stakeholders interviewed most dam failures in the past coincided with the occurrence of weather extremes, especially floods and heavy rains (see Table 6). The majority of the participants interviewed believed that floods and heavy rains make a considerable contribution to dam failures in many rural provinces in Vietnam. In addition, landslide is seen as another cause of dam failures particularly in the northern mountainous provinces such as Tay Bac, Hoa Binh and Ha Giang provinces. The age of dams is also a main objective factor causing dams to fail. The stakeholder interviews and on-site surveys confirmed that dams built over 30 years ago during the Vietnam War appear to have enormous safety problems. The safety of these dams is inherently compromised because of inadequate design and construction.

Table 6 Objective factors contributing to current dam safety problems

Objective factors	Number of participants	Percentage of participants*
Flood	15	100%
Heavy rain	12	80%
Age of dams	12	80%
Landslide	11	73%

Note: * On the basis of fifteen participants

The stakeholders expressed the view that subjective (human) factors are undoubtedly the dominant cause of the current poor dam safety status and dam failures (see Table 7). In general, human factors are seen by the key stakeholders as important or as more important for dam safety than the impacts of natural extremes and the age of dams. There are a number of human factors involved. The first two factors indicate the lack of responsibility and accountability that has a direct and strong influence on the safety of dams. The stakeholders reported that no specific organisations and individuals have taken responsibility for dam failures in the past. In addition, there is a lack of organisations and individuals that actually take responsibility at a number of stages such as dam repair, review, surveillance and maintenance as well as the setting of safety standards. Poorly defined and implemented accountability at both the central and local levels leads to the dam safety problems arising in various ways.

Table 7 Human factors contributing to current dam safety problems

Factors	Number of participants	Percentage of participants
Lack of responsibility	6	40%
Lack of accountability	3	20%
The absence of dam safety risk based assessment	13	86%
Poor dam safety management at the local (micro) level	12	80%
Poor dam safety management and assurance policy at the central (macro) level	6	40%
Life is given a low value	5	33%

Note: * On the basis of fifteen participants.

The lack of dam safety risk based assessment was regarded unanimously (86%) as a contributing reason for the small dam safety problems. Most participants did not correctly identify dam safety risks and hazards from dam failures. Most of them did not understand basic concepts of dam safety risks and dam hazards. On the one hand, the explanation of the participants indicated that a large number of dams are currently at 'High' risk of failure and many dams are potentially hazardous. On the other, most of the stakeholders insisted that small dams only constitute low threats. This unawareness and ignorance of the key stakeholders about safety risks and dam hazards and the absence of risk based assessment guidelines undoubtedly has a significant contribution to the physical dam safety problems.

Table 8 Factors related to dam safety management at the local level

ID/ Item	Problems of dam safety management at the local level	No. of participants	% of participants*
1	Lack of adequate operation manuals and management guidelines for dam managers	12	80%
2	Dam planning is poorly conducted	9	60%
3	Dam design is poorly conducted	7	47%
4	Dam construction is poorly conducted	8	53%
5	Review and inspection are poorly conducted	5	33%
6	Remedial actions and upgrades are poorly conducted	5	33%
7	Surveillance and maintenance are poorly conducted	6	40%
8	Lack of training and education for dam managers	12	80%

9	Lack of funds and insufficient investment in local dam safety management	14	93%
10	Limited powers of local authorities, local dam managers and the local community	8	53%
11	Lack of education and preparedness for the local community	5	33%

Note: * On the basis of fifteen participants

A majority of the participants (80%) regarded poor dam safety management at the local level as an influential factor (see Table 7). The stakeholders identified that six main problems (and a number of sub-problems) associated with the key components of dam safety management at the local level cause dam safety deficiencies (see Table 8). They include (1) a lack of adequate operation manuals and management guidelines for dam managers (item 1 in Table 8); (2) many stages including dam planning, design and construction; operation and review; monitoring and surveillance; and remedial works and maintenance are poorly implemented (items 2 to 7 in Table 8); (3) dam managers lack knowledge and qualifications to operate and manage dams (item 8 in Table 8); (4) there are insufficient funds for different stages of dam safety management (item 9 in Table 8); (5) local authorities and dam managers have insufficient financial and legal powers to handle non-complying and emergency situations. In addition, the local community has no or little influence on other stakeholders such as policy regulators, local authorities and dam managers to improve the current dam safety status (item 10 in Table 8); and (6) the local community lacks education about dam safety problems and preparedness for dam safety emergencies (item 11 in Table 8).

Poor dam safety management and assurance policy at the central level is also seen by the stakeholders interviewed to contribute to current dam safety problems (see Table 7). The results from the stakeholder interviews and comparative analysis are presented in Table 9 and indicate that the existing laws and regulations are neither efficient nor effective. In addition the current regulatory agencies at both the central and local levels lack competence in addressing dam safety problems. Moreover, the participants pointed out that the absence of dam safety assurance programs and the lack of dam safety standards are also causes of the current problems. The reported shortcomings of dam safety management and assurance policy at the central level represent a low level of involvement of central government agencies that inevitably leads to the current safety problems.

Table 9 Factors related to dam safety management problems at the central level

ID	Problems of dam safety management at the central level	Number of participants	Percentage of participants*
1	Incompetence of the regulatory agencies	4	26%
2	Deficiencies of the laws and regulations	3	20%
3	Lack of national dam safety programs	5	33%
4	Lack of dam safety standards	5	33%

Note: * On the basis of fifteen participants

Unconsciously devaluing the lives of the local community was highlighted as being an important reason for the current dam safety problems (see Table 7). Life is given a low value and consequently the protection of the local community against hazardous dams is given little priority. Some participants pointed out that economic values and political interests are seen as more important than human life and social values. Consider the following comments:

Small dam safety management in Vietnam can be summarised briefly as no one cares, no one manages or maintains, and no one researches.... No one cares because if they fail, no one would lose their positions.... these dams are non political dams (Policy Regulator 1).

Small dams do not receive attention from government agencies, local authority, national research institutions and international organisations in Vietnam because there is a lack of economic benefits and political interests arising from this issue (Researcher 1).

In summary, the results of small dam safety management in the area examined in Vietnam include two findings in line with two primary research questions. First, the most prevalent dam safety problems are erosion, seepage, structural cracking, inability to store design water capacity because of silting and leakage, vandalism, insufficient spillway capability because of inadequate design and/or blockage, traffic damage, settlement, sinkholes, animal burrowing and excessive vegetation. Second, both objective (natural) and subjective (human) factors are major reasons for current dam safety deficiencies. Objective factors are the age of dams and natural extremes, namely flood, heavy rain and landslide. Subjective factors include (1) the lack of responsibility and accountability at both the central and local levels; (2) the lack of dam safety risk based assessment; (3) the lack of adequate operation manuals and management guidelines for dam managers; (4) improper implementation of many stages of on-site

dam safety management practices such as planning, design, construction, review, inspection, surveillance and maintenance; (5) the lack of training and education for dam managers; (6) the lack of funds and under investment in local dam safety management; (7) limited powers of local authorities and dam managers; (8) the lack of education and preparedness for the local community; (9) incompetence of regulatory agencies; (10) deficiencies of laws and regulations; (11) the lack of national dam safety programs; (12) the absence of dam safety standards and (13) the lives of the local community having a low value assumed by policy makers, government staff and local authorities.

5. Conclusions

The paper has investigated the physical signs of problems associated with small dam safety in Vietnam, and explored factors contributing to the current dam safety problems in this country. The findings provide strong evidence that small dams in the study area - Tan Moc commune, Luc Ngan district, Bac Giang province constitute destructive threats to the downstream community, property and environment. As a result, there appears to be an urgent need for the Vietnamese government to take specific actions to protect lives, property and environment of downstream communities against hazardous dams. These actions are to develop appropriate guidelines and introduce an adequate accountability and assurance policy for the operation and management of small dams.

The outcomes of this research demonstrate that Vietnamese small dam safety management is completely unregulated. In addition, the role of small dam safety management was perceived as being insignificant by a number of the key stakeholders including central government agencies, local authorities and national research institutions, local dam safety management associations and the local community. The evidence provided ascertains that even though dam failures in rural provinces in Vietnam would coincide with natural phenomena, human factors are certainly the major cause of disasters resulting from these dam safety problems including dam failures.

The results provided suggest that the importance of small dam safety management should not be underestimated. On the contrary, greater attention should be paid to this issue. This research reaffirmed a concern arising through prior research that if dams are not managed properly, then all dams, large and small, high and low hazard, pose considerable safety risks because of the potential for failure either at the individual and/or cumulative level within catchments.

It is also evident that the safety of dams can be only achieved through adequate on-site practices at the local level and proper assurance policy at the central level. At the local level, the safety of dams can be achieved when various stages such as design, construction, operation, review, inspection, surveillance, remedial works and maintenance are properly implemented. At the central level, the safety of dams can be assured when the government establishes comprehensive dam safety assurance programs based on properly developed legislation.

There appears to be a need for adequate risk based assessment, responsibility and accountability policies for small dam safety management in Vietnam, and related to this need, it also appears important for the Vietnamese government to place a higher value on lives, property and the environment of downstream communities. Future research can explore how such accountability and assurance policies can best be provided in Vietnam.

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Environment extra!

Clean energy future draft legislation released in Australia

28 July 2011

A website has been introduced to complement the drive towards a clean energy future in Australia. The Australian Government's comprehensive plan for securing a clean energy future can be located at <http://www.cleanenergyfuture.gov.au>.

On 28 July 2011, the Deputy Prime Minister and Treasurer, the Hon Wayne Swan, and the Minister for Climate Change and Energy Efficiency, The Hon Greg Combet, issued a joint media release about clean energy future draft legislation. The Clean Energy Legislative Package (Package) includes four main bills:

- The Clean Energy Bill 2011, which sets up the carbon price mechanism.
- The Clean Energy Regulator Bill 2011, which establishes a regulatory body to administer the carbon price mechanism.
- The Climate Change Authority Bill 2011, which establishes a new Authority to advise the government on the future design of the carbon price mechanism, and
- The Clean Energy (Consequential Amendments) Bill 2011

Any comments had to be made in rapid time, by 22 August 2011. The package also includes details of the Government's Jobs and Competitiveness Program, which will assist emissions-intensive and trade-exposed industries. It also includes details of the Energy Security Fund, which will assist electricity generators to ensure energy security.

This legislation will be part of the whole package that will be introduced into Parliament between September to November 2011. The Government will provide tax cuts, increases in family payments and higher pensions and other benefits to assist households with the modest cost impacts of a carbon price. The Emissions Trading Scheme is expected to commence in Australia on 1 July 2012.

Support for renewable energy sources and innovation comes from the following: (i) establishment of Clean Energy Finance Corporation, A\$10 billion; (ii) leverage of private sector financing for renewable energy and clean technology projects; (iii) establishment of Australian Renewable Energy Agency to manage \$3.2 billion in renewable energy research and

development funding; and (iv) a renewable Energy Target of 20% renewable energy by 2020 which is planned to drive \$20 billion of investment in renewables by 2020.

Sources: Clean Energy Future web site at <http://www.cleanenergyfuture.gov.au/consultation-open-legislative-package> and presentation to the Institute of Chartered Accountants in Australia in Sydney on 16 August 2011 by Anthea Harris, Australian Government Department of Climate Change and Energy Efficiency.

Australia to put a price on carbon pollution

10 July 2011

Prime Minister Julia Gillard, Deputy Prime Minister and Treasurer Wayne Swan and Minister for Climate Change and Energy Efficiency Greg Combet announced the Australian Government's carbon price of \$23 for each tonne of pollution beginning on 1 July 2012.

The price will rise by 2.5 per cent a year in real terms during a three-year fixed price period until 1 July 2015. The carbon price mechanism will then transition to an emissions trading scheme where the price will be determined by the market. The Prime Minister said the carbon price was a central element of the Government's plan to move Australia to a clean energy future.

A carbon price will create economic incentives for the biggest polluters to reduce their emissions of greenhouse gases. Around 500 businesses will be required to pay for their pollution under the carbon pricing mechanism, with more than half of this revenue used to assist households with tax cuts, increased family payments and higher pensions, benefits and allowances. Carbon price revenue will also be used to support jobs and to invest in clean energy and climate change programs.

Minister for Climate Change and Energy Efficiency Greg Combet said the Government's carbon pricing mechanism would be implemented in two stages. For the first three years, starting from 1 July 2012, the price of each tonne of carbon pollution will be fixed, like a carbon tax. Then, from 1 July 2015, the carbon pricing mechanism will move to an emissions trading scheme where the price will be set by the market.

Mr Combet said market mechanisms were the most environmentally effective and economically efficient way of reducing pollution. A carbon price creates a competitive advantage for businesses, investors, researchers and innovators who find cleaner ways of doing business. In this way it creates powerful incentives and uses the market to deliver benefits for the community. The Deputy Prime Minister and Treasurer

Wayne Swan said the three-year fixed price period would provide stability and predictability across the economy.

Source: Prime Minister's Press Office <http://www.pm.gov.au/press-office/putting-price-carbon-pollution>.

Where can I find reliable, unbiased information on climate change science?

The Climate Commission was established to provide all Australians with an independent and reliable source of information about the science of climate change, the international action being taken to reduce greenhouse gas emissions, and the economics of a carbon price.

A good first step when looking for information is to look at the comments by the various national academies of science around the world. These organisations are the most reputable and prestigious scientific bodies in their respective countries.

The Australian Academy of Science is the peak Australian science organisation, representing the best scientists in the country. Information about science policy on climate change is available at <http://www.science.org.au/policy/climatechange.html>. It addresses the confusion on climate change science in the public domain and provides answers to key climate questions.

An alternative source is to go online at the Climate Commission public forum <http://climatecommission.gov.au/category/events> and ask one of the Commissioners for a direct answer to issues of concern.

Other information is available:

- Read the Climate Commission's report, *The Critical Decade* (<http://climatecommission.gov.au/topics/the-critical-decade>), which brings together an up-to-date summary of climate science, the risks and responses.
- Australia's CSIRO runs a climate change website (<http://www.csiro.au/science/Climate-Change.html>) and provides "comprehensive, science to help understand, respond to and plan for a changing climate. and have a book, *Climate Change: Science and Solutions for Australia* (<http://www.csiro.au/resources/Climate-Change-Book.html>)

drawing together the latest scientific knowledge on a series of climate change topics.

- NASA has a website at <http://climate.nasa.gov> which provides easily accessible and understandable information and research on global climate change science. The website also includes an interactive children's section and the opportunity to look at earth's climate system from NASA satellites.
- Australia's Bureau of Meteorology – provides decision-makers and the general public with access to accurate and reliable observations and information on the science of climate change (see <http://www.bom.gov.au/climate/change/>).

Source: Hannah Angus at <http://climatecommission.gov.au/topics/where-can-i-find-reliable-unbiased-information-on-climate-change-science/>

Integrated Reporting means Integrated Thinking

July 2011

The Global Reporting Initiative (GRI) believes that the successful company of tomorrow will have an integrated strategy to achieve financial results and create lasting value for itself, its stakeholders, and society. This integrated strategy should be reflected in an integrated report – a report that combines the analysis of financial and non-financial performance.

Integrated reports should capture and influence the company's short and long-term strategy and policy. They should present the risks and opportunities the company faces, integrated with disclosure on environmental, social and governance issues. Such reports will emphasize the fundamental link between financial and non-financial performance, and how they flow from and to core business strategy. The Board's plans for ensuring the company's sustainability should also be clear. In short, integrated reports should demonstrate the existence of integrated thinking. This belief in the need to integrate sustainability into strategy led GRI to co-convene the International Integrated Reporting Committee (IIRC) in 2010, together with the Prince's Accounting for Sustainability project (A4S) and the International Federation of Accountants (IFAC). GRI participates in various forums for advancing integrated reporting, including forums with a focus on particular regions and stakeholders. Of these forums, the IIRC is the most visible and far-reaching, with a membership that includes accountancy and auditing bodies, investors, civil society organizations, and reporting companies. The IIRC is tasked with

creating a globally accepted framework for integrated reporting. The combined expertise of its multi-stakeholder community informs the dialogue to develop the integrated reporting concept and framework.

Current reporting frameworks need more development in order to guide companies to produce integrated reports. GRI believes that a company can prepare for the integrated reporting revolution today, by exercising high quality disclosure on financial and non-financial performance. Companies that have not previously reported sustainability information may be unprepared for integrated reporting. GRI's Reporting Guidelines offer the most comprehensive guidance available for sustainability reporting, and are an excellent tool for progressing towards integrated reports.

GRI is present in the IIRC's Secretariat and Committee, and in its content Working Groups and task forces. Since July 2010, three Committee and four content Working Group meetings – along with weekly conference calls – have resulted in a draft discussion paper on the IIRC's proposed framework.

GRI will publicize public consultation widely; it is crucial for organizations to provide feedback on the proposed IR framework. The consultation period offers all interested parties the chance to join in the IIRC's discussions, and help shape the future of organizational reporting.

To learn more visit the IIRC's website.

Source: International Integrated Reporting Committee
<http://www.globalreporting.org/NewsEventsPress/LatestNews/2011/IntegratedReportingMeansIntegratedThinking.htm>.

Green Business Champion Ray Anderson Dies At 77

11 August 2011

Ray Anderson, 77, often called the “greenest CEO in America” for his crusade to turn his billion-dollar carpet company into an environmentally sustainable enterprise, died Aug. 8 at his home in Atlanta. He had liver cancer.

Mr. Anderson was the founder of Interface, the largest producer of commercial carpet tiles. For 20 years, he ran the business in compliance with government regulations but never thought much about the environment. Then, in 1994, he read Paul Hawken's book “The Ecology of Commerce,” which gave him a new understanding of how business practices could damage the environment.

“It was like a spear in the chest,” he told the Atlanta Journal-Constitution. “I was convicted as a plunderer of the Earth.” From that point forward, Mr. Anderson preached environmentalism with the conviction of a convert. He pursued what he called “Mission Zero”: to make Interface fully sustainable by 2020 through the use of recycled materials and renewable energy sources.

“It’s not often that you have a corporate CEO who is as committed to environmental issues or more than those of us in the environmental movement itself,” said Lester Brown, president of the Washington-based Earth Policy Institute. “I don’t think any other corporation has come close to doing what he has done.” Mr. Anderson founded his Georgia-based carpet business in 1973. He had seen modular carpet in England and thought that the concept would appeal to practical Americans. Easy to install, the tiles could be replaced one at a time as they wore out. They also suited the modern American office, with its shifting cubicles and proliferating wires and cords to accommodate.

“I fell in love with the idea,” he told the Journal-Constitution. “It just made so much sense.”

The problem, as Mr. Anderson would come to see it, was that carpet production was highly destructive to the environment. It required enormous amounts of petroleum and left behind mountains of unrecyclable waste. A prolific speechmaker, Mr. Anderson emphasized that the changes he had made since the 1990s did not cost him money — that, in fact, they saved his company hundreds of millions of dollars. “I always make the business case for sustainability,” he told the New York Times. “It’s so compelling. Our costs are down, not up. Our products are the best they have ever been. . . . And the goodwill in the marketplace — it’s just been astonishing.”

Critics on the left pointed out that Mr. Anderson did go on profiting from a business that, for all his efforts, had not yet achieved “Mission Zero.” On the right, they said that the free market on its own would eventually lead to a cleaner environment.

Source: Emily Langer, Washington Post

http://www.washingtonpost.com/local/obituaries/ray-anderson-greenest-ceo-in-america-dies-at-77/2011/08/10/gIQAGoTU7I_story.html.

Call for papers

Accounting Auditing & Accountability Journal

Special Issue: Accounting for Biodiversity

Guest editors: Michael John Jones and Jill Frances Solomon

The erosion of the world's biodiversity is widely recognised as one of the greatest current threats to the planet. Although there has been some consideration by the accounting community of climate change, particularly relating to greenhouse gas accounting, there has been practically no recognition or appreciation of the critical role of accounting in calling multinational corporations, governments and other organisations to account for their contribution to the biodiversity crisis. Our planet is presently experiencing a sixth period of mass extinction of species, which is thought to be more severe than those of earlier periods in geological time. Biodiversity plays a key role in economic development, providing ecosystem services, and indeed in the survival of the human race. However, adopting a non-anthropocentric view, the intrinsic value of biodiversity is also crucially important from a moral and ethical standpoint. Given the self-evident importance of biodiversity and its current neglect by accounting researchers, this special issue seeks to focus the attention of the academic accounting community on this key global issue. We take an eclectic view of accounting for biodiversity and seek contributions on accounting, accountability and assurance issues concerning biodiversity. We encourage submissions on:

- valuation of biodiversity including species and ecosystems
- reporting and disclosure issues
- assurance of biodiversity reporting
- theoretical frameworks relating to biodiversity accounting
- rationales underlying the need for companies to actively protect, conserve and improve
- biodiversity within their sphere of operation
- biodiversity governance and accountability mechanisms
- biodiversity risk and risk management
- interdisciplinary aspects of biodiversity accounting
- the emancipatory potential of biodiversity reporting
- institutional relationships and their impact on biodiversity accounting
- the response of private, public and third sectors to the need for biodiversity accounting

We would stress that given the embryonic nature of research in this area that the above list is merely indicative rather than exhaustive and that

submission on other biodiversity topics are welcome. Papers can be theoretical, empirical or methodological in nature. They can adopt a historical or contemporary perspective.

The submission deadline for this special issue is **28th January 2012**.

Manuscripts should be sent electronically by email (in a word file format) to the guest editors Mike Jones and Jill Solomon (michaeljohn.jones@bristol.ac.uk; jill.solomon@kcl.ac.uk). All papers will be reviewed in accordance with AAAJ's normal procedures.

Social and Environmental Accountability Journal 33(1), April 2013

Special Issue on Social and Environmental Accounting and
Policy Making

Special Issue Editor: Jan Bebbington, University of St Andrews

Owen *et al.*, (1997)ⁱ suggested that both administrative and institutional reforms are required to ensure that social and environmental accounting is effective. Administrative reforms address the way in which accounting, auditing and reporting activities are undertaken (including the development of new forms of accounting practice). In contrast, institutional reforms relate to the rules that govern the production and dissemination of information as well as underlying behaviours themselves. Therefore, as one seeks to reshape both forms of account and the context within which these accounts are produced some engagement with the world of policy making will be required.

ⁱ Owen, D., Gray, R. and Bebbington, J., (1997) "Green Accounting: Cosmetic Irrelevance or Radical Agenda for Change?" *Asia-Pacific Journal of Accounting*, 4(2), (pp. 175-198).

This special issue focuses on the issue of policy making and calls for reflections (based on empirical or conceptual investigations) into policy making practices (in their broadest sense) and experiences in the area of social and environmental accounting. Issues that might be considered in this context include:

- Company Law requirements (and any reviews or modification of company law)
- Stock exchange listing requirements
- Investor initiated disclosure requirements (such as the Carbon Disclosure Project)

- Accounting standard setting activities (and related groups such as the Carbon Disclosure Standards Board and the International Integrated Reporting Committee)
- Private regulatory/policy activities (such as that of the Global Reporting Initiative, Institute of Social and Ethical Accountability and the Equator Principles)
- Policies of professional accounting bodies (including educational/accreditation practices), and
- Policy approaches that implicate social accounting practices (such as a reliance on Social Return on Investment to allocate public funds).

Moreover, we would be interested in hearing reflections on the engagement of accountants in broader policy making processes as well. Further, given the variety of policy processes that emerge across the globe, we wish to publish paper with a wide geographic spread.

Authors interested in contributing to this Special Issue of *SEAJ* should send papers for review to: csear@st-andrews.ac.uk **no later than 29th February 2012.**

Authors are encouraged to contact the Guest Editor to discuss proposed topics.

Contact Jan Bebbington, University of St Andrews

Email: kjb10@st-andrews.ac.uk

Sustainability Accounting and Management Policy Journal

Special Issue Call for Papers (submission deadline: 29 February 2012)
Sustainability Accounting for the Industrial Use of Biomass

Guest Editors

Prof. Dr Stefan Schaltegger, CSM Leuphana University Lüneburg, Germany

Prof. Dr Roger L. Burritt, CAGS University of South Australia Adelaide, Australia

Prof. Dr Rob Bailis, Yale University, New Haven, USA

The environmental impacts of oil use are increasing and oil reserves are decreasing. This has led to the development of plant oil based biofuels such as bioethanol, biodiesel, biokerosene. Plant oils, such as palm oil,

soy oil or rape seed oil, have furthermore “conquered” global food and cosmetic production.

However, biofuels have been heavily criticised for not necessarily guaranteeing positive ecological or social benefits. Conflicts have been reported between agribusinesses, local communities and smallholder farming discussed as “fuel versus food” and “land grabbing”. In response, numerous sustainability certification schemes and guidelines have emerged, leading to a complex set of regulations and standards. LCAs, however, have indicated substantial reduction in emissions if producers follow good land use practices.

It is thus timely to analyse the relevant factors which influence whether, under which conditions and with which production systems biofuels can actually create a real contribution to a more sustainable or less unsustainable oil based economy.

Accountants face a new set of challenges to account for and communicate the issues of plant oil production for key stakeholders such as airlines, the food industry, or agricultural supply chains. Conventional accounting systems and lifecycle assessments face unprecedented physical and monetary measurement challenges. Management accounting will be critical to providing internal decision support for managers, non-government organizations and governments to identify, measure and prepare information that assists decision makers about the industrial use of biomass. Issues about units of measurement, data quality and its sources cannot be neglected if purpose-orientated information is to be provided.

Accounting for sustainability performance is critical because, if biofuels and plant oil production systems are not confirmed to be sustainable, redesign of current paths of development would be necessary.

Issues to be addressed in submissions could include, but are not limited to:

- Sustainability accounting, accountability and reporting of plant oil production and related agricultural systems, incl. supply chain issues and comparison with conventional fuels, oils and fats
- Case studies and empirical analysis of plant oil and biofuels
- Analysis of fuel versus food issues, or large agribusiness versus smallholder farming issues, etc.
- Methodological issues of sustainability performance measurement, accountability and reporting, incl. environmental impact assessment, LCA, LCC, EMA and other methods

- Stakeholder issues in the assessment and reporting of the sustainability of biofuels and plant oils
- Comparative case studies with biofuels and plant oils used in transportation (including aviation, shipping and road transport), or the food and cosmetics industry
- Assessment of emerging sustainability certification systems and their relevance for EMA

For a more encompassing Call for Papers see:

http://www.emeraldinsight.com/products/journals/call_for_papers.htm?id=3369

