Eco-Efficiency in Corporate Budgeting

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1 ABSTRACT

Any measure of eco-efficiency requires financial information, for calculating the numerator, and physical information about the environment, for calculating the denominator. Accounting and finance staff provide key financial information about the numerator in eco-efficiency calculations. Hence, for eco-efficiency measures to be calculated and for the measures to add value it is essential for them to be integrated with accounting and financial management processes – such as budgetary control.

Calculating measures of eco-efficiency is not enough on its own to ensure corporate value is added. Accounting and finance staff have to be involved in the planning of future long term eco-efficiency improvement. If value added from continuous improvement in eco-efficiency activities is to be anticipated it is necessary for eco-efficiency and budgeting to be integrated. The paper provides some conceptual and practical guidance to help managers achieve this integration.

Recently a number of companies have suggested that corporate budgeting no longer serves a purpose in their organizations (e.g. in network organizations). By demonstrating that, if information related to the neglect of potential environmental protection activities is ignored the costs to business can be very high, this suggested change in practice is considered. It is concluded that a set of contingent guidelines need to be developed for budgeted eco-efficiency situations to help management and regulators assess value-added opportunities from using this new environmental management tool.

2 INTRODUCTION

This paper draws attention to the fact that successful development and implementation of corporate eco-efficiency requires integration with corporate budgeting. This is not just a matter for Chief Executive Officers and operations management. Staff, such as those employed in accounting and finance, have an equally important part to play, in particular, through their role in integrating eco-efficiency with the corporate budgeting process.

2.1 Corporate Budgeting

A budget can be defined as a ‘quantitative expression of a proposed plan of action by management for a future time period and is an aid to the coordination and implementation of the plan’ (Horngren, Foster & Datar, 2000: 883). In practice, corporate budgets are used for a number of purposes:

- to help a business achieve its objectives;
- to authorize managers to spend a given amount;
- to forecast events over which no control is exercised;
- to plan by making a conscious attempt to affect factors which are open to influence and control;
- to communicate plans to managers responsible for carrying them out and to facilitate coordination between managers of different organizational business units;
- to motivate managers to perform in line with organizational expectations, by establishing a minimum performance standard; and
- to evaluate performance by providing an appropriate yardstick, and sometimes the only quantitative reference point available (Otley, 1977).

Given this range of purposes it is hardly surprising that budgets pervade business planning, motivation, control and organizational activities. Indeed, it is more surprising to learn that some businesses have suggested that they are moving beyond budgeting or are abandoning budgeting (Hope & Fraser, 1997a, 1997b; Kersnar, 1999). Some brief comments on the relationship between eco-efficiency and companies that may have gone ‘beyond budgeting’ will be made at the end of this paper. For the vast majority of companies budgeting remains, and will be assumed to be, a critically important activity. Consequently, possible links between eco-efficiency and corporate budgeting are a potentially important consideration.

2.2 Dimensions of eco-efficiency

In practice, the term “eco-efficiency” has been given different meanings (see, e.g. de Simone & Popoff, 1997; OECD, 1997; Schaltegger & Sturm, 1992; WBCSD, 1995) and, as a result, has little precision. Therefore, it is very important to clarify the dimensions of eco-efficiency being discussed here. In general, efficiency measures the relation between outputs from and inputs to a process. The higher the output for a given input, or the lower the input for a given output, the more efficient is an activity, product, or company. As the purpose of economic behaviour is to manage scarce resources in the best possible manner, emphasis is placed on the need for managers to seek efficient outcomes.

Efficiency is a multi-dimensional concept, because the units in which input and output are measured can vary. If inputs and outputs are measured in financial terms, efficiency is commonly referred to as *profitability or financial efficiency*. Typical measures of profitability include: contribution margin percentage, return on sales, economic value added and return to equity on assets employed. Economic efficiency indicates whether, and for how long, social activities can be sustained in economic terms. Accounting and finance staff provide expert advice about the calculation of financial efficiency.

If inputs and outputs are measured in technical terms, emphasis is usually placed on physical measures such as kilograms. Technical efficiency is also called *productivity*. Measures of productivity include: output per hour and output per employee. The difference between the best possible efficiency ratio and the efficiency ratio actually achieved is described as *X-efficiency* (Leibenstein, 1966). The concept of X-efficiency is useful because it suggests that in practice organizations do not appear to be cost minimizers (using the latest technology); rather they are more inclined to imitate their rivals in various policies and to follow industry norms and targets. To the extent that this occurs these organizations are technically inefficient. X-efficiency measures the extent of this technical inefficiency. Efficiency, because it is expressed as a ratio between a measure of output and a measure of input, is not bound to a financial or technical dimension: different dimensions can be combined by calculating *cross-efficiency* figures such as shareholder value created per employee.

As efficiency in general is the ratio between output and input, *ecological efficiency* can be interpreted as the relationship between a measure of output and a measure of environmental impact (Schaltegger & Sturm, 1994):

$$\text{Ecological efficiency} = \frac{\text{Output}}{\text{Environmental impact added}}$$

Environmental impact added is a measure of all environmental influences that are assessed according to their relative environmental impact (Schaltegger et al., 1996).

Two kinds of ecological efficiency measures can be distinguished: ecological product efficiency and ecological function efficiency. Ecologically efficient management of a company is characterized by a high ratio between products sold, or functions accomplished, and the associated environmental impact added.

Ecological product efficiency is a measure of the ratio between provision of a unit of product and the environmental impact created (see Schaltegger et al., 1996, Schaltegger & Burritt, 2000) over the whole, or over a part, of the product's life cycle. Company managers tend to illustrate environmental improvements by communicating their total product efficiency or a part thereof (e.g. the number of cars produced per unit of energy consumed). Product efficiency can be improved by implementing pollution prevention techniques or by introducing end-of-pipe devices, reduced use of inputs per unit or through substitution of resources. Although, in principle, improvement of product efficiency is desirable, some products will never be as ecologically efficient as others in providing a certain service. For example, a car will always be less ecologically efficient than a bicycle.

The second formula for ecological efficiency, *ecological function efficiency*, takes a broader view, by measuring how much environmental impact is associated with the provision of a specific function in each period of time (see Schaltegger et al., 1996, Schaltegger & Burritt, 2000). A function could, for instance, be defined as the painting of one square metre of sheet metal or the transport of a person over a certain distance. The alternative that causes the least environmental impact in fulfilling the specific function has the best *ecological function efficiency*. Ecological function efficiency is, therefore, defined as the ratio between provision of a function and the associated environmental impact added.

Ecological function efficiency can be improved by substituting products that have a low product efficiency with highly efficient products (e.g. a bicycle instead of a car), by reducing the amount used to fulfil the function (e.g. carpools lead to a decreased demand for cars), by prolonging the life span of products (e.g. longer corrosion guarantees on cars), and by improving product efficiency.

Environmental interest groups often prefer to measure the environmental record of a product according to its overall function efficiency (e.g. the ecological function efficiency of a car in transporting a person over a specific distance compared with the efficiency of a bicycle, or public transport).

Both measures of ecological efficiency are useful, and their adequacy depends on the purpose of the investigation. The two ecological efficiency ratios can be applied at different levels of aggregation, such as a unit of product, a strategic business unit, or total sales of a firm. In this context it is important to consider the total output and the absolute environmental impact: a large number of ecologically efficient products can be more harmful than a small amount of ecologically inefficient items.

The cross-efficiency between the economic and the ecological dimension – economic-ecological efficiency– is the ratio between the change in value and change in environmental impact added. *Economic-ecological efficiency is often referred to as eco-efficiency* (Schaltegger & Sturm, 1992/94, Schaltegger & Burritt, 2000).

Any measure of eco-efficiency requires financial information, for calculating the numerator, and physical information about the environment, for calculating the denominator. Accounting and finance staff provide key financial information about the numerator in eco-efficiency calculations and link this with physical information. They rely on physical information provided by natural scientists. Hence, for eco-efficiency measures to be calculated, and to add corporate value, it is essential for them to integrate traditional accounting and financial management with natural science (physical) measures such as provided by ecological accounting (Schaltegger & Burritt, 2000).

Once the physical measures are related to cost, revenue, liability and asset information further value can be added by integrating eco-efficiency measures into corporate budgetary control and capital budgeting processes. Emphasis here is placed on budgetary control, which involves short term plans designed to achieve long term objectives. For most businesses, whatever their size, accounting information, especially projected accounting information found in budgets, is a ubiquitous phenomenon. As budged information plays a fundamental role in the management of most business enterprises it follows that for eco-efficiency measures to add corporate value they need to be incorporated with the budgeting process. Only in these circumstances will individuals in organizations be fully aware of what constitutes acceptable behaviour in terms of eco-efficient outcomes. Once they become aware of what is acceptable behaviour they need to be motivated to undertake the actions that will lead to the outcomes that a business is seeking (i.e improving profitability and the environmental consequences of corporate activity at the same time). While '[l]ooking into the future – and translating this into a vision of where the company is going and the competencies and technologies it will require to get there – is essential for eco-efficiency' (DeSimone & Popoff, 1997: 97), future scenarios need to be linked to short term planning, control, and motivational mechanisms. Accounting systems, especially short term budgetary control systems, can be designed to encourage such desirable long run outcomes.

2.3 Necessary integration into corporate budgeting

Conventional accounting has been criticized for being far too orientated towards the past and financial numbers instead of towards present and future activities and non-financial information (see e.g. Johnson & Kaplan, 1987a; 1987b). Budgeted information is based on past and contemporary information and is used to plan the corporation's future as well as to check whether a corporation achieved its planned objectives. It is suggested here that, in order to add value to their businesses, managers need to integrate eco-efficiency measures with budgetary control mechanisms. A number of reasons support this view. Management is more than a process of looking at past results. Past eco-efficiency measures can provide a guide to the future, but for planning, control and accountability purposes future expected eco-efficiency targets should be specified. Comparison of expected and actual eco-efficiency measures is needed if feedback is to be used to promote change. Granted, budgetary control does not operate on its own to influence the behaviour of personnel. In fact, it would be a rather short-sighted management team that used budgets as a sole device for short term planning, control and motivation. Rather, budgeting operates in a complex conjunction with management style, organizational structure, specific job descriptions, personnel recruitment, selection and promotion policies designed to encourage individuals to use their energy to achieve the objectives of business. However, as part of this complex web of motivating factors, specific gains are available from introducing an emphasis on integrating eco-efficiency with the budgeting process. These gains include the anticipation of potential environmentally induced financial impacts on the company (potential environmental costs) and the requirement of the sustainable development concept to establish proactive management of processes which influence future business periods.

3 CURRENT APPROACHES OF ENVIRONMENTAL BUDGETING

An important use of accounting information for management is to assist with planning for the future. Based on the general definition of environmental costs as costs intended to protect the environment some authors propose that potential or future environmental costs be separately identified. Parker (1999: 64), following an empirical survey of environmental costing in Australia, recommends that change from conventional to environmentally aware accounting systems should be introduced through the adaptation of existing budgetary control systems, such adaptation to be governed by:

- The environmental management processes that are considered to be significant activities for the organization involved;
- The operational decision and control needs of the management team;
- The degree of management's familiarity and comfort with environmental input/output statistics and costs; and
- The rate of change in accounting system innovation, deemed appropriate to the organization involved.

According to Parker (1999), for environmental costing purposes, practice suggests that the need is to focus upon key operational strategies with which managers may be familiar and comfortable – such as setting budgetary targets for land remediation projects, pollution control systems, waste management and recycling activities. Parker's (1999) approach addresses environmental problems after they have occurred. It is essentially an end-of-pipe approach extrapolated to future expenditure on environmental problems that will continue to exist. There is no mention of zero waste, zero pollution, or zero land degradation strategies.

The importance of potential costs of environmental protection in the process of developing a tool for linking eco-efficiency with budgets has also been discussed by Wagner & Janzen (1991). Indeed, they have designed a separate costing system along these lines. Integration of future costs of environmental protection using full cost accounting has also been discussed by Neumann-Szyszka (1994). Also, direct costing, another popular conventional management accounting technique (see Horngren et al., 2000), has been suggested as a basis for budgeting environmental protection costs (for the discussion of the distinction of environmental costs and costing approaches BMU & UBA, 1996). However, direct costing is less decision orientated than activity based costing, because it concentrates on calculating the costs of specific business activities simply by using volume as a cost driver, rather than a richer set of cost drivers as used in activity based costing. Consequently, Borjesson (1997) suggested activity based budgeting be introduced for environmental protection costs. However, none of the approaches (see also Freese & Kloock, 1989; Roth, 1992; Kloock, 1993; 1995) have, as yet, been implemented in company practice. Extending the full cost, direct cost and activity based approaches to include budgeting of environmental protection costs is a step in the right direction, because future consequences for the environment are required to be taken into account if managers use these methods.

However, any consideration of the estimation of future costs faces quite substantial problems. Estimation of the future costs of pollution prevention and environmental liabilities is particularly difficult as neither future technologies, nor future demands of stakeholder groups (including regulatory requirements) are known. Furthermore, the explicit assumption in environmental budgeting that environmental protection is always related to a single case or project (Wagner & Janzen, 1991: 124) does not always reflect reality. Instead, environmental protection related to a particular site or company often needs to be assessed. One major problem with this perspective is that it is based on the implicit rationale that increased environmental protection leads to higher costs – in Parker's (1999) case the costs of end-of-pipe management of waste, land remediation, pollution control systems, and recycling activities.

In summary, two problems with using conventional accounting systems to budget for costs of environmental protection are that:

- the systems are reactive and tend to focus on additional costs caused by environmental regulations rather than on the benefits provided by opportunities that are conjoint with changes to improve environmental impacts; and

- they do not take into account the costs incurred when environmental protection is neglected by business.

Budgetary control needs to address these issues. Eco-efficiency is concerned with proactive ways of obtaining continuous improvement in environmental and financial performance. Hence, cost accounting methods that focus on the costs of environmental protection without highlighting potential environmental gains are unlikely to create eco-efficiency–orientated knowledge. Information provided by these methods contradicts somewhat the management aim of enhancing corporate eco-efficiency. It certainly does nothing to encourage a proactive use of budgetary control that is based on a management philosophy designed to eliminate adverse corporate environmental impacts.

4 AN ALTERNATIVE SUGGESTION – MATERIAL AND ENERGY ACTIVITY BASED BUDGETING (MEABB)

A separate set of methods for environmental costing is orientated towards discovering past and present costs of material and energy flows in business (Fichter et al., 1997, Schaltegger & Müller, 1997, Schaltegger & Burritt, 2000). If environmental costs are defined as all costs caused by material and energy flows that may have an impact on the environment, environmental costs are caused by any kind of material purchased and processed and associated waste 'produced'. Environmental costs then include the costs of purchasing and handling materials which cause environmental impacts. If waste was not produced, the material from which the waste emanated would not have had to be purchased. Purchasing and handling costs are therefore material flow-related environmental costs. This also “automatically” includes the costs of treating input materials by end-of-pipe and integrated technologies as well as the environmentally related internal company costs of the products sold, such as, for example, liabilities relating to products dumped in a landfill. Thus, environmental costs can be lowered by reducing material flows because they all cause environmental impacts. From this perspective, costs of scrubbers and effluent treatment plants, are not regarded as costs of environmental protection but rather as environmental costs.

Full cost accounting (incl. all company-internal costs, however, not considering external costs) was the first method to focus on environmental costs as costs related to material and energy flows (Fischer & Blasius, 1995; Fischer et al., 1997).

One of the main advantages of full cost accounting of material and energy flows is that any reduction of throughput and related environmental impacts is recognized as a reduction of environmental costs. This way of thinking spurs advanced corporate environmental management to renewed efforts, i.e. prevention instead of a mere abatement of pollution. The information provided is decision-oriented with a focus on improving corporate eco-efficiency. The search for potential cost savings through means of environmental protection is encouraged as the costs of neglected pollution prevention are calculated and made transparent within the company through the budgeting process and associated incentives structure. In practice, it is much easier to distinguish between costs related to material and energy flows than between costs of integrated environmental technologies and normal production technologies. Integration with cost accounting is facilitated if the identified material flows are related to cost centres, cost objects, and associated activities and linked with actual and budget costs.

One problem with this approach is that corporate material and energy flows have to be known. Moreover, the implementation of a material and energy flow accounting system is relatively expensive. This is partially because of the need to establish a parallel ecological accounting system to support the introduction of a general account of all material flows, an allocation of related overhead costs to the material flows (e.g. the administrative costs to deal with permits related to material flows) and the identification of appropriate allocation bases (or keys) (Schaltegger et al., 1996, Schaltegger & Burritt, 2000). A process costing view is taken by Fichter et al. (1997) and Fischer et al. (1997). The approach suggested here whereby costs are allocated based on material flows to internal company *activities* such as, for example, various production activities (Schaltegger & Müller, 1997), is similar to the process costing view.

It seems that no cost accounting approaches considering *potential future costs of material and energy flows* have yet been proposed in the literature (Schaltegger & Burritt, 2000). Indeed, the whole concept of budgeting has not been addressed by proponents of material and energy flow orientated costing. This is surprising given the potential cost savings that can be discovered by taking a material and energy flow orientated view of current production processes. It is to be expected that a future-orientated costing approach that considers the potential environmental costs related to material flows from investments, production processes and business operations would show even larger cost saving potential compared with analysis that is based on past and current operations with an end-of-pipe focus. The main reason why a proactive approach may uncover larger cost saving potential is that measures to reduce material and energy flows are mostly much cheaper than measures for changing existing processes or installations. Thus, proactive environmental management may be best reflected through a material and energy flow orientated activity based budgeting approach, a system with a rich set of cost drivers that enhances the understanding of the business processes and activities associated with each product and which reveals the activities where value is added and where it is destroyed and, as a result, facilitates activity based management (Morrow, 1992). Conceptually the approach is the same as the activity based material flow costing system, except that figures relate to expected future costs (see Schaltegger & Burritt, 2000).

4.1 MEABB – an example

Figure 1 illustrates the main steps in material and energy flow-orientated activity-based budgeting (MEABB). It shows a two-step process for allocating budgeted costs: firstly, from joint environmental cost centres (e.g. an incinerator providing common environmental services) to the 'responsible' cost centres (e.g. production centres 1, 2 and 3); and secondly, from the responsible cost centres to final cost objects (e.g. units of products A and B).

After being estimated, the costs of joint environmental cost centres, such as incinerators and sewerage plants, have to be budgeted and allocated to the 'responsible' cost centres and cost objects.

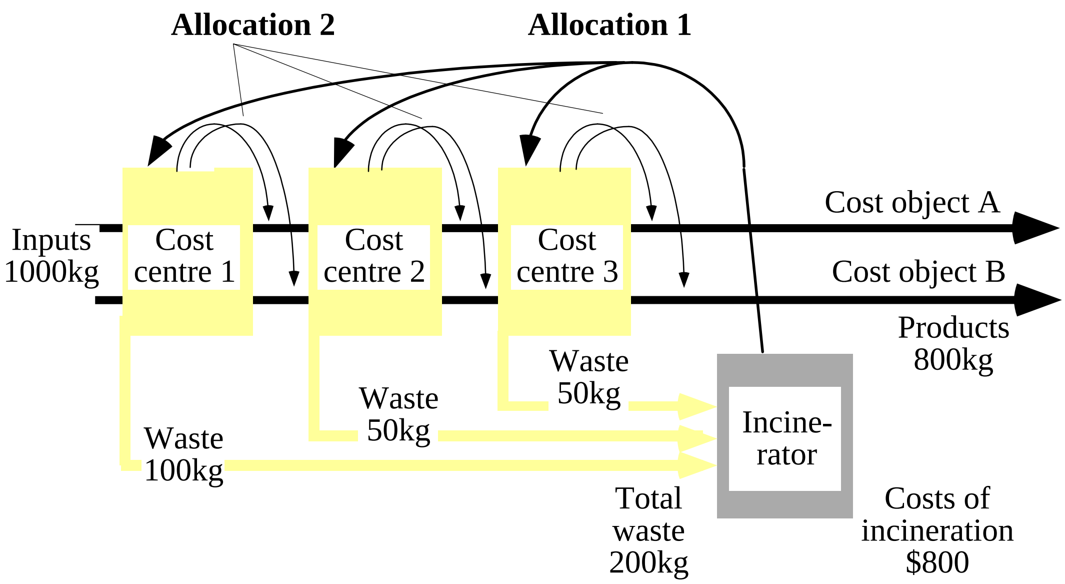

Figure 1 – Allocation of budgeted costs related to waste incineration

Total input to production is 1,000 kilograms of material, 200kgs of which will be treated as waste in the incinerator. Total incineration costs are budgeted at $800. Given these figures, if we assume, for simplicity, that every unit of waste caused the same costs, the treatment of one kilogram of waste would cost $4. This relationship is called the *cost allocation rate*.

As a *first allocation step*, budgeted costs of the incinerator have to be allocated to the three cost centres (Allocation 1) based on the cost allocation key: $400 to cost centre 1 ($4 * 100kgs of waste) and $200 to cost centres 2 and 3 ($4 * 50kgs each). The cost allocation reflects the amount of waste produced by each cost centre.

As a *second step* (Allocation 2), the budgeted cost centre costs have to be allocated to the cost objects (e.g. product A and B). A second cost allocation rate needs to be chosen for this allocation, one that reflects the budgeted separate costs of waste incineration that are expected to be caused by each product within each cost centre (e.g. Product A 100% and a ‘green’ product, Product B, 0%).

At present, even in some 'advanced' management accounting systems, many companies only allocate the costs traceable to environmental cost (service) centres (e.g. an incinerator) initially to production cost centres and secondly to products in the way described above. However, additional environmentally-induced future costs, associated with the flow of raw materials and the expected waste emanating from production processes, rather than from a joint environmental cost centre (the incinerator in this case), are ignored. Yet, some of these costs of waste could be saved and the profitability of products increased substantially if less waste was created in the first place. This requires consideration in budgeting by proactive management. Future waste will use manufacturing capacities, labour, and increased administration. If no waste is to be produced, depreciation would be lower, and the total salary bill reduced. Greater efficiency in resource usage and resource productivity would lead to less waste and an improved financial bottom line. Furthermore, as illustrated above, improved resource productivity has the potential to reduce labour cost and thereby increase labour productivity.

The question to be answered is what planned activities (e.g. purchasing, production, and incineration) will relate to the generation of waste. For instance, in the example shown in Figure 1, 200 kgs of the 1,000 kg input will be purchased only to be emitted from the production process as waste, without creating any value. In this case, waste will cause a 20% increase in purchasing cost, higher costs of machinery depreciation and extra administration costs. Neglecting to track and trace these costs would result in underestimation of the total costs of cost centres and cost objects (see Schaltegger & Burritt, 2000) because such costs would be budgeted in the general corpus of ‘period’ costs, being neither linked with environmental cost centres, production processes, nor products. Therefore, using conventional management accounting procedures, a third step is needed whereby budgeted indirect costs are allocated to cost centres and to cost objects in order to motivate managers to be mindful of such costs (see Burritt, 1997).

Figure 2 illustrates this *third allocation step* on the basis of the example used earlier on. Recall that the purchase of 1,000 kgs of raw material inputs is planned to create

800 kgs of products. Of the 200 kgs of waste, 100 kgs will be caused in step 1, and 50 kgs each in steps 2 and 3.

The first and second allocation steps helped to estimate and allocate the expected costs of the environmental cost centre ($800 for incineration) to cost centres and objects. However, some environmentally-induced costs would be excluded when calculating this way. The inputs which would be purchased 'just to be thrown away', without creating any value, have an associated opportunity cost. As waste is not inevitable, and can be reduced by preventative action, the inputs could be used to create economic value. The value expected to be foregone, is measured in terms of economic value added, contribution margin or profitability, and represents the opportunity cost. Therefore, management should also track, label and account for these other environmentally-induced costs, such as increased depreciation and higher costs for staff – costs that are not directly traceable to joint environmental cost centres but costs, nevertheless, that vary with the amount of production activity. Figure 2 takes these budgeted environmentally-induced costs into consideration, and illustrates that a *third allocation step* is necessary if managers are to be motivated to reduce these costs over time.

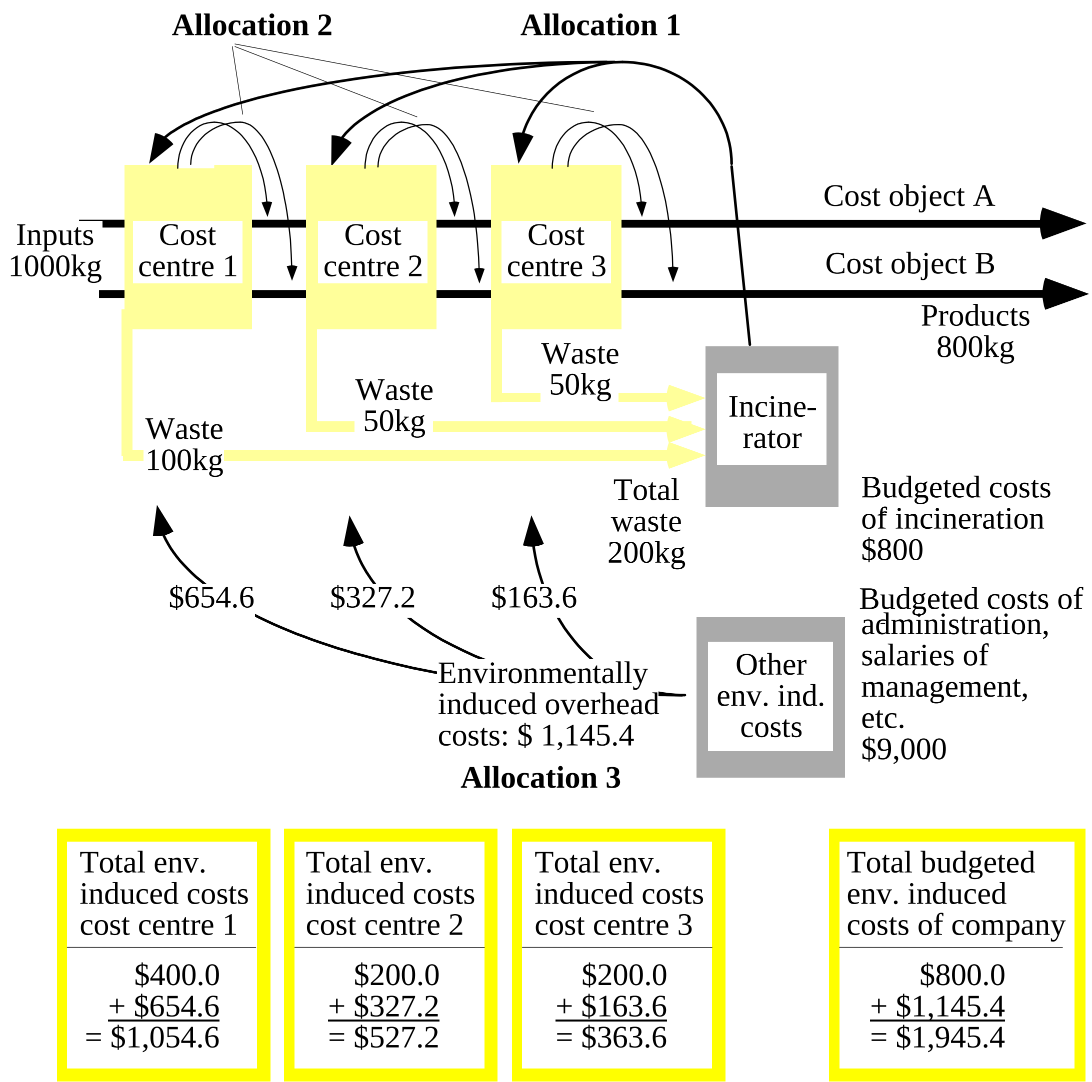

Figure 2 – Budgeted allocation of environmentally-induced indirect costs.

In the case presented it is assumed that the budgeted environmentally-induced overhead costs of $9,000 are all variable, that the volume of waste in kilograms is the agreed basis for linking costs to cost centres, and that the overhead costs per kilogram of all three cost centres are the same.

One thousand kgs of material are planned to be processed in cost centre 1, and 900 kgs and 850 kgs in cost centres 2 and 3 (see Table 1). Allocation rates for total environmentally-induced overhead costs will be 36.36% (cost centre 1), 32.73% (2) and 30.91% (3) if the total amount of processed material (e.g. 1,000kg of 2,750 kg for cost centre 1) is taken as allocation base. Thus, the total overhead costs of each cost centre will be $3,273 (cost centre 1), $2,945 (cost centre 2) and $2,782 (cost centre 3).

	Cost centre 1	Cost centre 2	Cost centre 3	Total
Kilograms processed	1,000 kg	900 kg	850 kg	2,750 kg
As % of total	36.36%	32.73%	30.91%	100%
Total overhead costs per cost centre	$3,273	$2,945	$2,782	$9,000
Waste processed	200 kg	100 kg	50 kg	
Waste as % of material processed	20%	11.11%	5.88%	
Waste-induced overhead costs	$654.6	$327.2	$163.6	$1,145.4
Waste-induced costs as % of total overhead costs				12.73%

Table 1 – Environmentally-induced overhead costs.

In this case the environmentally-induced indirect (overhead) costs are calculated as follows:

Cost centre 1: physically, 100 kgs of expected waste is directly related to production in cost centre 1. Economically, however, the waste which later shows up in cost centres 2 and 3 causes additional costs in cost centre 1 because good input is spoilt. In total, 200 kgs (100 kgs + 50 kgs + 50 kgs) of the 1,000 kgs of inputs planned to be purchased (or 20%) would cause indirect costs in cost centre 1. Hence, in this case, the additional, environmentally-induced indirect costs of cost centre 1 amount to:

20% (200 kgs of 1,000 kgs) of $3,273 = $654.6

Cost centre 2: 900 kgs of material will enter cost centre 2, but only 800 kgs will finally leave the company as good products. Thus, 100 kgs of the 900 kgs (11.11%) which enter cost centre 2 cause waste. The total overhead costs allocated to cost centre 2 are $2,945. The indirect waste costs amount to:

11.11% (100 kgs of 900 kgs) of $2,945 = $327.2

The costs in cost centre 3 amount to:

5.88% (50 kgs of 850 kgs) of $2,782 = $163.6

In summary, as calculated, recognising environmental costs in the budget as activity-based costs to be traced or allocated to cost centres, the total of all budgeted environmentally-induced indirect costs amounts to $1,145.4 ($654.6 + $327.2 + $163.6).

The total direct costs of the environmental cost centre (the incinerator) amount to \$800 whereas the total of all indirect environmental costs amount to \$1,145.4. The total of all budgeted environmentally-induced costs is shown in Figure 2 for each cost centre as well as for the whole company. The budgeted cost total for cost centres to absorb has increased from the \$800 cost of the incinerator to \$1945.4 because of the recognition of additional variable indirect environmental costs.

As the above example shows, the three-step allocation of environmentally-induced indirect costs in corporate budgeting can provide the motivation for management to take proactive measures which reduce material flows thereby realizing large efficiency gains as well as improving the company's environmental record. In other words, when environmentally-induced indirect costs are considered in budgeting and allocated on the basis of material flows, information provided to cost centre managers encourages them to improve the eco-efficiency of the company as well as to support environmentally benign methods of production.

5 ECO-EFFICIENCY AND BEYOND BUDGETING

The usefulness of MEABB will depend on the specific circumstances of any particular organization. Undoubtedly, MEABB will be more appropriate for some organizations than for others.

Problems with budgeting in some organizational settings have been recognized for many decades (see, for example, Hopwood, 1974: 41). Hopwood draws attention to the fact that budgets are easy to construct and use when an organization is comparatively stable and unchanging. In these circumstances, budgets can be technical masterpieces, but at best they will only codify existing practices. He argues that budgets would be of most use where their foundations are complex, unstable and changing – just the situation where uncertainty implies that any final budget is far less likely to be achieved. Small wonder that some companies facing considerable uncertainties appear to be in favour of dismantling or going beyond budgeting (Hope and Fraser, 1997a; 1997b).

The main recent criticizm of budgeting has been placed on the table by Hope and Fraser (1997a). They argue that 'in most companies today' organization is all about generating intellectual capital rather than tangible assets. Managing intellectual capital is not something that budgets fit well with because tight budgetary control is not a good way to encourage growth of intellectual capital - where the need for creativity is high. Instead, the whole edifice of company success is based on trust between the various groups of people in the company and avoidance of any adverse side effects generated by attempts to control employees in the workplace through budgets.

Although here is nothing new in this argument, as review of any text on management control systems will show (e.g. Merchant, 1998: 258), it does highlight that budgets are a control device that is not necessary in all circumstances. In which circumstances is MEABB most likely to be of use? It has long been recognized that, if each business unit is highly independent of other business units and there are few central corporate assets and expenses, then the emphasis on budget use for control can be reduced (Solomons, 1965: 143). Yet, it remains the case that most large and medium sized companies do still retain interdependent sub-units as well as central assets and expenses. Goods are transferred between profit centres using transfer prices, head office has ownership of assets and expenses that need to be linked with operational divisions, their products and customers, and some corporate-level decisions simply cannot be delegated. In these circumstances, conventional budgeting retains its significance and environmental aspects of transfer pricing, cost allocation, and corporate-level decisions need to be considered.

At same time, it must be acknowledged that federally decentralized organizations (N form) may not find budgeting useful for all functions. Many such organizations have given up centralized budgeting for aspects of their business sub-units (e.g. marketing and customer support, but frequently not for capital raising or tax). These decentralized units may own and operate their own budgeting processes for authorization, internal planning and control, but head office control is not present. Consequently, it might be assumed that environmental aspects of budgeting could be delegated or ignored. However, because budgeting is a multi-purpose activity, it cannot automatically be assumed that any organization will automatically benefit by going beyond environmental budgeting (especially MEABB).

Hope and Fraser (1997a) suggest that ABB, the global engineering and technology group, is a good example of the N-form organization that has given up budgeting – with its 200,000 employees and a federation of 1300 distinctive businesses; each business has multiple profit centres; the HQ only has 150 people; each unit manages its own finance; and R& D is devolved to operating companies. The focus is on maximizing shareholder value using such tools as TQM, BPR, decentralization, empowerment, economic value added, and the balanced scorecard. Yet, the emphasis on value added, makes it appear that organizations such as ABB are well suited to incorporate eco-efficiency measures (which address value added and environmental impact added) into their decentralized repertoire of tools. Eco-efficiency is, after all, concerned with adding shareholder value as well as improving the environment. However, if budgeting is frowned upon as a control device then the opportunity presented by MEABB may well be overlooked. MEABB addresses the issue that if potential environmental protection activities are ignored the costs to business can be very high. It aims to ensure that:

- a process exists for estimating and then capturing value added from environmental improvements through efficient materials and energy management;
- a challenge is laid down for all managers and employees to act in ways that reduce environmental impacts in accordance with short run operating plans based upon long term environmental policy;
- scenarios that address possible long run (strategic) environmental issues are contemplated and addressed through short run recognition of potential environmental revenues and costs;
- top management support is seen to be provided for 'win-win' situations, when, in its absence, consideration of environmental issues may lapse;
- approaches to resolution of environmental issues are coordinated, rather than being left to each sub-unit of an organization when the whole picture is needed if gains are to be appreciated; and
- for many companies an integrated budget remains the only quantitative reference point available.

6 THE GENERIC IMPORTANCE OF BUDGETED ECO-EFFICIENCY?

Further consideration needs to be given to the organizational contexts where MEABB has the potential to be relevant to management. Where environmental issues in particular industries have the potential to drive the total organization to failure (e.g. in minerals extraction, chemicals, and oil transportation industries), the need for overall planning and control through environmental budgeting is clear.

Also, where organizations have an overall responsibility to control their global environmental impacts such as greenhouse gas emissions, central overview through environmental management integration processes will be necessary. This net is spread very wide. Indeed, such situations seem to pervade business activities of small, medium and large organizations. Likewise, if any organization can gain shareholder value while reducing the environmental consequences of its activities then it will need policies to ensure that decentralized managers use eco-efficiency measures in a proactive way, by setting targets, standards, benchmarks or budgets and making sure that these are achieved through an appropriate incentive structure.

Can any organization leave the decision to disengage from budgeted eco-efficiency issues to the complete discretion of its federally decentralized sub-units? Hope and Fraser (1997a) suggest that, in companies striving to increase intellectual capital, budgets will constrain front-line managers, middle managers will see budgets as unnecessary controls rather than as integration devices, and top managers will view budgets as inhibitors of innovation and creativity. In short, budgets will destroy value.

However, in an eco-efficiency context, those going beyond budgeting will need to look again. Top managers need to challenge the destructive approach to environmental resources that represents the status quo if business is going to survive in the long run. Middle managers need to develop tools to help the integration of 'win-win' competencies within a challenging environmental policy framework laid down by top management. Likewise, front line managers must be made aware of the entrepreneurial opportunities presented by environmentally benign activity. Budgeted eco-efficiency of the type alluded to in this paper provides a necessary pillar of support for effective management of value. Not every organization can outsource its physical activities and associated environmental risks and focus on intellectual capital alone. MEABB would help ensure that an overly strong focus on intellectual capital as creator of value will not be used to place a veil of ignorance over, or a distraction from, concerns for real world (environmental) impacts of corporate activity -concerns that can make value generated by intellectual capital appear inconsequential.

Eco-efficiency is a relative measure whose use involves forecasts, targets, benchmarks, and budgets (physical and financial aspects), trend analysis and cross-sectional comparison with actual data after the event. If expectations and actual performance are incongruent and disclosed, then external and internal pressure will be brought to bear on organizations to change their ways, irrespective of their internal organizational structure and incentive systems – whatever their form.

The search for improved eco-efficiency is, by definition, something to be sought. The financial bottom line improves and the environment is conserved. Budgeted eco-efficiency is not so easily defended because it comes with the 'baggage' associated with poor budgeting systems. These are indisputable in certain situations. What is needed next is development of some contingent guidelines for environmental budgeting that set out those situations where MEABB is likely to be effective and where it will be less effective. These guidelines will help company executives, and regulators to know when budgeted eco-efficiency would be a useful management or regulatory tool.

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