Chapter 16

THE GREEN-BUDGET MATRIX MODEL

Theory and Cases in Japanese Companies

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Abstract: A number of Japanese companies have introduced Environmental Management Systems (EMS) and environmental accounting, although most companies have focused only on the external reporting aspects of environmental accounting and do not consider any future action plans and budgets concerning their environmental management. To utilize EMS more effectively, an action-plan which provides a map to drive activities, and a budget which guarantees that the plan is put into effect, are essential for environmental management. The Green-Budget Matrix Model which is introduced in this paper is a tool to support managers in identifying the type of activities that drive excellent environmental performance and in effectively allocating their economic resources. The process of preparing the matrix also generates useful information for analyzing the status quo, foreseeing the future of environmental management, and promoting a shared mutual recognition of their mission amongst members of the organization. The principal aim of this paper is to explain the idea and structure of the Green-Budget Matrix Model, and to examine its application in practice.

1. INTRODUCTION

In recent years a number of Japanese companies have been certified under ISO 14001, the international standard for environmental management systems (EMS). A survey initiated by the Japanese Standards Association found that 18,820 organisations had been registered under ISO14001 up to August 2005, and 356 listed companies and 177 non-listed companies have

S. Schaltegger, M. Bennett and R. Burritt (Eds.), Sustainability Accounting and Reporting, 355-372.

disclosed environmental accounting information in either their environmental report or their annual report in Japan (MoE 2004). It seems that publication of environmental accounting guidelines by the Ministry of the Environment (MoE) in 1999, 2000 and 2002 has encouraged many companies to introduce environmental accounting (MoE 2002).

This tendency of Japanese companies to adopt environmental accounting continues up to the present, although most companies have not connected their environmental accounting with their EMS. This is because their main purpose in introducing environmental accounting is to collect environmental information for external stakeholders, such as shareholders and creditors, and it also seems that their main purpose in registering for ISO 14001 is to raise the company's reputation. Consequently, with the exception of a few top-tier companies, most Japanese companies have not yet substantially engaged with environmental management.

The underlying concept of EMS is to reduce the environmental impacts of companies' operations through continual improvements (Epstein and Roy 1997, ISO 1996, Kawano 1998). All EMS standards, such as ISO 14001 and EMAS, emphasize the need for environmental management and for the measurement of physical environmental performance as an important part of this (Schaltegger et al. 2003). They also require that organizational objectives and targets be established in order to improve environmental performance and the implementation of appropriate management activities in order to accomplish those targets.

If one of the purposes of environmental accounting is to express the result of EMS, it has to formulate action plans to guide the actual implementations of EMS, as well as budgets that will make these plans a reality. In other words, since considerable economic resources such as labour, goods and money are invested in EMS, budgeting for these activities is essential for their proper implementation.

The Green-Budget Matrix Model (GBMM) that will be introduced in this paper is a practical tool to support the effective operation of EMS so that routine activities can lead to a reduced environmental burden. It derives environmental conservation plans and budget proposals logically, and generates information that encourages the effective use of business resources. GBMM therefore encourages companies to construct their EMS in a strategic way.

This paper will firstly focus on the contribution of GBMM, and the procedure for preparing the matrix. A case will then be introduced featuring the application of the model in a Japanese manufacturing company, and finally some concluding comments will be made.

2. NECESSITY OF AN ENVIRONMENTAL BUDGETING TOOL

2.1 Operational Budgeting for Environmental Management

In general, a budget "is the quantitative expression of a proposed plan of action by management for a specified period and an aid to coordinating what needs to be done to implement that plan", with four useful characteristics (Horngren et al. 2003:176f.):

- "Compels strategic planning and implementation of plans"
- "Provides a framework for judging performance"
- "Motivates managers and employees"
- "Promotes coordination and communication among sub-units within the company"

From these characteristics, it is clear that the budget is one of the systems that are necessary for the normal conduct of corporations' operations in their pursuit of profits. In other words, it is impossible to conduct actual business activities satisfactorily without setting up and implementing a budget. Since environmental management activities by companies consume considerable economic resources such as labour, goods and money, budgeting (which is the design process for these activities) is essential for their proper implementation.

Although a number of Japanese companies have introduced an EMS, there are also other companies which have formulated and implemented budgeting for environmental conservation activities, but there are few studies of environmental budgeting. Burritt and Schaltegger (2002) is one study that proposed the integration of eco-efficiency with environmental budgeting. Their reason for focusing on budgeting is that budgets look towards the future. Budgeting to assist with environmental management has played important roles in the verification of targets, analysis of budget variances, and the motivations of management and employees. Moreover, while conventional management accounting information is based on past events and is orientated towards financial terms, budgets are orientated towards future events and can incorporate non-financial terms into their scope.

Burritt and Schaltegger (2002) made the notion of eco-efficiency central to their argument, so this must be given due consideration. Generally, efficiency can be defined as the ability to generate a high level of output from a certain input, or to generate a certain output from less input. Burritt and Schaltegger take these notions of efficiency and apply them to the environmental or ecological dimension. They proposed the adoption of eco-efficiency

indicators which are calculated by employing a financial variable as the numerator and a physical variable as the denominator, and made them an integral part of corporate decision-making since eco-efficiency is a useful indicator that can integrate environmental effects into conventional financial information. They pointed out the need to integrate eco-efficiency indicators into corporate operational budgeting.

Their aim was to integrate the methods of activity-based budgeting (ABB) with materials and energy flow cost accounting, which they called "Materials and Energy Activity-Based Budgeting" (MEABB). This MEABB model emphasises the way in which budgeted environmental costs are allocated, depending on materials and energy flows. This method of allocation can also help to identify which products with negative environmental effects cause large environmental costs.

MEABB has a future-orientated approach which takes into account potential environmental costs relating to materials and energy flows. It can thus contribute to reducing environmental costs compared to *ex post* approaches, such as using end-of-pipe technology (Burritt and Schaltegger 2002). GBMM has the same future-orientated approach as MEABB, and also focuses on eco-efficiency as the basis of performance evaluation for environmental protection/conservation activities. In other words, eco-efficiency is one of the elements to achieve the objectives of GBMM, with another being quality costing which provides GBMM with a methodological framework.

2.2 Quality Costing for the Environment

Quality costing is a "win-win" approach which aims at not only cost reduction but also quality improvement. It classifies quality costs between prevention, appraisal, internal failure, and external failure costs, in line with the PAF (prevention-appraisal-failure) approach. Both environmental management and quality management are closely related activities, the objective of which is to accomplish a specific level of *quality* for manufactured goods and services (Kawano 2002:41f.). At the same time, quality management tools can provide environmental management with useful methods. In particular, since environmental costs and quality costs share many common characteristics, the "quality costing" framework has recently come to be seen as a useful approach that could be extended to environmental problems also.

For example, Diependaal and de Walle (1994) considered that quality control concepts could be transplanted to corporate environmental management since ISO 9000 has been widely adopted worldwide. Similarly, the concepts of quality costing could be applied to the field of environmental accounting. They referred to the case study of a furniture manufacturing company and argued that investing more economic resources into prevention

activities could contribute to reducing those costs which are driven by *ex post* activities.

Hughes and Willis (1995) provide another important contribution to this approach to quality costing for the environment (QCfE). They pointed out the risk of huge environmental liabilities as a result of strict environmental regulation, such as the Superfund law, and proposed environmental cost management from a quality cost management viewpoint in order to avoid these liabilities. They also emphasized that prevention was the most cost-effective way to balance the goals of achieving ever-higher levels of quality, decreasing costs, and generating increased profitability and customer satisfaction.

Like Hughes and Willis, Diependaal and de Walle (1994) considered quality management and environmental management as essentially existing in the same dimension. In addition, both studies gave a high priority to preventive activities, as these activities lead to a reduction in other costs such as failure costs. QCfE has three common steps, the first of which is to classify environmental costs based on the PAF approach. The second step is the cost-effectiveness (eco-efficiency) analysis of corporate environmental conservation activities, and the final step is to create information on environmental care that can be used for decision-making by management.

Since companies invest considerable economic resources into corporate environmental conservation activities, it is necessary to draw up a plan. Next, estimated costs should be allocated to planned activities, and then the budget has to be devised and executed. There must be close relationships between environmental conservation activities and the budget; however, there are few tools available to help with planning processes. This is the main reason for the introduction of the new QCfE procedures proposed here.

The Green-Budget Matrix, which is prepared using the process of QCfE, can provide useful information for planning and budgeting for the next fiscal year. The process of preparation of the Matrix, which is the major concern of the GBMM, can also contribute to:

- Identify the principal and most serious environmental problems within the organization
- Formulate plans for activities to reduce the environmental burden
- Allocate business resources to these activities.

Hence, it can be seen that GBMM is a tool to help managers to implement effective EMS in order to establish "economically-ecologically integrated eco-control" (Schaltegger 1996:254), which can be defined as both the "processes of evaluation and steering of financial and ecological impacts of corporate activities", and "institutionalised, internal management process

based on environmental accounting and reporting" (Schaltegger 1996:250ff., Schaltegger and Burritt 2000:379ff.).

3. THE GREEN-BUDGET MATRIX MODEL AS A TOOL FOR ENVIRONMENTAL BUDGETING PRACTICES

3.1 What is GBMM?

In Japan the quality cost matrix model was advocated by Ito (2001) as a radical tool to support quality management, and it has recently been implemented in some companies. GBMM refers to an approach which adapts the framework of the quality cost matrix model to environmental cost management.

The aim of the model is not only the reduction of environmental costs. Environmental protection activities of course cause costs but, if designed well, can also reduce costs, and sometimes the cost savings or economic benefits even exceed these costs. The main objective of GBMM is to generate information which will support the preparation of plans, such as for environmental investment projects or environmental conservation measures, in order to ensure that the economical and social benefits exceed the costs. The model is a tool that allows environmental conservation planning or budgeting for environmental conservation activities to be considered in a logical way, and holds the possibility of "win-win" potential to realize higher economic performance through more effective environmental management.

3.2 Classification of Environmental Costs in GBMM

As mentioned above, the reason for GBMM to follow the classification of quality costs is that the characteristics of quality are similar to those of the environment. As shown in Table 16-1, environmental costs are classified in accordance with quality costs. This classification reflects an understanding of the similarity between environmental costs and costs of quality. However, especially with regard to failure costs, environmental costs differ in a number of aspects.

For example "external environmental losses", which can regarded as "external failure costs" under the quality cost classification, refer to those losses that are borne by the community or consumers, or those losses for which it is not possible to specify who is liable. In the field of quality costing, failure costs refer to those losses which are borne by the manufacturer so that a reduction in failure costs can contribute to improving financial performance.

However reductions in external environmental losses are not directly related to financial performance.

Table 16-1. Basic classification of environmental costs.

Classifications	Definition and examples
Environmental conservation costs	The *ex ante* expenses which are designed to prevent environmental problems from arising and to reduce future outlays: for example, operational expenses for environmental management systems, expenses for pollution treatment, the balance of the expenses of green procurement and design for the environment (DfE), expenses for recycling, expenses for environmental insurance, etc.
Environmental appraisal costs	The expenses of monitoring the environmental effects for which a company is responsible, and the expenses of checks and inspections to prevent the design, development and shipping of environmentally harmful products. For example, expenses related to life cycle costing (LCC) and environmental impact assessment (EIA), expenses for toxicity testing, and other checking and inspection expenses.
Internal environmental losses	The losses caused by imperfect environmental conservation measures, inspection, etc.: for example, the costs of waste materials (including costs of non-product outputs and materials flows), waste treatment expenses, pollution treatment expenses, waste products collection and recycling expenses, compensation costs, and budget forecasts of energy and packaging expenses which are inaccurate despite being based on rational and reasonable assumptions.
External environmental losses	The losses borne by the community or local residents. These are caused by inadequacies in a company's environmental conservation measures, inspection procedures, etc. This type of loss includes environmental burden where the liability could not be currently identified such as air pollution, land contamination, and water pollution caused by the emission of CO_2, NO_x, CFC, etc.

It is for the reasons stated above that these losses are excluded from the category of environmental costs by the MoE classification (MoE 2002). However, against a background of ever more stringent regulations, it is impossible to evaluate the results of environmental conservation activities without measuring these losses. The reason is that the objective of these activities is to reduce social costs or environmental burden, so it is therefore appropriate to include external environmental losses as a major category within environmental costs.

Another difference between the costs of quality and environmental costs exists in the GPMM. With the costs of quality, the main aim of cost management is to identify those processes which lead to failure costs, since failure in the market can give rise to large economic losses, compared with

internal losses in general. On the other hand, environmental costs cannot be fully controlled by companies on their own, and the community and consumers also have some responsibility for meeting these costs. Therefore, any company may be required to implement production activities associated with risks that it may not be able to manage, so that it is impossible to decide the extent to which any damage is the company's own responsibility.

Moreover, it is difficult to measure most external environmental losses on a monetary scale, so GBMM therefore does not employ monetary measurements for external environmental losses. Instead, each environmental problem or effect is measured by an appropriate physical unit. Of course, the possible utility of monetary measurement is not rejected, but it is essential to point out that the difficulty of using this for external environmental losses does not present an obstacle to the use of the matrix model for the purpose of analyzing and evaluating the environmental burden.

3.3 Structure of GBMM and the Process of Preparing the Matrix

Table 16-2 shows the basic structure of the Green-Budget Matrix. The matrix is a work sheet which takes into account environmental conservation costs and the relationship between internal and external environmental losses.

The items of environmental conservation costs and appraisal costs are arranged in rows in the matrix. This classification could be applied by companies which comply with the MoE's guideline on the measurement of environmental costs. Companies could of course apply their own classification of environmental costs instead, in which case it would be required that the environmental cost items should correspond to the environmental conservation activities undertaken by the company.

The detailed items of internal and external environmental losses are arranged in columns in the matrix. For example, internal environmental losses are seen as environmental damage costs, which are categorized as one of the environmental costs according to the MoE's guideline. Of course, various different ways of itemising environmental losses could be considered.

For example, the full amount of energy consumption costs is included in internal environmental costs in the matrix without considering whether they are related to the environment. This is because energy consumption costs cannot be classified against each separate objective, and it would be counterproductive to exclude non-environmentally related energy consumption when considering the overall energy savings. Also, if a company were to cause serious environmental problems, it would be important to take opportunity costs into consideration. These opportunity costs are a similar concept

to the loss of corporate brand prestige or the social image of a company and are almost impossible to measure in monetary terms, although fortunately the main objective of the matrix is not to attempt to measure these losses precisely. This is because the matrix is designed to provide feed-forward information to management on environmental conservation costs, not to manage internal or external losses, despite there being an assumption that planning and implementing environmental conservation measures could lead to a reduction in these losses. The measurement of environmental losses itself is therefore not a central concern in this context. The most serious problem is that because of the difficulty of measuring these losses, they may be excluded and therefore overlooked in environmental conservation planning.

Table 16-2. Conceptual model of the Green-Budget Matrix.

		Details of activities	Environmental conservation costs (C_j) (j=1.2…m) (+Environm. appraisal costs)								Materiality	Targeted amount of losses	Difficulty	Absolute weight	Relative weight
Details of expenses		Actual amount	C_1	C_2	C_3	-	-	-	-	C_m					
Internal environmental losses	L_1 (*1)	-	R_{ij} (*2) -	-	-	-	-	-	-	-	-	-	-	-	-
	L_2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	L_3	50	-	○ 1.2/ 4.0	Δ 0.4/ 4.0	-	● 2.0/ 4.0	-	Δ 0.4/ 4.0	-	5	10	4	20	4.0
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
External environmental losses	-	-	-	● 2.2/ 5.0	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	Δ 1.4/ 3.0	-	-	-	-	-	-	-	-	-	-	-
	L_m	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green budget weight				4.8								Total absolute weight		500	100%
Estimated environmental costs and/or losses				168							Total			€3,500	
Actual environmental costs and/or losses				175							Total			€3,850	

(*1) Li = Environmental internal and external losses (i = 1.2…..n)

(*2) Rij = Correlation between costs and losses (j = 1.2…..m)

3.4 Process of Preparing the Green-Budget Matrix

The process of preparation of the Green-Budget Matrix has the following steps:

1. Identifying the details of internal environmental losses and external environmental losses.

   Each detailed item of internal and external environmental losses is arranged in rows in the matrix. Moreover, each item of losses ($L_{1, 2, 3... n}$) is expressed as the actual current amount or quantity in the matrix. However, it is necessary to classify the losses systematically and accurately in order to ascertain these amounts or quantities.Evaluating the materiality of each environmental loss.

   Materiality, which refers to the priority given to tackling the problem depending on the seriousness or the company's situation, is evaluated according to a five-point scale for each item of loss. For example, the materiality of "L3" is evaluated as "5" in Table 16-2 based on the current amount or quantity. However, materiality is not decided simply according to the amount or quantity, but should also take into account the advantage for competitors.

3. Setting targets for each item and evaluating the difficulty of accomplishing each of these targets.

   The next period's targets are determined by each item's loss, and then the difficulty will be evaluated again according to the five-point scale in order to accomplish these targets. For example, the difficulty of "L_3" is evaluated as "4" in Table 16-2.

4. Deciding the absolute weight (Wa_i) and the relative weight of losses (Wr_i).

   The absolute weight is calculated by multiplying the materiality and the difficulty by each item of loss (Wa_i). The product is regarded as a quantified indicator for evaluating the influence of each environmental loss on the business.

   Next, sum up all of the absolute weights and then decide the relative weight of losses. This can be calculated using the following formula:

$$Wr_i = \frac{Wa_i}{WA}, \quad WA = \sum_{i=1}^{n} Wa_i$$

For example, as shown in Table 16-2, the absolute weight is calculated by multiplying "5" and "4". Then if, for example, the total absolute weight is calculated as "500", the relative weight of losses is calculated as 4.0%.

5. Listing environmental conservation activities.

   The items of environmental conservation costs and appraisal costs are arranged by column in the matrix ($C_{1, 2, 3... n}$). Since it appears that each item of the conservation costs is totalled by environmental conservation activities, in general, this process is almost synonymous with the listing of environmental conservation activities.

   The same process is applied to environmental appraisal costs, although in fact there are many cost categories that can be identified as appraisal costs, and in any case it is not very important to make a distinction between conservation costs and appraisal costs. From a practical point of view, it seems that appraisal costs could be incorporated into conservation costs.

6. Evaluating the relationship between cost and loss in each cell.

   The relationship between the costs ($C_{1, 2, 3... m}$) and losses ($L_{1, 2, 3... n}$) is evaluated with the correlation between the various items of environmental conservation costs and of environmental losses being graded for each cell as "double circle" (strong correlation), "circle" (correlation), and "triangle" (weak correlation). These are weighted as "5", "3", and "1" in turn. Also, it is expressed in Table 16-2 as an intersection between the row (L_3) and the column (C_3). This grading is able to evaluate the extent of environmental conservation activities which contribute to reducing environmental losses.

7. Calculating the Green-Budget weight.

   When all the cells are weighted, then the numerical values of each cell are added with respect to each item of the environmental conservation costs. This is the process of deciding the Green-Budget weight in Table 16-2. The Green-Budget weights are the quantitative expressions of weighting when a company allocates business resources to each environmental conservation activity. For example, the Green-Budget weight of column "C_3" is calculated as "4.8" in Table 16-2.

8. Environmental budgeting.

   The final step of the preparation of the Green-Budget is to formulate the environmental budget. The total amount available to spend on environmental conservation costs is allocated to each activity in proportion to its ratio of the Green-Budget weight. For example, the estimated environmental costs and losses of the "C_3" column are calculated by multiplying total amount "€3,500" and the Green-Budget weight "4.8%" so that it is calculated as "€168" as shown in Table 16-2

   In principle, the matrix should be prepared for each individual division or factory. However, there are some companies that do not set a budgeted amount at this level. In this situation, the actual performance figures for previous fiscal years could be used as a provisional budgeted amount.

Moreover, if managers evaluate and analyze the actual costs incurred in the preceding period, then they can rationally consider the appropriateness of prior allocations of business resources to environmental conservation measures.

GBMM clearly distinguishes between internal environmental losses and external environmental losses, and thereby helps managers to prepare effective environmental management plans and to compile a budget. In this case, since the reduction of internal environmental losses could be directly tied to higher profits, managers could draw up measures on cost-effectiveness. On the other hand, with regard to the external losses, GBMM could help managers to decide on environmental measures within the limits of the financial resources available to them, and help them to produce good results within these financial constraints.

3.5 The Contribution of GBMM

GBMM plays three major roles in its preparation process. Firstly, it helps managers to identify principal and serious environmental problems within the organization by estimating and weighting each loss according to both its impact (materiality) on the business and the difficulty of reducing it. Secondly, in order to reduce internal or external environmental losses, GBMM supports the selection of actions and formulation of plans for environmental conservation by evaluating the cost-effectiveness and eco-efficiency of each activity. Thirdly, since business resources are allocated to activities according to the contribution of each, GBMM generates more feasible budgets for environmental conservation activities.

Six Japanese companies have implemented GBMM since 2001: Nitto Denko Corporation, Toyo Seikan Kaisha Ltd., Nissan Motor Co. Ltd., Kirin Brewery Co. Ltd., Toshiba Corporation, and Kyusyu Electric Power Co. Inc. Since these companies are classified under several different categories of business, it is clear that the contribution which GBMM can offer is by no means limited to only a specific industry sector. The next section discusses the case of Nitto Denko.

4. A CASE STUDY AT AN INDUSTRIAL PRODUCTS MANUFACTURING COMPANY

4.1 Environmental Budgeting at Nitto Denko Corp.

Nitto Denko is a Japanese industrial products manufacturing company which is shifting its environmental management from end-of-pipe measures to up-stream/process-integrated measures. In line with this policy, in each year since fiscal year 2000 it has developed an environmental budget whose characteristics are as follows (Nitto Denko Corporation 2003):

- An environmental budget is compiled by each division and by the Company Group in order to identify individual environmental themes and responsibilities.
- In addition to the "environmental conservation costs" that are indicated in the MoE guidelines, the purchasing and processing costs of materials that do not become products (industrial wastes), and the purchasing cost of energy, solvents and water consumed in in-house manufacturing, are also defined and recognized as "environmental impact costs".
- By effectively sharing the "environmental conservation costs", reducing the "environmental impact costs" produces good environmental performance. The goal is to reduce total costs by improving the productivity with which natural resources are used.

Since Nitto Denko has already introduced the PAF classification, which can measure and analyze quality costs, as a support tool for quality improvement, it seemed that the company has the background to apply GBMM. That is, for a company such as Nitto Denko which pursues the reduction of the cost of its industrial wastes, quality cost management and environmental cost management have similar characteristics that "aim at maximum output with minimum input, in other words, cope with both environment and economy".

For example, the environmental aspect "industrial waste reduction activities" could be connected with the quality aspect "failure products eradication activities". Hence, details of environmental costs that were accrued in line with materials flows have, to some extent, common characteristics with items of appraisal costs and internal failure costs. The matrix could therefore help managers who plan to fuse environmental costs and quality costs in the future.

4.2 A Trial of the Green-Budget Matrix at the Company

As mentioned above, since each division in Nitto Denko compiles an environmental budget in order to identify individual responsibilities, the division is trialling GBMM. The main items of "environmental impact costs" correspond to internal environmental losses, and the main items of "A Request of Preparing Voluntary Plans in Relation to the Environment" published by the Ministry of Economy, Trade and Industry, correspond to external environmental losses. Nitto Denko therefore determined the correlation between these losses and environmental conservation costs, materiality and difficulty, and undertook a trial calculation of the next period's environmental budget based on previous actual figures (see Table 16-3).

Since one of the characteristics of GBMM is to reduce "environmental impact costs" by inputting appropriate environmental conservation costs, the correlation between "environmental impact costs" and environmental conservation costs is considered by using the matrix.

As a result of the pilot project, Nitto Denko has realized a number of benefits through preparing GBMM. These are:

- Since the budget matrix was compiled in relation to targets to reduce environmental losses, environmental costs were effectively allocated to each activity at the beginning of the budgeting process, so that the company would be able to make an effective reduction in its environmental burden.
- Since the company is able to accumulate data on environmental losses in a time series, managers can utilize the unique feed-forward function of the matrix and then compile a future capital investment plan which takes into account the environmental effects of their operation.

Nitto Denko has also tackled reducing the costs of industrial wastes by implementing "materials flow cost accounting". Both GBMM and materials flow cost accounting have similar characteristics in terms of their concentration on industrial waste. Both tools measure materials costs and waste costs, including conversion costs, distribution costs and disposal costs, in monetary terms, and then evaluate "the negative value" of the company. Hence, both tools could contribute to clearing up the causes of the generation of wastes, and to planning and analyzing improvement measures.

In this respect, both GBMM and materials flow cost accounting pursue ecological as well as economic objectives so that their linkage in the future has a natural logic.

Table 16-3. Green-Budget Matrix prepared by a division of Nitto Denko Corp. (source: JEMAI 2003:216).

Details of expenses			Details of activities: Actual amount	Environmental conservation costs (3) — Pollution prevention costs: Preventing air pollution	Preventing water pollution	Preventing other types of pollution	Saving energy consumption	Resource circulation costs: The efficient utilisation of resources	Conservation of water and the utilisation of rainwater	Appropriate disposal of waste	Recycling waste	Administration costs	R&D costs: Operational costs	Personnel expenses	Materiality	Targeted amount of losses	Difficulty	Absolute weight (1)	Relative weight (2) %
Internal environm. loss (monetary conversion)	Losses caused by inefficient use of resources	SOx levy (materials containing sulfer)	308.0 Kyen	○ 0.7/2.1			● 1.05/2.1					△ 0.35/2.1			1	300 Kyen	3	3	2.1
		Value of industrial waste (original estimation)	374.8 Myen					○ 3.9/17.6				○ 3.9/17.6	○ 3.9/17.6	● 5.9/17.6	5	337 Myen	5	25	17.6
		Energy	129.4 Myen	○ 1.5/11.3			● 2.3/11.3		○ 1.5/11.3		○ 1.5/11.3	○ 1.5/11.3	○ 1.5/11.3	○ 1.5/11.3	4	128 Myen	4	16	11.3
		Organic solvents	70.6 Myen	○ 1.9/14.1	△ 0.9/14.1		△ 0.9/14.1	○ 1.9/14.1			○ 1.9/14.1	○ 1.9/14.1	○ 1.9/14.1	● 2.8/14.1	4	64 Myen	5	20	14.1
		Water	3.6 Myen		○ 0.4/2.1	△ 0.2/2.1			● 0.6/2.1		○ 0.4/2.1	○ 0.4/2.1			1	3.6 Myen	3	3	2.1
External environm. loss (mass conversion)	METI's "Voluntary Plan"	Waste recycling rate	98.0%							○ 1.4/6.3	● 2.1/6.3	○ 1.4/6.3	△ 0.7/ 6.3	△ 0.7/6.3	3	100%	3	9	6.3
		Value of industrial waste ratio	9.5%					○ 2.7/17.6		○ 2.7/17.6	○ 2.7/17.6	○ 2.7/17.6	○ 2.7/17.6	● 4.1/17.6	5	8.4%	5	25	17.6
		Consumption of energy per product unit	843 (l/Myen)	○ 1.7/11.3			● 2.6/11.3				○ 1.7/11.3	○ 1.7/11.3	○ 1.7/11.3	○ 1.7/11.3	4	831 (l/Myen)	4	16	11.3
		Solvent emission ratio	7.8%	● 4.4/17.6	△ 1.5/17.6					○ 2.9/17.6	○ 2.9/17.6	○ 2.9/17.6	△ 1.5/17.6	△ 1.5/17.6	5	4.5%	5	25	17.6
Green budget weight (4)				10.2	2.8	0.2	6.8	8.5	2.1	7.1	13.3	16.9	13.9	18.2		Total absolute weight		142	100

4.3 Estimations of Opportunity Losses

Since the main objective of GBMM is to measure accurate environmental conservation costs, the model does not attempt to make a budget for internal and external environmental losses. Of course, the matrix has cells where the amount or quantity and estimated volume of these losses can be entered, but this is only one of the factors that are needed in the estimation of environmental conservation costs. However, if these losses are estimated incorrectly, the usefulness of the environmental conservation cost information considered in the matrix will inevitably be reduced.

Consequently, an annoying problem occurring in the analysis stage of GBMM is the measurement of an opportunity loss, such as a decrease in sales arising from a suspension of operations due to the occurrence of environmental problems or an accident, or from a loss of corporate brand/ prestige. They also refer to future costs/liabilities of current environmental impacts, so it is still difficult to estimate opportunity losses in precise terms. Nitto Denko has therefore not yet attempted to evaluate them, although it perceives them potentially to be elements of internal environmental losses.

In contrast, Toshiba, which is another typical Japanese company which is implementing GBMM, evaluates in monetary units as "risk prevention benefits" the avoidance of future opportunity losses for present capital investments and environmental conservation activities. Toshiba also estimates customer benefits which refer to the reduction of environmental impacts of products throughout their life-cycles. These benefits are depicted as "economic benefits for environment" in Toshiba's GBMM. The company's matrix has three major categories of columns: "economic benefits for environment", "internal" and "external environmental losses".

Notes for Table 16-3:

(1) Absolute weight: multiplying the materiality and difficulties for each item.

(2) Relative weight: sum all items, and then calculate the environmental weight of losses that can be calculated to make the volume of each item re-converting to a percentage.

(3) Environmental conservation costs: the grade could be assigned numerical values, such as "●" (5 points), "○" (3 points), and "Δ" (1 point), and then allocate the weight of the environmental losses to each cell by each row in the work sheet proportionally. These costs include depreciation, but exclude investment.

(4) Environmental budget weight: the numerical values of each cell are aggregated for each item of the environmental conservation costs.

5. CONCLUSIONS

Several Japanese companies have focused exclusively on the external reporting aspect of environmental accounting and have calculated only the environmental costs of conforming to the MoE guidelines, and do not consider any future action plan and budget concerning their environment management in the next fiscal year.

Although environmental accounting intends to show the results of the company's EMS, an EMS cannot be expected to be successful without having an action-plan which provides a map for driving activities and a budget which guarantees to put the plan into effect. The lack of these budgets is evidence that the EMS of Japanese companies do not work well. In the case examined, the Green-Budget Matrix was found to be a most useful instrument for supporting managers in this context.

GBMM is a tool designed to help managers identify the sort of activities that drive excellent environmental performance through the effective allocation of economic resources. It also provides useful information for analysing the status quo, foreseeing the future of the EMS, and promoting a mutual shared recognition between members of the organization of their mission through the matrix preparation process.

GBMM can also contribute to other objectives. Budgeting is mainly a short-term future-orientated activity whereas environmental planning requires more long-term orientated decisions. By applying GBMM to capital budgeting, it can be used as a strong support tool for decision-making for long-term environmental capital investments. In fact, Toyo Seikan has adopted the matrix and uses it for capital budgeting.

GBMM has also become a driving force towards the Sustainability Balanced Scorecard (SBSC). The identification of business relevance of different environmental issues is a core goal of the SBSC (Figge et al. 2003). GBMM evaluates the relevance on its own logic, and helps to identify the initiatives or actions for realizing the goals, especially in the case of integration with capital budgeting.

The practical way of implementing SBSC, however, has not yet really been settled. It is necessary to have further discussion on this issue and to verify how GBMM supports SBSC.

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