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ENVIRONMENTAL COST ACCOUNTING FOR CAPITAL BUDGETING:

A BENCHMARK SURVEY OF MANAGEMENT ACCOUNTANTS

Prepared for:

Pollution Prevention Division
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Any errors in analysis and interpretation of data remain the sole responsibility of the authors.

EXECUTIVE SUMMARY

nvironmental cost accounting --- the identification, compilation, analysis, use, and reporting of environmental cost information -- has emerged as one of the foremost items on the agenda of business in the 1990s. The reasons for this phenomenon are many and varied, and originate both within and outside the firm.

For internal decision-making, environmental costs impinge upon many facets of business operations. For legal staff, meeting the Securities and Exchange Commission (SEC) requirements for disclosure of environmental liabilities (most notably remediation costs) demands regular and systematic appraisal of the anticipated costs "reasonably likely to have a material effect" on the financial condition of the firm. For the accounting staff, compliance with Financial Accounting Standard (FAS) No. 5 on contingency costs creates the same need for tracking and reporting environmental liabilities that affect the balance sheet of the firm. And for financial staff responsible for monitoring and maximizing the value of the firm, disclosure of any kind of environmental information -- pollution levels or their cost repercussions -- may influence the stock market's perception of the firm's value.

Though the formal requirements of the SEC and Financial Accounting Standards Board (FASB) have attracted much attention, they are by no means the only reason for firms to put in place workable environmental costing systems. For product managers, properly inventoried and allocated environmental costs may make the difference between a profitable and unprofitable product line. For the environmental or production engineer, a rigorous accounting of environmental compliance costs is integral to identifying and prioritizing process improvements. For the plant manager facing an increasingly competitive domestic and global marketplace of products with low profit margins, effective control of environmental costs may be critical to ensuring long-term viability. And, at the highest management level, the chief executive committed to continuous improvement should have a working knowledge of environmental costs to benchmark a firm's performance against its competitors and industry as a whole.

On the external front, pressures are mounting to encourage or require tracking and disclosure of various types of environmental costs. The debate over how to improve national income accounts to account for use and depletion of natural assets has spilled into the corporate arena in the form of pronouncements on "full-cost accounting" (FCA). Though definitions vary, the vision is common -- creating accounting systems that will allow both firms and their stakeholders (investors, customers, environmental organizations, host communities) a clear perspective on the total environmental effects of a company or facility. The emergence of life-cycle analysis, including its monetary component life-cycle costing (or "impact valuation"), is a reflection of this movement toward greater public accountability of the environmental consequences of product manufacture, use, and disposal. Though few firms have yet to take steps in the direction of reporting such cost information, pressures to do so will continue to grow as part of the broader movement toward higher standards for corporate environmental management systems, public accountability, and accounting.

PURPOSE AND SCOPE

The purpose of this study is to benchmark current corporate environmental cost accounting practices as they are applied to the capital budgeting decisions in U.S. manufacturing firms. It seeks to provide business managers and government agencies with an understanding of how firms are integrating environmental cost considerations into decisions about environmental investments. Such an understanding can assist firms in comparing their practices with industry averages and in prioritizing improvements. For government agencies, a profile of environmental accounting in relation to environmental investments can help target technical assistance and policy initiatives as well pinpoint those areas of cost accounting where innovation is most visible or, alternatively, most lagging.

In this study, “environmental investments” is broadly defined, encompassing any capital project -- compliance or non-compliance -- that has as a major (though not necessarily exclusive) objective, the control, reduction, or prevention of pollution. Though all types of investments and other business decisions certainly stand to benefit from improved environmental accounting, a focus on *environmental investments* offers the most accessible "window" into current corporate practices. This is the case because most corporate environmental accounting innovations thus far have been linked to, and driven by, decisions surrounding environmental projects. Thus, the study findings are confined to one application of environmental cost accounting as an internal decision support tool. The costs of interest are all those which are "internal" (versus external or social) in nature, that is, costs that are material to the firm's decisions about if, when, and how much of its capital resources ought to be allocated to specific environmental investments.

RESPONDENTS

The survey targeted corporate management accountants in U.S. industrial firms based on the judgment that the accounting function in business, if properly informed and mobilized, can play a key role in advancing environmental accounting practices in business organizations. This is not to say that management accountants currently play such a catalyst role. Indeed, to date, environmental staff probably have been the prime movers in rethinking how accounting systems can better serve the firms' long-range environmental management objectives. At the same time, the accounting profession remains dominated by financial accountants whose responsibility is largely information-gathering to support *external* reporting to shareholders and regulators. Advances in the management accounting community have occurred, but progress has been slower in revamping cost accounting systems to provide relevant information to modern business decision-making. Nonetheless, besides being an excellent source of benchmarking information for the business and government audiences, the opportunity is at hand to activate the management accountant profession in support of improved environmental accounting.

The survey sample was selected from a list of approximately 5,000 members of the Institute of Management Accountants (IMA) using two criteria: (1) employment in the manufacturing sector (SICs 20-39) and (2) self-identification as responsible for planning and budget or cost functions within their respective firms.

Of the estimated 787 eligible respondents, we received 149 completed questionnaires, a response rate of 19%. Though the survey sample was randomly drawn, respondents were decidedly weighted toward larger firms. Forty-two percent have 5000 employees or more

worldwide, whereas only 8% have fewer than 200 employees. Moreover, 49% report annual worldwide sales of over $500 million and only 3% report sales under $10 million.

CAPITAL BUDGETING PROCESS

How do firms structure and manage their capital budgeting processes, specifically with respect to environmental projects? Are such projects given special treatment in the form of earmarked funds or budget caps? What business functions regularly participate in the capital budgeting process? Major findings from the survey indicate that:

- The single most common structure, reported by 30% of all respondents, is budgeting at three business levels -- plant, division, and corporate. Corporate only, division only, and plant only represented 17%, 16%, and 16%, respectively.

- Discretionary spending for capital projects is a feature often associated with firms with multiple plants. In total, 72% of respondents report some level of discretionary spending allowed at individual facilities, ranging from $5000-$100,000.

- The vast majority of respondents (86%) report a single capital funding pool for all capital projects, environmental or otherwise.

- Product/operations, environmental, and finance/accounting personnel are the most routine contributors to costing environmental projects, followed by consultants and purchasing staff.

TRACKING COSTS

Moving from questions of capital budgeting in general to the question of environmental costing practices:

- 71% of respondents reported that their company tracks some environmental costs on a company-wide basis.

- Among those who track environmental costs on a company-wide basis, 64% reported tracking at plant level, 63% at the corporate level, and 44% at the divisional level. These figures reflect multiple responses (i.e., tracking may be occurring at more than one level within the firm).

THE COST INVENTORY: HOW WIDE IS THE NET?

What internal costs are included in environmental project financial evaluation? And to what extent are such costs quantified in the project justification process, as opposed to handled in qualitative fashion only?

- Environmental costs most often considered in project financial evaluation are those that are the most tangible and quantifiable, for example: on-site air/wastewater/ hazardous waste testing/monitoring, on-site wastewater pretreatment/treatment/ disposal, on-site hazardous waste pre-treatment/treatment/disposal, off-site hazardous waste transport, and waste manifesting are considered by more than 60% of the respondents.

- Environmental costs least frequently considered in project financial evaluation include: environmental fines and penalties, corporate image, insurance costs, personal injury claims, marketable by-products, natural resources damage costs, legal staff time, and sales of environmentally friendly/green products. Based on earlier studies, these are also the costs generally perceived as less tangible, contingent, and difficult to quantify.

ARE ENVIRONMENTAL COSTS QUANTIFIED?

To what extent, then, are "considered" costs also quantified? Among those costs normally considered in project financial evaluation, which are assigned a "specific dollar value" for costs or savings?

- In general, firms who consider a specific cost item are inclined to take the next step and quantify such costs. For example, while only 55% report considering insurance costs, 84% of those respondents quantify these costs. This pattern generally holds true across all cost items.

- For two-thirds of all environmental costs, 70% of firms who report they consider such costs also quantify them during project financial evaluation.

SUPERFUND LIABILITY: MAJOR OR MINOR PLAYER?

Among all environmental costs on the minds of corporate managers, one deserves special attention -- Superfund liability. We asked respondents if and how Superfund liability affects various aspects of internal management decision-making in the area of capital budgeting.

- Among all respondents, only 32% indicated they consider Superfund in capital environmental project evaluation.

- Among those who do consider Superfund, 33% assign a specific dollar value, 23% do not, and 44% combine qualitative and quantitative evaluation methods. This

suggests that somewhere between only 7-14% of all respondents regularly quantify Superfund liability during project financial evaluation.

- If liability is considered in any form, it generally appears after financial evaluation is complete and a project is brought to upper management for final review and approval.

- For the few firms who consider a project's effect on hazardous waste ("Superfund") liability in preparing an appropriations request for an environmental project, 74% use an assessment method developed internally.

- By a substantial margin, the most frequently cited hurdle (58%) to quantifying liability is difficulty in estimating *if* liability costs will occur. Following this is the difficulty in estimating the *magnitude* of costs (45%) and *when* liability will occur (29%).

- Contrary to conventional wisdom that legal concerns play a key role in excluding liability from investment decisions, remarkably few identified "If I quantify, I may be subject to toxic torts" (5%) and "If I quantify, I have to disclose to the SEC" (3%) as barriers to quantifying liability.

- A total of 61% of survey respondents indicated that Superfund liability was either very important (27%) or somewhat important (34%) in determining priorities for environmental projects, suggesting that the general appreciation of liability avoidance well exceeds concrete steps to quantify it.

COST ALLOCATION

When firms incur environmental costs, not all processes and products are equally responsible for cost generation. Even in modest-sized manufacturing firms with two or three production lines, the costs of licensing, monitoring, waste storage, emissions controls, environmental staff time, off-site disposal, insurance, future regulatory compliance, and even liability are not driven equally by each production line. Some process lines may be more hazardous materials-intensive, generate more emissions per unit output, require more frequent and intensive inspection and monitoring, and generate greater quantities of waste requiring off-site disposal. Similarly, particular processes, or products, may cause a disproportionate share of costs associated with training and reporting to government agencies, or give rise to risks that may result in higher insurance costs or risks of future personal or property damages. In short, when it comes to environmental costs, not all processes and products are created equal.

To obtain a glimpse of current practices, we asked respondents to describe their current practices in cost allocation across a range of 17 environmental costs. For each cost item, respondents were asked to check whether the initial cost assignment was: always to overhead, usually to overhead, usually to product/process, or always to product/process.

- For every cost item, "always to overhead" is the most frequent response. Virtually all costs fall in the 55-75% response range; that is, well over half of respondents report initially assigning environmental costs always to overhead accounts.

- Costs most often initially assigned to overhead -- from licensing/permitting to insurance costs -- are those most typically associated with central staff functions or plant-, division-, or corporate-wide overhead costs, e.g., legal, environmental, and training staff activities.

- The pattern of diminishing frequency from overhead to product/process assignment holds steadily for all entries, regardless of how tangible costs are.

- 58% of those who initially assign costs to an overhead account later reallocate to a product or process. This translates into about 44% of all survey respondents.

- Labor hours (55%) and production volume (53%) are by far the most common bases for allocating overhead costs back to products/processes, followed by materials use (27%) and square footage of facility space (24%).

- Financial/accounting systems data, mentioned by 51% of respondents, is the most frequent source of environmental cost information. This is followed by purchasing, production/operation logs, engineering estimates, and materials tracking information.

FINANCIAL INDICATORS: THE BOTTOM LINE

Improving the cost inventory and cost allocation methods are major steps toward greater balance and rigor in evaluating environmental projects. Two other variables that can play a decisive role in determining whether projects survive the intense competition for scarce capital resources are the choice of project financial indicators and the related issue of analysis time horizons.

In addition to their less tangible and contingent nature, many environmental costs and savings materialize only in the mid- and long-term. In contrast to costs of activities such as on-site air and hazardous waste testing, monitoring, handling, and manifesting, other costs (or savings/revenues) linked to corporate image, liability, and green product sales are by nature those with longer-term time horizons. In the case of future compliance costs, the very term implies costs that will materialize only some years into the future. Thus, if any of these costs form part of the cost/benefit calculation of a proposed environmental project, an analytical method that is insensitive to mid- and long-term cost and revenue streams will be incapable of capturing the long-term profitability of the proposed project. Pollution prevention projects are especially vulnerable to this shortcoming. This is the case because many rely on product redesign, process modification, and materials substitution that may be capital intensive but yield attractive returns beginning 3-5 years after the initial capital outlay.

- 74% of respondents indicated they perform "a less detailed/informal screening" of environmental projects prior to a detailed financial analysis.

- For those firms that perform informal screenings, Return on Investment (ROI) (25%) and Payback (25%) are the most commonly used financial indicators. Eleven percent of respondents report use of qualitative methods.

- For full project justification, ROI at 24% is the leading quantitative indicator, followed by Internal Rate of Return (IRR) at 18%. However, for 27% of respondents, the single most frequent response to this question, is that their "evaluation is qualitative only." This strikingly high figure may be explained by the tendency of some respondents to interpret environmental projects as compliance-driven or "must-do," thereby not warranting the resources to develop a full financial evaluation.

- Among all respondents, 56% indicate no "standard hurdle rate, or threshold" is required before approving an environmental project. Moreover, 57% report equal hurdle rates for environmental and non-environmental projects, 36% report that hurdle rates are lower for environmental investments.

- Among those respondents who use Payback at any stage of project justification, 1-2 years is by far the most common (50%) hurdle rate required for project approval. For IRR users (48% of respondents), hurdle rates reported are 10-19%, followed by 20-30% (25% of respondents) and greater than 30% (18% of respondents).

CONCLUSIONS

Among the many internal business functions served by rigorous, disaggregated environmental cost information, capital budgeting for environmental projects is one of the principal beneficiaries. Accounting systems to identify, compile, analyze, and report environmental cost information in a timely and rigorous fashion are a prerequisite to understanding the sources and magnitude of environmental costs in the firm. Only if these costs are understood can managers maintain a clear picture of the true costs of current production processes and products. This, in turn, allows managers to direct attention to opportunities to minimize compliance costs, reduce operating costs, and fully mesh the environmental and financial performance goals of the organization.

Concerning the key issues of environmental cost inventory and cost allocation methods, the survey suggests that much work remains before business practices provide managers with a comprehensive and transparent look at "true" costs of processes and products. While most firms quantify the more obvious and measurable environmental costs, substantially fewer have grappled with those that are less tangible, uncertain, and difficult to quantify. Estimates of environmental costs in the range of 3%-20% of facility operational or product line costs as reported by some companies may, after a closer look, be substantially understated.

Dealing systematically with these types of costs is not new to corporations. In the normal course of business, managers regularly look into the future to forecast everything from the price of oil to consumer demand for a new line of computers. Applying these approaches, including those drawn from risk analysis, to estimate less tangible costs would represent a major step toward characterizing current and future environmental costs.

Cost allocation, too, remains a major challenge. Most firms continue to place most environmental costs initially into overhead accounts. Though some subsequently allocate these costs to products or processes, the basis upon which these allocations are made are often ill-conceived, that is, they bear little or no relationship to the activities which are responsible for their creation. When proper allocation does not occur, managers receive distorted signals regarding the true costs and benefits of retaining or changing processes and products. Moreover, like incomplete cost inventories, misallocation of environmental costs stands in the way of effective performance monitoring, product pricing, incentives and rewards systems, and other activities essential to maintaining a competitive enterprise.

Upgrading the capital budgeting system through improved environmental accounting systems is best viewed in the broader context of strategic planning. With multiple forces working to fuse environmental and financial objectives of the firm, it is critical to exercise an even hand in evaluating the returns to all capital investments, environmental or otherwise. When cost inventory and cost allocation practices fail to provide a level playing field for all investments, managers are left without the information they need to make optimal use of limited resources. In particular, those environmental projects with strong pollution prevention content, as well as those with side benefits unrelated to environmental improvement per se -- e.g., process optimization and yield, market penetration, corporate image -- are particularly vulnerable to the adverse effects of incomplete cost information.

While many social benefits may result from improved internal environmental accounting, the case for such improvements may be made purely on the basis of the firm's self-interest. This is the central message that public policymakers, professional associations, trade associations and stakeholders should deliver to firms seeking to understand and apply environmental accounting techniques to their capital budgeting processes.

INTRODUCTION

Environmental cost accounting --- the identification, compilation, analysis, use, and reporting of environmental cost information -- has emerged as one of the foremost items on the agenda of business in the 1990s. The reasons for this phenomenon are many and varied, and originate both within and outside the firm.

For internal decision-making, environmental costs impinge upon many facets of business operations. For legal staff, meeting the Securities and Exchange Commission (SEC) requirements for disclosure of environmental liabilities (most notably remediation costs) demands regular and systematic appraisal of the anticipated costs "reasonably likely to have a material effect" on the financial condition of the firm (Edwards 1992). For the accounting staff, compliance with Financial Accounting Standard (FAS) No. 5 on contingency costs creates the same need for tracking and reporting environmental liabilities that affect the balance sheet of the firm. And for financial staff responsible for monitoring and maximizing the value of the firm, disclosure of any kind of environmental information -- pollution levels or their cost repercussions -- may influence the stock market's perception of the firm's value (Freedman 1993).

Though the formal requirements of the SEC and Financial Accounting Standards Board (FASB) have attracted much attention, they are by no means the only reason for firms to put in place workable environmental costing systems (Ditz, Ranganathan and Banks 1995; Todd 1994). For product managers, properly inventoried and allocated environmental costs may make the difference between a profitable and unprofitable product line. For the environmental or production engineer, a rigorous accounting of environmental compliance costs is integral to identifying and prioritizing process improvements. For the plant manager facing an increasingly competitive domestic and global marketplace of products with low profit margins, effective control of environmental costs may be critical to ensuring long-term viability. For the personnel officer seeking to create fair and effective employee incentive and reward programs, environmental costs may be a key ingredient in measuring staff performance. And, at the highest management level, the chief executive committed to continuous improvement should have a working knowledge of environmental costs to benchmark a firm's performance against its competitors and industry as a whole.

On the external front, pressures are mounting to encourage or require tracking and disclosure of various types of environmental costs. The debate over how to modify national income accounts to incorporate the use and depletion of natural assets (Repetto 1989) has spilled into the corporate arena in the form of pronouncements about "full-cost accounting" (FCA) (Popoff and Buzzelli 1993). Though definitions vary, the vision is common -- creating accounting systems that will allow both firms and their stakeholders (investors, customers, environmental organizations, host communities) a clear perspective on the total environmental effects of a company or facility. The emergence of life-cycle analysis, including its monetary component, life-cycle costing (or "impact valuation"), is a reflection of this movement toward greater public accountability of the environmental consequences of product manufacture, use, and disposal.

Though few firms have yet to take steps in the direction of reporting such cost information, pressures to do so will continue to grow as part of the broader movement toward higher standards for corporate environmental management systems, public accountability (Cascio 1994), and accounting (Gray 1993, Rubenstein 1994).

This study is an effort to better understand current practices in one of the many dimensions of environmental cost accounting -- the use of environmental costs in the capital budgeting practices of U.S. firms. Our focus is on benchmarking the way U.S. firms identify, allocate, and analyze environmental costs in the context of evaluating the profitability of potential environmental investments. By environmental investments, we mean any capital project -- compliance or non-compliance -- that has as a major objective the control, reduction, or prevention of pollution. Thus, our analysis is confined to one aspect of environmental accounting as an *internal* decision support tool, where costs are limited to those germane to the business functions discussed earlier. This distinction between internal and external (or societal) cost domains is a critical one for preserving the clarity of our study's scope and implications (White, Savage, and Shapiro forthcoming).

Our study has a number of predecessors. Earlier investigations of corporate practices in accounting for liability provide a profile of how firms deal with SEC and FASB requirements to disclose future environmental liability costs (Price Waterhouse 1992). Specific questions focused on the estimation, accrual, recovery, discounting, and reporting of remediation costs known or anticipated by 523 U.S. companies.

A more recent informal survey of 26 Global Environmental Management Initiative (GEMI) conference attendees (23 representing Environmental, Health, and Safety (EHS) functions within their respective firms) provides a profile of several aspects of environmental cost accounting practices (Bristol-Myers Squibb 1994). This survey focused on topics such as methods and levels of tracking costs, financial analysis of projects, use of Total Cost Assessment (TCA) techniques (White, Becker, and Goldstein 1991), and management's motives and perceptions of the benefits of environmental cost accounting in general. Though limited to a small sample, some key findings of this survey are noteworthy:

- environmental costs are most often allocated to overhead accounts (versus to products or processes);
- compliance-related projects are approved without prior financial analysis; and
- management control, both capital and operating, is by far the most frequent reason for tracking environmental costs.

Promoting the use of environmental cost information in capital budgeting has been the subject of both federal and state voluntary and regulatory initiatives. EPA's Environmental Accounting Project, one component of its Design for the Environment (DfE) activities, has viewed capital budgeting as one of the key business activities through which improved environmental accounting practices can foster industrial pollution prevention (US EPA 1995). At

the state level, New Jersey, Maine, and Washington require firms to use some form of environmental accounting, or TCA, in evaluating pollution prevention investment options. Though each has its own language and requirements, all are aimed at guiding business toward enlarging the inventory of environmental costs and allocating such costs to processes and products rather than to pooled overhead accounts. Following this trend, business and non-governmental organizations such as GEMI (GEMI 1994) and the Coalition for Environmentally Responsible Economies (CERES 1995) have identified improved environmental accounting methods as integral to a firm achieving best practices in evaluating capital investments and establishing a sound materials management program.

As the recognition for improved environmental accounting gains momentum in business, accounting, and government circles, it is useful to step back and take a systematic look at the perceptions, accomplishments, and plans of various types and sizes of firms. Such benchmarking can provide valuable information to companies, trade associations, technical assistance providers, and policymakers to:

- evaluate where U.S. firms as a whole are in various aspects of environmental accounting applications in capital budgeting;

- compare current practices across firms of different types and product lines to identify leading and lagging sectors, and to help business and government assistance programs identify priorities;

- compare progress in different aspects of environmental accounting as applied to capital budgeting decisions (e.g. cost inventory, cost allocation methods) as input for future professional, federal, and state technical assistance initiatives; and

- assess if and how certain public policies (e.g. Superfund liability) promote or impede improved environmental accounting practices.

Thus, the purpose of this report is to inform both private and public sector initiatives aimed at solidifying the link between sound environmental accounting and sound capital budgeting for environmental projects. While improved environmental accounting benefits *all* types of investment decisions, environmental project analysis is likely to be especially enhanced by more rigorous accounting methods for reasons presented later in this report. Thus, the focus on environmental projects offers a convenient "window" on where firms are and where they are going in bringing environmental costs more systematically into their budgeting process.

THE MANAGEMENT ACCOUNTANT PERSPECTIVE

Many business functions contribute to the identification, tracking, analysis, use, and reporting of environmental cost information: the **purchasing staff** who procure waste disposal services; the **environmental manager** who oversees the design and operation of an on-site solvent recovery system; the **environmental manager** or **legal staff** who oversee monitoring, permitting, and other compliance activities; the **environmental engineer** who operates the on-site wastewater treatment plant; the **production engineer** who tracks raw material inputs and losses in a batch operation; and the **accountant** or **financial manager** who receives, organizes, and reports cost information to upper management.

Is there a single best source of environmental cost information and practices? Because environmental costs are so varied, diffuse, and often unrecognized, the answer is generally no, especially for mid- and large-sized companies. Assembling costs for a rigorous profitability evaluation of compliance and non-compliance projects may require inputs from environmental, legal, purchasing, operations, facilities management, financial, marketing and accounting staff. In fact, it is probably true that if fewer than three of these staff areas are involved in developing cost information, it is highly probable that some salient costs (or savings) have been omitted from the project evaluation. And the more a firm seeks to venture into the area of less tangible costs and savings --e.g., liability avoidance, future regulatory compliance, corporate image effects, expansion into "green" markets -- the wider the cost "net" must be cast to properly capture and quantify such costs.

For this project, we have chosen to survey corporate management accountants in U.S. industrial firms based on the judgment that the accounting function in business, if properly informed and mobilized, can play a key role in advancing environmental accounting practices in business organizations. This is not to say that management accountants currently play such a catalyst role. Indeed, to date, environmental staff probably have been the prime movers in rethinking how accounting systems can better serve the firms' long-range environmental management objectives. At the same time, the accounting profession remains dominated by financial accountants whose responsibility is largely information-gathering to support *external* reporting to shareholders and regulators (Gray 1993, Rubenstein 1994). Advances in the management accounting community have occurred, but progress has been slower in revamping cost accounting systems to provide relevant information to modern business decision-making (Johnson and Kaplan 1991). Nonetheless, the opportunity is at hand to activate the management accountant profession in support of improved environmental accounting (Epstein 1995). To take strides in that direction requires an understanding of the current knowledge base, practices, and perspectives of the profession and the companies it serves. In this spirit we have chosen management accountants as our targeted population.

RESEARCH DESIGN

The survey sample was selected from a list of approximately 5,000 members of the Institute of Management Accountants (IMA) using two criteria: (1) employment in the manufacturing sector (SICs 20-39) and (2) self-identification in IMA's membership form as responsible for planning and budget or cost functions within their respective firms. The IMA membership list provides the accountant's name, business, and business address (but no telephone number). We randomly selected 1,000 names from this list.

In early January of 1995, we sent an advance letter to potential respondents alerting them to the upcoming survey and explaining the purpose of the research (Appendix A). This letter identified EPA as the funding agency and IMA as the collaborator in the study. The full survey, together with a pre-stamped return envelope, was sent approximately two weeks later[1] (Appendix B).

Follow-up by postcard and telephone was conducted during February. A coding error resulted in the loss of identifying information for 200 members of the sample, preventing follow-up with this group. Reminder postcards were mailed to the other 800 potential respondents in mid-February. Telephone reminders began the following week. We contacted all those for whom we were able to obtain a working business phone number. Callers asked respondents to return the surveys within five business days. Respondents were contacted in person whenever possible, and voice messages were left when this was not possible. Each phone number where callers reported no answer was tried at least four times. Accountants whose surveys were returned as undeliverable by the post office were excluded from telephone follow-up. A summary of contacts with the survey sample is shown in Table 1.

Table 1. Contacts with Survey Sample

Type of Contact	n
Advance letter	1,000
Survey with pre-stamped return envelope	1,000
Post-card follow-up	800
Telephone follow-up	626

The IMA list included many entries that no longer represent an active accountant at the business identified in the list. Sixty surveys were returned as undeliverable, and 10 respondents informed us by mail or phone that they are not currently engaged in work relevant to the survey. Telephone follow-up identified additional problematic entries. Information about these entries is useful in interpreting the response rate for the survey, since it indicates that the survey reached far fewer than the original 1,000 eligible participants.

[1] Office of Management and Budget Approval # 2070 0138.

Because the IMA list did not include telephone numbers, our first task in conducting telephone follow-up was to identify a telephone number for each accountant's business. We found 567 phone numbers using *Phonedisc 95*, a CD-ROM business phone directory. In an attempt to locate numbers for businesses not included in the CD-ROM directory, we next called Directory Assistance for 160 members of the original sample list. An additional 59 phone numbers were identified by this method. Based on this rate of success (37%), we concluded that contacting Directory Assistance for the remaining 173 companies would not be cost-effective. Businesses with no phone listing include those that have terminated operations or moved outside the area served by their earlier telephone directory. Non-listed businesses also include accountants who work independently and those who do not have a business telephone number. For businesses that no longer exist or moved, the mailed survey may not have reached an eligible accountant. Among the businesses we did reach by telephone, follow-up calls revealed that 114 accountants in the sample list were no longer at the company identified in the IMA list. For these entries, the mailed survey did not reach an eligible accountant. Table 2 summarizes results of follow-up efforts.

Table 2. Follow-Up Results

Outcome	n
Survey returned by post office	60
Accountant reported he/she not engaged in relevant work	10
Accountant no longer at listed business	114
No business phone listed in CD-ROM/Directory Assistance	109

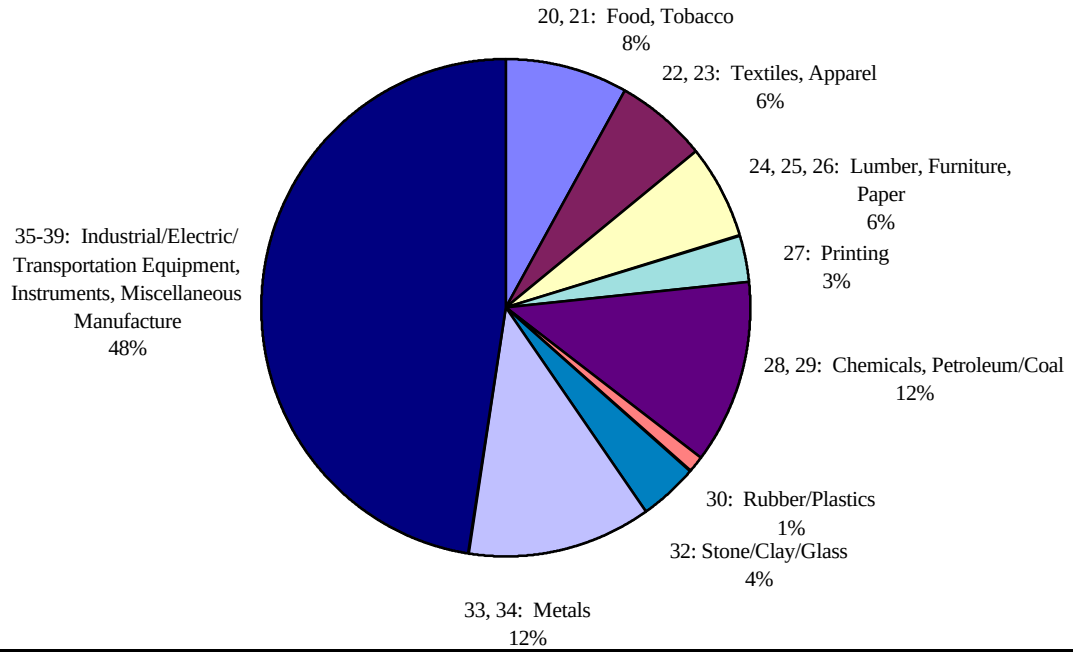
Based on follow-up results, we can estimate the number of surveys that eventually reached an eligible participant. A conservative estimate assumes that surveys reached a participant unless (1) they were returned by the post office or (2) telephone follow-up confirmed that the accountant was no longer at the IMA business address. Using this assumption, we estimate that the survey reached 816 eligible accountants. If we make the additional assumption that the percentage of accountants no longer at the listed business would be similar for the 200 businesses with whom we were unable to follow-up, we estimate that 787 surveys reached an eligible accountant. Both of these estimates overstate the number of surveys that reached an eligible accountant, since the substantial percentage of businesses for whom there is no business phone listing includes those that went out of business or moved some distance, so that the accountant listed by IMA is presumed no longer eligible for the survey.

We received 149 completed questionnaires. Thirty-three accountants declined to participate when contacted by telephone. "Too busy" was the most common reason for declining to participate. Using 787 as a reasonable, and perhaps high, estimate of the number of surveys that reached an eligible accountant, the survey achieved a response rate of 19%. This participation rate is similar to results for other mail surveys of professional groups.

RESPONDENT PROFILE

Figure 1 depicts the distribution of respondents by SIC code. Nearly half (48%) work for firms in one of four equipment manufacturing sectors plus miscellaneous manufacturers. We lumped these five SICs together to control the length of the questionnaire: industrial equipment, electric equipment, transportation equipment, instruments and miscellaneous manufacturing. The remainder are scattered across the other nine categories, with the heaviest representation in chemicals and petroleum/coal (12%) and metals (12%). Those least represented in the sample are printing (3%) and rubber/plastics (1%). The former is not surprising since printing firms, though large in number, are generally small establishments of 30 employees or less. These types of firms are unlikely to have a full-time accountant responsible for planning and budgeting or cost functions; our survey sample, on the other hand, focuses on such accountants.

Figure 1. Respondent's product line (by SIC code)



Respondents are located with almost equal frequency in corporate (32%), divisional (31%) and individual plants (31%) (Figure 2). Slightly less than two-thirds (61%) are registrants with the Securities and Exchange Commission (SEC). With respect to employees (Figure 3), somewhat under half (42%) have over 5000 employees worldwide, while only 8% have fewer than 200 employees. The remaining 50% are mid- to mid-large-size enterprises in the 200-999 range and 1000-5000 employee range.

Figure 2. Respondent's position at firm

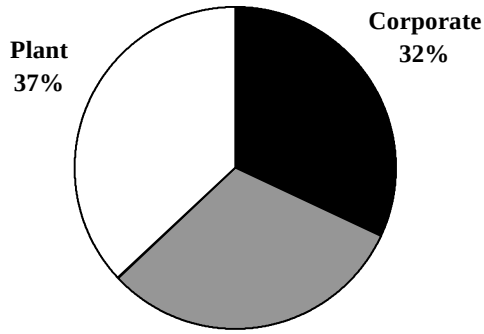
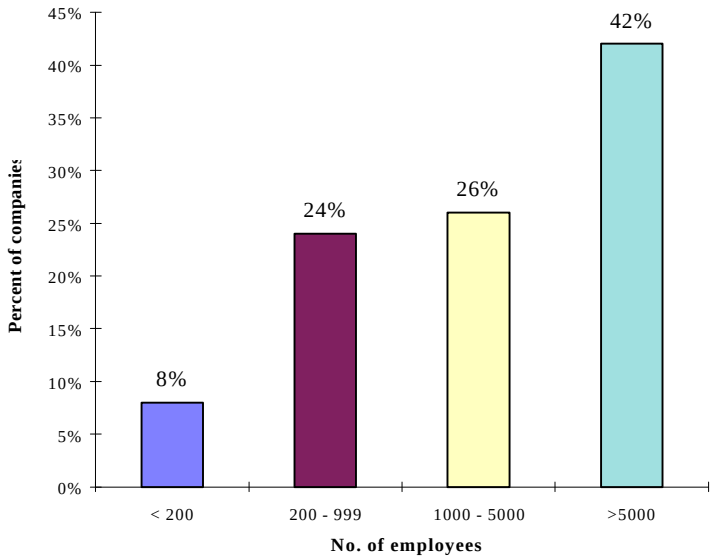
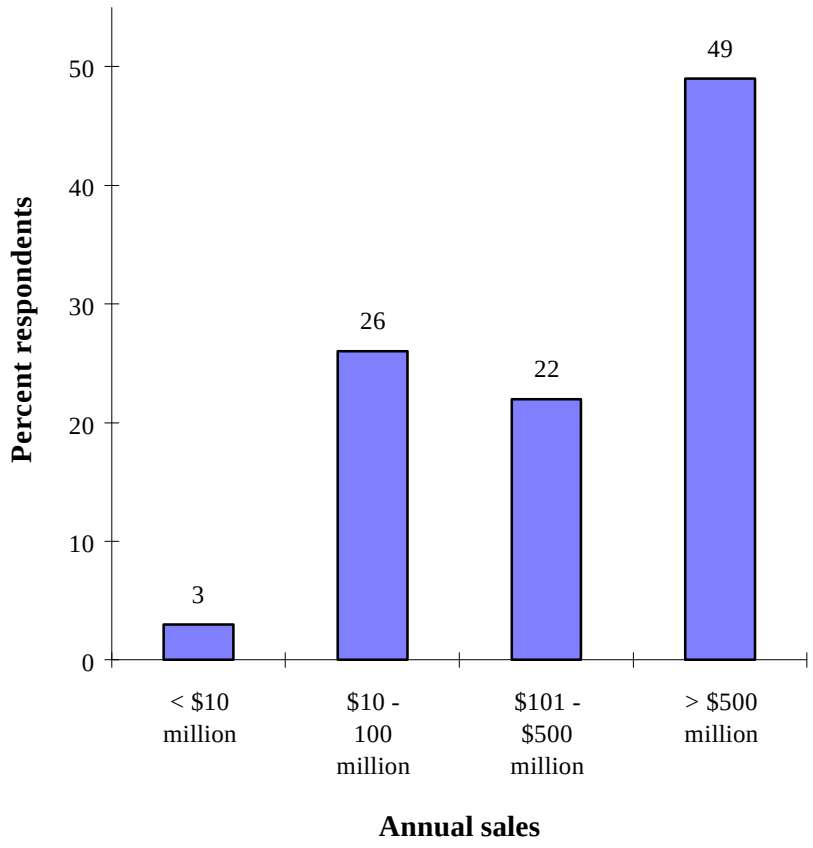


Figure 3. Number of employees worldwide



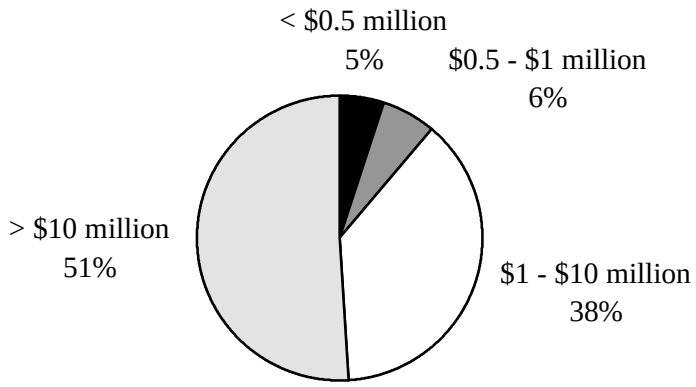
Annual sales volume approximately mirrors the employment profile of the respondents (Figure 4). Nearly half have annual worldwide sales greater than $500 million, while only 3% report sales of under $10 million. Using 200 employees and $10 million annual sales as a general rule for distinguishing small businesses from medium and larger enterprises, our sample is clearly weighted toward the latter. This, again, is expected given our criteria for inclusion in the sample. Professional management accountants with planning, budgeting, and cost responsibilities are likely to be affiliated with larger corporate organizations with routinized planning and budgeting cycles, multiple plants and divisions, and complex cost structures requiring dedicated accounting staff for management and oversight. And, of course, they also are likely to have the financial and human resources to devote to completion of a survey questionnaire in comparison to the greater resource constraints facing smaller firms.

Figure 4. Most recent annual sales



Finally, annual corporate capital budgets track the pattern of company size reflected in sales and employment levels (Figure 5). About half (51%) of the respondents report capital budgets greater than $10 million, 89% over $1 million, and only 5% less than $.5 million. The medium- and large-scale weighting of our sample is again evident.

Figure 5. Annual corporate budget

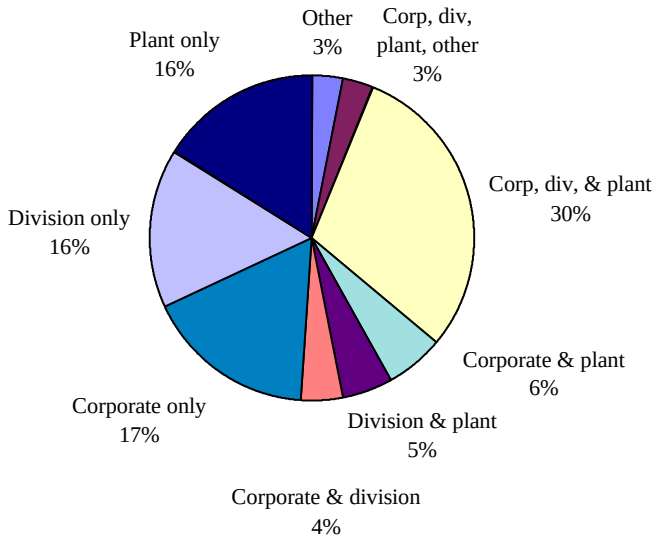


CAPITAL BUDGETING PROCESS

How do firms structure and manage their capital budgeting process, specifically with respect to environmental projects? Are such projects given special treatment in the form of earmarked funds or budget caps? What business functions regularly participate in the capital budgeting process?

A look at the data (Figure 6) reveals that the single most common combination of responses was budgeting at all three levels, a process described by 30% of all respondents. Corporate only, division only, and plant only represented 17%, 16%, and 16% respectively. Based on Tellus' experience working with firms during the last five years, the prevalence of this tiered-type structure is typical of medium- to large-size firms, wherein initial project identification and justification begins at the plant level, moves up to divisional or group review (unless a project is small enough to qualify for discretionary spending at the facility level), and finally is approved or rejected by corporate management. A number of respondents indicated some variation on the category names, e.g., "departmental," "operating unit," and "branch." Interestingly, only one respondent indicated budgeting by "product line." Among all respondents, virtually all (95%) budget on a regular as opposed to an ad hoc basis, a finding expected for a sample dominated by mid- to large-size manufacturers. Four of the five firms whose budgeting is ad hoc fall within the lower half of firm sizes ($p<.05$)[2] as measured by annual sales.

Figure 6. Level at which capital budgeting occurs

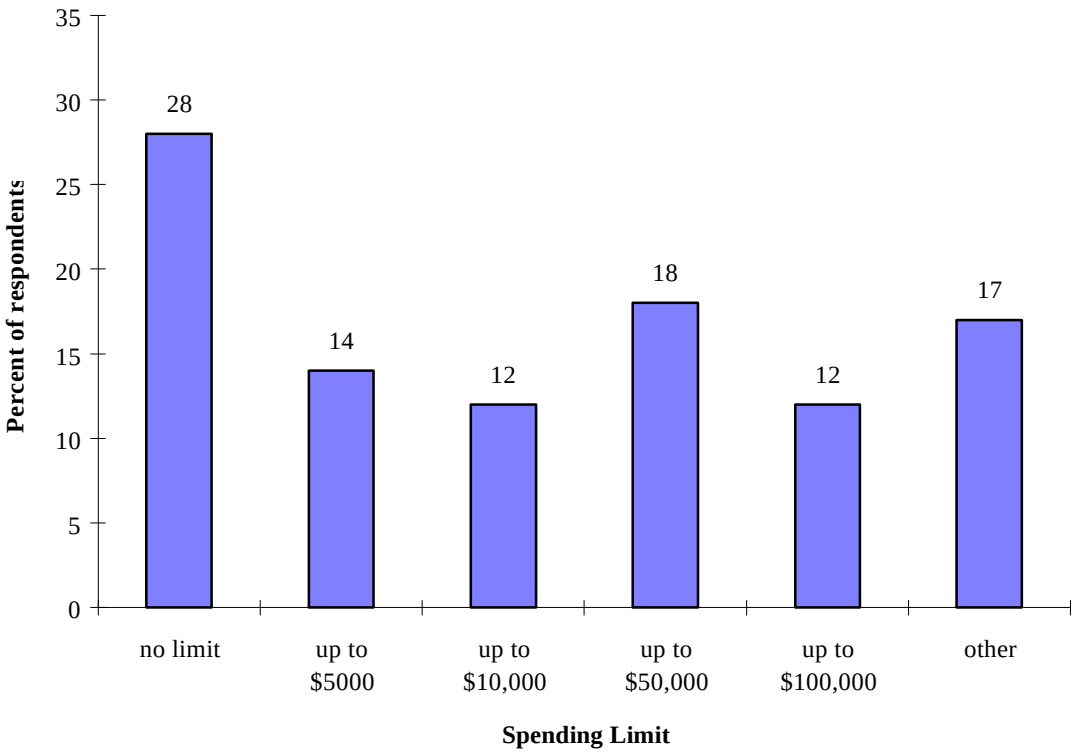


Discretionary spending for capital projects is a feature often associated with firms having multiple plants. In these instances, plant managers are allowed to spend up to a predetermined

[2] Pearson chi square test were used for all statistical analyses at $p < .05$.

fixed amount for projects without the formal justification process and divisional or corporate approval required for larger expenditures. When asked if such discretion exists, respondents indicated a wide range of such caps (Figure 7). At the low end, 28% indicated no discretionary spending whatsoever, or "no limit"; all expenditures, no matter how small, require upper management approval. After this no-limit category, respondents reported in roughly equal fractions (12%-18%) discretionary caps ranging from $5000 to over $100,000.[3] Thus, in total, 72% report some level of discretionary spending allowed in their firms. As in the case of budgeting cycle, and consistent with our expectations, it is the larger firms that give individual plants greater independence in undertaking capital projects with upper management approval ($p < .05$). For example, 80 percent of firms with annual sales under $10 million indicated no allowance for discretionary spending, whereas only 13% of firms with sales greater than $500 million reported such a procedure.

Figure 7. Limit on discretionary capital spending



Firms use a wide range of categories to classify projects as they enter the budget cycle, and category names may be critical (White, Becker, and Goldstein, 1991b). Those bearing an "environmental" tag may be viewed as inherently non-value adding. These projects are seen as

[3]One respondent reported that the discretionary cap depends on who is the highest ranking plant personnel. The figure ranges from $25,000 for a "Director" to $250,000 for an Assistant Vice President and $500,000 for a Vice President. Another respondent reported that the discretionary cap is variable and depends on plant size.

necessary but unprofitable uses of capital and, perhaps, are subject to a lower hurdle rate, if any. Alternatively, a project labeled "profit-adding" or "cost-saving" will be more welcome by management in the course of project justification. It is sometimes the case that a project with strong environmental content may be automatically labeled "environmental" and escape systematic financial analysis even though it may, in fact, yield a competitive rate of return if profitability analysis were performed.

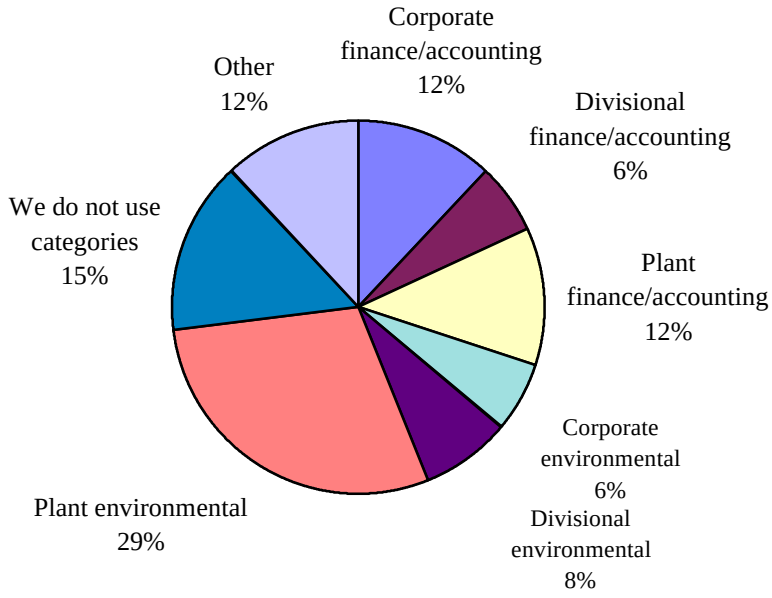
Given a list of 14 project categories, respondents were asked which are used to classify projects in their firms (Table 3). At the high end (60% or greater reporting the use of a category) are “cost-saving,” “environmental,” “replacement,” and “expansion.” Among other potential environmentally-related categories, about a third, 32%, use the term “compliance,” 25% use “waste treatment,” 20% use “pollution prevention,” and 17% use “waste reduction.” Thus, overall, “environmental” is by far the most common environmentally-related category, which may be interpreted as an indication that most firms lump environmental projects of all types into a single category. Insofar as this is the case, the tendency not to discriminate between different types of environmental projects may cloak important contributions of pollution prevention (P2) and waste reductions to non-environmental objectives such as overall yield enhancement and product quality, as well as profit-adding and cost-saving.

Table 3. Terms firms use to categorize capital projects

Term	Percent who use term
Cost saving	73
Environmental	67
Expansion of existing operations	64
Replacement	64
Maintenance	54
Expansion into new operations	50
Compliance	32
General/Administrative	27
Waste treatment	25
Pollution prevention	20
Profit adding	20
Waste reduction	17
Profit sustaining	13
Abandonment	3

Which business functions tend to assign environmental projects to individual categories? Among the eight choices available and allowing for one answer only (Figure 8), plant environmental staff most often make this critical determination (29%), followed by plant finance/accounting (12%) and corporate finance/accounting staff (12%). Among those who responded "other," a variety of staff functions were named: engineering, plant engineering, capital planning committee, division manager, consultants, product/process engineer, corporate manufacturing, and president. Another 15% report using "no categories." Thus, after eliminating "other" and "no categories," 55% of respondents indicate "plant environmental" and "plant finance/accounting" as those responsible for project classification. The pivotal role of these staff in project categorization should make the staff a prime target for initiatives -- originating either internal or external to the firm -- to upgrade and refine the project classification process to avoid

Figure 8. Who makes the initial decision to place an environmental project in a particular category?



the aforementioned pitfalls in financial analysis.

Are environmental projects, both compliance and non-compliance, accorded a separate capital budget pool or, alternatively, do they compete with other contending projects for capital resources? The vast majority of respondents (86%) report a single pool, whereas only 11% report a separate pool for environmental projects and 3% for compliance projects. This is a finding of substantial consequence for pollution prevention projects. It once again reinforces the

importance of rigorous cost analysis if P2 projects are to compete effectively, since special set-aside funds are the decided exception and intense competition the rule. Though 94% report annual environmental project expenditures have either "no set cap" or "vary from year to year," the general absence of earmarked funds implies an intense annual competition for capital resources.

In the course of environmental project justification, many staff functions may contribute to developing cost information for environmental projects (White, Becker, Goldstein 1991a and 1991b). These staff functions may include environmental, operations, accounting, financial, purchasing, and facilities management. As the cost net extends to encompass less tangible longer-term costs, savings, and revenues, other staff functions (e.g., legal and marketing) increasingly become important sources of information. In fact, there is a direct correlation between the rigor of cost analysis and the number of staff involved in identifying, compiling, and analyzing cost information. The more numerous and less tangible project costs are -- a characteristic typical of many P2 investments -- the more different staff functions are required to do the job right. For example, costs/savings associated with liability avoidance, future regulatory compliance, compliance with future international environmental management systems standards, and penetration of green product markets -- all may require input from staff not traditionally involved in the project justification process.

When given seven typical sources of cost information and allowed multiple responses, respondents most often cited product/operations, environmental, and finance/accounting staff as routine contributors to costing environmental projects (Table 4). Over a third indicated consultant (38%) and purchasing (36%) participation, followed by vendors (23%) and legal staff (20%). "Others" included a strong showing by engineering/plant engineering (13 respondents) plus an assortment of single mention of others, including: industrial engineering, facilities engineering, corporate engineering, and maintenance. The strong showing of environmental and production/operations is not surprising given the state-of-the-art of environmental project costing in general, which heavily emphasizes conventional company costs. As awareness of less tangible costs/savings increases, we are likely to see a more active role on the part of staff functions such as legal and marketing. Finally, the appearance of vendors and consultants, though not surprising, is a reminder that these parties should be included in any initiative aimed at strengthening the costing methods used by manufacturing firms in evaluating environmental projects.

Table 4. Who develops cost estimates for environmental projects?

Department	Routinely involved (%)
Production/Operations	65
Environmental	64
Finance/Accounting	64
Consultants	38
Purchasing	36
Vendors	23
Legal	20
Other	13

Trends in Capital Budgeting

Are capital budgeting practices in general changing in U.S. manufacturing firms? Are such practices following the rapid pace of change in business organizations, change spurred by such forces as merger and acquisition activity, new product development, and changing environmental regulations? Are efforts to achieve environmental improvements affecting the way firms manage their capital resources or, as some observers argue, are past practices and traditional shareholder value drivers intact despite pressures to become increasingly "green" (Walley and Whitehead 1994)?

When presented with eight potential changes to their firms' capital budgeting practices during the last three years, the common answer (60%) was "no change." Raising the discretionary cap on facility-level capital expenditures was a distant second at 17%, which may reflect primarily an inflation adjustment and not a real dollar increase. Four options explicitly related to environmental projects[4] were each mentioned by no more than 7% of respondents. Thus, a picture of essentially unchanging capital budgeting practices emerges, at least for the changes identified in the survey instrument. Of course, this does not preclude the possibility that firms are making changes unrelated to those that affect their handling of environmental projects. Notwithstanding this possibility, it appears that capital budgeting practices, at least for environmental projects, have remained relatively constant amidst downsizing, re-engineering, and other trends and styles that are reshaping American manufacturing industry (Klammer 1994).

[4] Whether the firm stopped or started classifying environmental projects separately from other capital projects, and whether the firm stopped or started distinguishing environmental compliance from non-compliance projects.

Tracking Environmental Costs

Moving from questions of capital budgeting in general to the question of environmental costing practices, our survey found 71% of respondents reporting that their company tracks environmental costs on a company-wide basis. This is a surprising finding. In work with many different firms during the last five years, Tellus Institute has found few instances -- certainly less than the majority reported in this survey -- of accounting systems designed to tag or segregate environmental costs on a routine basis. The survey finding may be attributable to one or a combination of four explanations:

- the respondents self-selected in favor of those management accountants whose firms are more apt to practice advanced environmental accounting methods;

- Tellus' earlier work (White, Becker and Goldstein 1991a; White, Savage and Dierks 1995), covering a diverse but small sample of firms, is not representative of company practices in general;

- "tracking environmental costs" may be defined more loosely by respondents than intended by the question, thereby leading to an increased number of positive responses; and

- "company-wide" may have been loosely defined by respondents.

The nature of the question allowed respondents to either choose an option ("no") that implied their company did not track environmental costs at all or choose "company-wide" ("yes"). In other words, "company-wide" was interpreted as "at all" or "at any level."

Figure 9 depicts the most common organizational level at which environmental costs are tracked. Among those who track environmental costs company-wide, slightly under two-thirds reported tracking at plant level and at the corporate level, and 44% at the divisional level. This probably reflects the absence of divisions in many of the respondents' firms, as well as factors related to the accounting structure. Figure 10 sheds further light on the tracking question. Here we see the most common structure among those who track environmental costs is participation of all three levels -- plant, division, and corporate -- followed closely by plant only and corporate only. This response, as in the earlier "do you track" question, may also reflect varying interpretations of "environmental costs." Those firms who report the involvement of all three levels probably have in place the most systematic and tiered procedure for compiling and reporting environmental costs originating at the plant level and moving up the corporate hierarchy. For those in almost equal numbers who report plant-only and corporate-only tracking, we suspect a less comprehensive and routinized tracking system. For example, plants may compile relatively straight-forward costs like waste handling and disposal, whereas corporate tracking may focus on Superfund liability.

Figure 9. Level at which environmental costs tracked (n=104, multiple answers accepted)

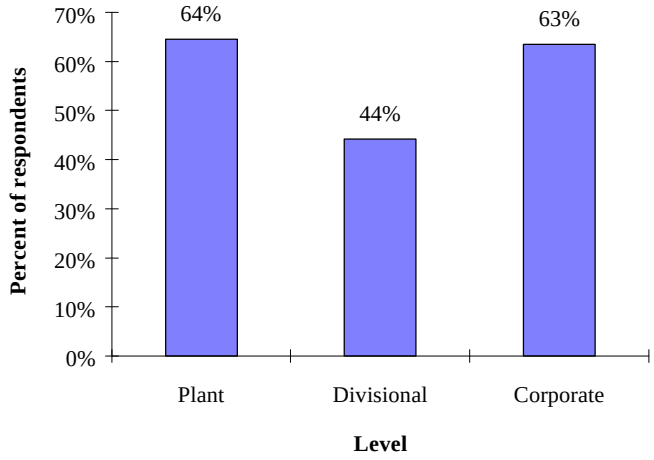
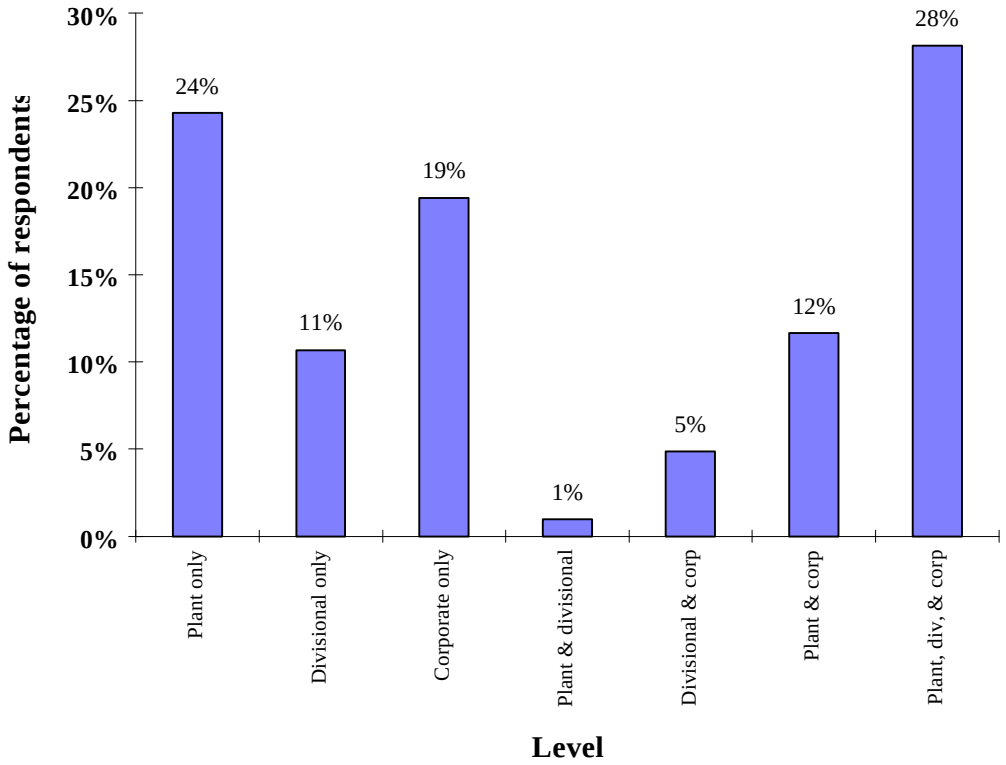


Figure 10. Level at which environmental costs tracked



THE COST INVENTORY

How Wide is the Net?

Definitions of environmental costs are subject to enormous variation (GEMI 1994, Fagg et al 1993). Figure 11 presents a three-part, "nested" scheme for distinguishing different types of costs (Shapiro, Savage, and White forthcoming). For most firms, current tracking practices encompass only Box A (conventional costs) including items such as:

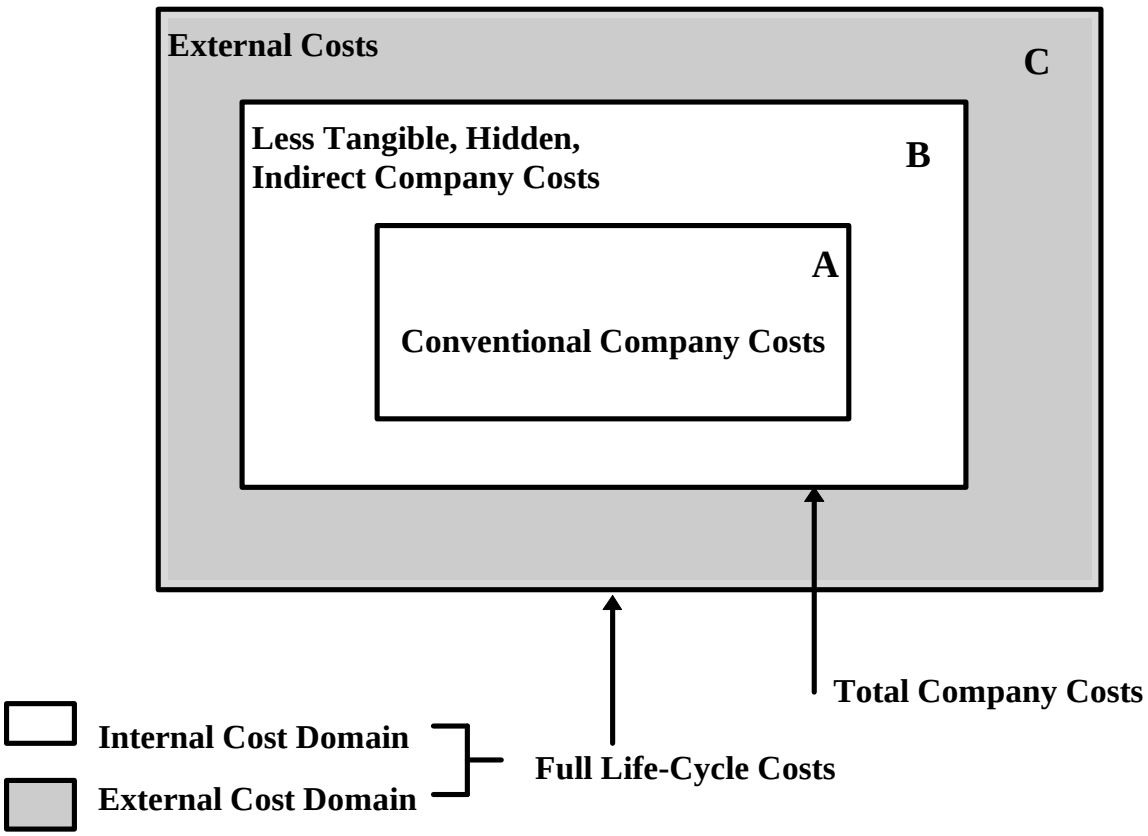
- off-site waste disposal,
- purchase and maintenance of air emissions control systems,
- utilities costs,
- and perhaps costs associated with permitting of air or wastewater discharges.

Beyond this conventional cost domain is Box B, encompassing a wide range of less-tangible costs (and savings and revenue streams) such as:

- liability,
- future regulatory compliance,
- enhanced position in "green" product markets,
- and the economic consequences of changes in corporate image linked to environmental performance.

Probably more than any other less-tangible cost, especially in relationship to SEC requirements and financial reporting in general, liability has been the subject of substantial discussion within and outside the accounting profession (Canadian Institute of Chartered Accountants 1993; Surma and Vondra 1992; Newell, Kreuze, and Newell 1990). Also included in Box B are changes in stock value linked to environmental performance, an elusive yet potentially significant less-tangible item of special interest for publicly traded firms (Cohen 1995). Together, Boxes A and B comprise the internal domain, the collection of costs for which firms are accountable (or otherwise experience) under current and foreseeable regulatory and market conditions.

Figure 11. Cost Boundaries



Box C comprises external costs, or "externalities" in the language of economics. These costs entail those for which the firm is not accountable or are not of material economic consequence to the firm under current and foreseeable regulatory and market conditions. Box C may include, for example, adverse health effects for air emissions that result even if such emissions are within compliance levels; damages to buildings or crops resulting from SO_2 emissions; and irreversible damage to ecosystems or species owing to mining or forestry activities. A few firms have taken the first step toward developing accounting systems that track and, in some instances, report the physical and economic magnitudes of these external costs (Boone 1995, Elkington 1991). Certainly the pronouncements of business leaders suggest that the future may see further corporate initiatives to track and report these costs as part of the general movement toward enlightened public accountability (Popoff and Buzzelli 1993; Andraca and McCready 1994).

With continuously evolving U.S. environmental regulations and public expectations and with emerging international environmental management systems standards, the boundaries depicted in Figure 11 are anything but static. Costs in Box C today may well be in Box B tomorrow. In the same vein, the less tangible nature of Box B costs such as liability and

corporate image will change as more rigorous measurement techniques are developed to quantify such costs. For now, however, putting in place systems to more effectively track Box A and Box B costs is the nearer-term, high-payoff challenge facing most firms.

Within this conceptual framework, what internal (Box A and Box B) costs are included in environmental project financial evaluation as reported by the management accountants in our sample? And to what extent are such costs quantified in the project justification process, as opposed to handled in qualitative fashion only?

The first of these questions, the inclusiveness of the cost inventory, is reported in Table 5. This table presents the percent of respondents who "normally" consider 28 different types of costs (or savings or revenues) in preparing financial justification for environmental projects. This cost inventory includes items ranging from the conventional, tangible, and measurable -- e.g., production efficiency/yield, energy, water, hazardous waste pre-treatment/treatment/disposal -- to those which, in the eyes of most corporations today, would be regarded as less conventional, less tangible, and less measurable (White, Becker, and Savage 1993).

Table 5. Costs normally considered in financial analysis

Cost Item	Percent who consider
On-site air/wastewater/hazardous waste testing/monitoring	79
Energy costs	78
On-site wastewater pre-treatment/treatment/disposal	77
Licensing/permitting	76
Water costs	74
Production efficiency/yield	74
On-site hazardous waste pre-treatment/treatment/disposal	71
On-site hazardous waste handling (storage, labelling)	70
On-site air emission controls	69
Employee safety/health compensation claims	69
Off-site hazardous waste transport	62
Manifesting for off-site hazardous waste transport	59
Staff training for environmental compliance	59
Future regulatory compliance costs	59
Environmental penalties/fines	57
Insurance costs	55
Corporate image effects	55
Personal injury claims	54
Reporting to government agencies	53
Frequency of plant shutdown	51
Off-site wastewater/haz. waste pre-treatment/treatment	50
Property damage	50
Environmental staff labor time	41
Air pollutant emission credits (SOx, NOx)	40
Marketable by-products	36
Natural resource damage	31
Legal staff labor time	28
Sales of environmentally friendly/green products	25

Note that this list is neither exhaustive of all cost items that ought to be considered in project justification, nor are the listed items pre-defined as "environmental." In fact, there is no single standardized list of "environmental costs" to which all firms adhere, nor is there likely to be one in the foreseeable future (Ditz, Ranganathan, and Banks 1995). Because environmental costs are simply those incurred in meeting the environmental objectives of the firm, and such objectives vary across firms and even within firms at different points in time, developing a standardized list is infeasible. Moreover, devoting substantial energy to defining what is and is not an

"environmental" cost diverts attention from the fundamental challenge: enlarging the cost inventory to ensure that all costs, environmental and non-environmental, are properly accounted for in the capital budgeting process. Toward this end, Table 5 is empirically-based, containing cost items which are (a) associated with environmental projects and (b) frequently, in Tellus' experience, wholly or partially absent in appropriation requests for capital funds. For this reason, many conventional cost items such as equipment, direct labor, and raw material inputs do not appear on our list.

Scanning Table 5 reveals, aside from a few surprises, an ordering of cost items one might expect given the state-of-the-art of environmental accounting. The highest percent responses are generally costs which are front-line (often on-site) waste management costs that motivate environmental project proposals in the first place: on-site air/wastewater/hazardous waste testing/monitoring, on-site wastewater pre-treatment/treatment/disposal, on-site hazardous waste pre-treatment/treatment/disposal, off-site hazardous waste transport, and waste manifesting. By and large, they fall within Box A of Figure 11. All are considered by 60+ percent of the respondents.

Also included in the upper half (over 59% or greater) of responses are energy and water costs. Though normally classified as standard utility costs, they nonetheless are subject to change insofar as environmental projects directly or indirectly alter the water and energy requirements of a new production process. In the same vein, production efficiency/yield, which is normally considered by about three-quarters of respondents, is usually not viewed as an environmental cost *per se*. Nonetheless, product yield, for example, in the chemical and petroleum industry is often a concurrent beneficiary of projects whose principle aim is emissions reductions through process modifications or simply housekeeping measures.

One unexpected finding is the appearance of future regulatory compliance costs in the upper half of Table 5. Though marginally falling into the upper half (59% report that it is normally considered), even this modest showing suggests that a significant number of firms increasingly are looking for ways to avoid future compliance costs in addition to controlling or eliminating current regulatory pressures. Such behavior -- reflecting a desire to get off the "regulatory treadmill" -- may portend a future of greater visibility for prevention-oriented projects in the capital budgeting process.

At the lower half of the response list (57% or less) are costs that most firms would view as less tangible, though by no means less significant, contributors to the future stream of costs and savings associated with environmental projects. In this category fall such costs as environmental fines and penalties, corporate image, insurance costs, personal injury claims at the higher end of the response ranking; and marketable by-products, natural resources damage costs, legal staff time, and sales of environmentally friendly/green products at the lower end of the response ranking. Not surprisingly, many of these costs are of a contingent, or probabilistic, nature. That is, whether and when they materialize, and what their costs to the firm will be, all are subject to substantial uncertainty. Nonetheless, acute events (e.g., fire, spill, or explosion) owing to the use or manufacture of hazardous materials do occur, and projects that reduce or eliminate the probability of such accidents are rightfully credited with an avoided cost. A recent example of the

financial benefits of such risk reduction is demonstrated in an accelerated corporate-wide phase-out of PCBs by a large manufacturer (White, Savage, and Dierks 1995). In this instance, a project which languished in the capital budgeting process was given new life and approved by upper management when the appropriations request incorporated explicit, quantitative, and monetized estimates of avoided risks of a PCB spill, fire, and plant shut-down. Still, the responses in Table 5 suggest that as a group, such contingent costs have yet to be routinely included into the capital budgeting process for at least 40%, and as much as 69% (in the case of natural resource damages) of the firms represented by the respondents.

Other less tangible costs also are subject to omission by many firms. Corporate image, undoubtedly one of the most difficult to measure among all less-tangible costs, is normally considered by 55% of respondents, a surprisingly high response (even if limited to a qualitative consideration) given the elusive nature of image effects. At 40%, air emission credits, a relatively new development spurred by the Clean Air Act Amendments of 1990, may simply be outside the realm of possibilities for a majority of the respondents. Sales of environmentally friendly/green products, at 25% the lowest response of all items, also may be applicable only to a small fraction of firms in the consumer product business. In contrast to primary or intermediate industries (e.g., petroleum, most chemicals, metals), consumer products manufacturers are more sensitive to attaining a "green" product image that may be enhanced through certain environmental investments.

Finally, insurance costs, reporting to government agencies, environmental staff labor time, and legal staff labor time are all cost items that traditionally fall within the centralized administrative functions of the firm. Their relatively high rate of omission from the capital budgeting process may be linked to the tendency to pool such costs in overhead categories (as we discuss in the next section), thereby disconnecting such costs from the processes and sources that generate them in the first place. Of course, for some environmental projects, managers may correctly view such costs as fixed - that is, invariant with respect to a proposed environmental project. Legal and environmental staff costs, for example, may not decline to any significant degree as a result of a proposed environmental project; most of their environmentally-related functions --litigation, reporting, manifesting -- will continue in essentially the same fashion as before the project is implemented. However, firms should be cautious of making these assumptions before such pooled costs are properly disaggregated. This will enable firms to clearly understand what exactly these costs are, what portion is fixed and what portion is variable and, finally, which costs are controllable and which are not (Ditz, Ranganathan, and Banks 1995).

Are Environmental Costs Quantified?

Considering environmental costs in the capital budgeting process is an important, but only a first, step in bringing rigor and comprehensiveness to the financial evaluation of environmental projects. Monetization of such costs -- estimating specific dollar values -- is the second and ultimate measure of how far firms are in realizing the full benefits of a complete cost inventory, one which encompasses both tangible and less tangible internal costs as depicted in Box A and

Box B of Figure 11. To what extent, then, are "considered" costs also quantified? Among those costs normally considered in project financial evaluation, which are assigned a "specific dollar value" for costs or savings? Table 6 reports responses to this question. Note that the percentages in Table 6 reflect responses provided by a *subset* of the total survey sample (i.e., those who answered "Yes" to the question of whether they consider a specific cost item at all in preparing environmental project financial evaluation).

Table 6. Cost items for which specific values are calculated among those who "consider" each cost

Cost Item	Percent who calculate
Water costs	94
Energy costs	92
Production efficiency/yield	89
Marketable by-products	89
Frequency of plant shutdown	87
On-site air/wastewater/hazardous waste testing/monitoring	84
Licensing/permitting	84
Insurance costs	84
On-site hazardous waste pre-treatment/treatment/disposal	82
On-site air emission controls	81
On-site wastewater pre-treatment/treatment/disposal	81
Environmental staff labor time	79
Legal staff labor time	78
Off-site hazardous waste transport	77
Off-site wastewater/haz. waste pre-treatment/treatment	76
On-site hazardous waste handling (storage, labelling)	75
Environmental penalties/fines	75
Sales of environmentally friendly/green products	73
Air pollutant emission credits (SOx, NOx)	72
Manifesting for off-site hazardous waste transport	71
Personal injury claims	64
Employee safety/health compensation claims	63
Property damage	60
Staff training for environmental compliance	59
Future regulatory compliance costs	56
Natural resource damage	55
Reporting to government agencies	53
Corporate image effects	26

Several findings in Table 6 are noteworthy. First, percentages are higher than in Table 5. This suggests that those who consider a particular cost item are inclined to take the next step and quantify such costs. For example, in the case of marketable by-products, only 36% consider the cost, but a full 89% of these respondents report quantifying this same item. Similarly, whereas only 55% report considering insurance costs, 84% of those quantify these costs. This pattern holds generally true across all cost items. The median value in Table 6 is 76.5%, well above the 58% in Table 5. Indeed, for more than two-thirds of all cost items in Table 6, greater than 70% of respondents who report considering such costs also quantify them. Moreover, for one-third of these costs, over 80% report quantification. One not surprising exception is the first item in Table 6, corporate image: 55% consider this cost while only 26% quantify it, less than half the percentage of the second least-quantified item (reporting to government agencies). Image value is among those less tangibles for which quantification techniques are essentially non-existent. Notwithstanding this exception, the overall message of Table 6 is clear -- more than conventional wisdom may suggest, many firms are finding ways to quantify costs, even costs usually regarded as less tangible and difficult to monetize. Further understanding of how this occurs, though outside the scope of this survey, is a valuable direction for future research.

Superfund Liability: Major or Minor Player?

Among all environmental costs on the minds of corporate managers, one deserves special attention: Superfund liability -- the cost of remediating contaminated sites, which faces companies who are identified under the law as "potentially responsible parties." With the strict, joint, and several liability standard of the Superfund law, firms that contributed wastes to any listed federal Superfund site may be responsible for a small or large fraction of the costs of remediation as a result of the negotiation process. How such costs are handled for purposes of SEC filings and for financial reporting in general has been the subject of voluminous discussion (CICA 1993; Crough, Cahan, and Leonard 1992; Edwards 1992; Newell, Kreuze, and Newell 1990; Price Waterhouse 1994).

In this survey, our interest in Superfund liability is of a different nature. In contrast to issues of financial accounting and external reporting, we queried respondents as to if and how Superfund liability affects various aspects of internal management decision-making in the area of capital budgeting. These questions are of interest for policy as well as benchmarking purposes. They are also of direct interest to EPA as the agency considers ongoing and future options for restructuring Superfund programs to serve the multiple objectives of expediting the remediation of hazardous sites, equitably sharing the cost of such remediation, and creating the incentives to avoid future waste disposal practices that threaten human health and the environment.

The survey intentionally used the phrase “hazardous waste (‘Superfund’) liability” instead of “Superfund” alone to help respondents quickly identify the kind of liability in which we were interested. However, for some in the business community, “Superfund” has evolved into a generic term to encompass a wide range of costs associated with mismanaging waste, e.g., administrative fines, penalties for corrective actions at waste sites imposed by states, and

violations of federal “RCRA” (waste transport and facility) regulations. Thus, while our survey sought to elicit corporate perspectives and practices specific to *Superfund* liability, the survey respondents may well have considered other waste-related liability as well in responding to questions.

It is reasonable to speculate that after more than a decade the threat of Superfund costs may be spurring environmental investments which eliminate the waste streams that eventually lead to Superfund clean-up costs for generating firms. Whether the threat is a strong or weak incentive (or no incentive at all) undoubtedly is firm-specific. Those firms involved as potentially responsible parties (PRPs) in multiple sites already may have taken action to avoid future liability burden. This may occur in the form of:

1. regular certification and monitoring of waste disposal vendors,
2. maintaining contractor-owned but dedicated disposal facilities,
3. gradually moving all waste treatment and disposal to on-site systems,
4. redesigning processes and materials that generate the hazardous waste stream in the first place.

In some instances, incremental waste volumes shipped to a site that already is Superfund-listed does not necessarily lead to incremental liability exposure under the strict, joint, and several liability standard of Superfund. Liability exposure will depend as much on which firms are PRPs and how "deep" their pockets are as it does on the volume and hazard of the wastes disposed by any individual firm. Recent initiatives to change Superfund’s strict, joint, and several liability standard may alter the way liability burdens are spread among PRPs (Sussman 1994).

Keeping these variables in mind, we asked respondents if they consider "a project's effect on hazardous waste (Superfund) liability in preparing an appropriations request for environmental projects." Among all respondents, only 32%, or slightly less than one-third, indicated they do consider Superfund. A "No" response to this question does not preclude the possibility that Superfund is acting as a driver to improved corporate environmental management practices overall, e.g., improved materials accounting, record-keeping, monitoring, and manifesting. Superfund liability may also affect the degree of scrutiny firms apply in selecting waste transport and disposal vendors, since mismanagement by vendors can result in penalties for the waste generator. Nonetheless, the low "Yes" response rate does suggest that Superfund liability, in comparison to other items in the firms' cost inventory, has yet to enter the capital budgeting decisions of most firms surveyed.

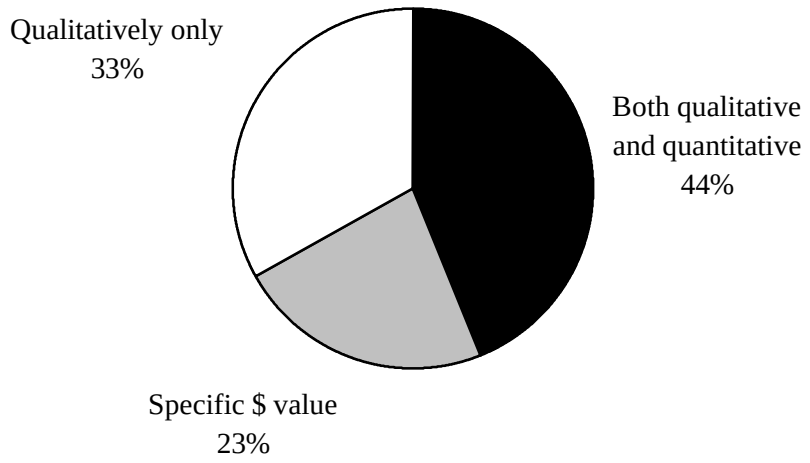
Because liability is one of a family of contingent costs which, as earlier discussed, is subject to the vagaries of many variables (e.g., future waste volumes and composition, the quality of on-site waste treatment, the distance to and site of disposal facilities, and even the number and economic resources of PRPs), firms are understandably reluctant to place a dollar value on future Superfund liabilities. Reinforcing this view is the belief that quantification itself may subject the firm to higher penalties in the event that it becomes a PRP. Some managers fear that

quantification of liabilities is, in effect, an admission of known (and, by implication, preventable) risks which in future may be held against the firm in the course of litigation.

How, then, is liability handled among firms that do consider it in the project financial evaluation process? Figure 12 shows a mix of responses, split between qualitatively only (33%), specific dollar value (23%), and a combination of qualitative and quantitative (44%). Focusing

on the second category, and remembering that Figure 12 reflects the practices of only those respondents who consider liability (1/3 of all respondents), then only about 7% of all survey respondents regularly quantify liability during project financial evaluation. Even if we assume half of the "mixed" responses (.5 x 44%) regularly quantify, the figure rises to 14% of all survey respondents. Thus, it appears that liability quantification remains a practice of few mid- and large-size firms in the U.S. manufacturing sector.

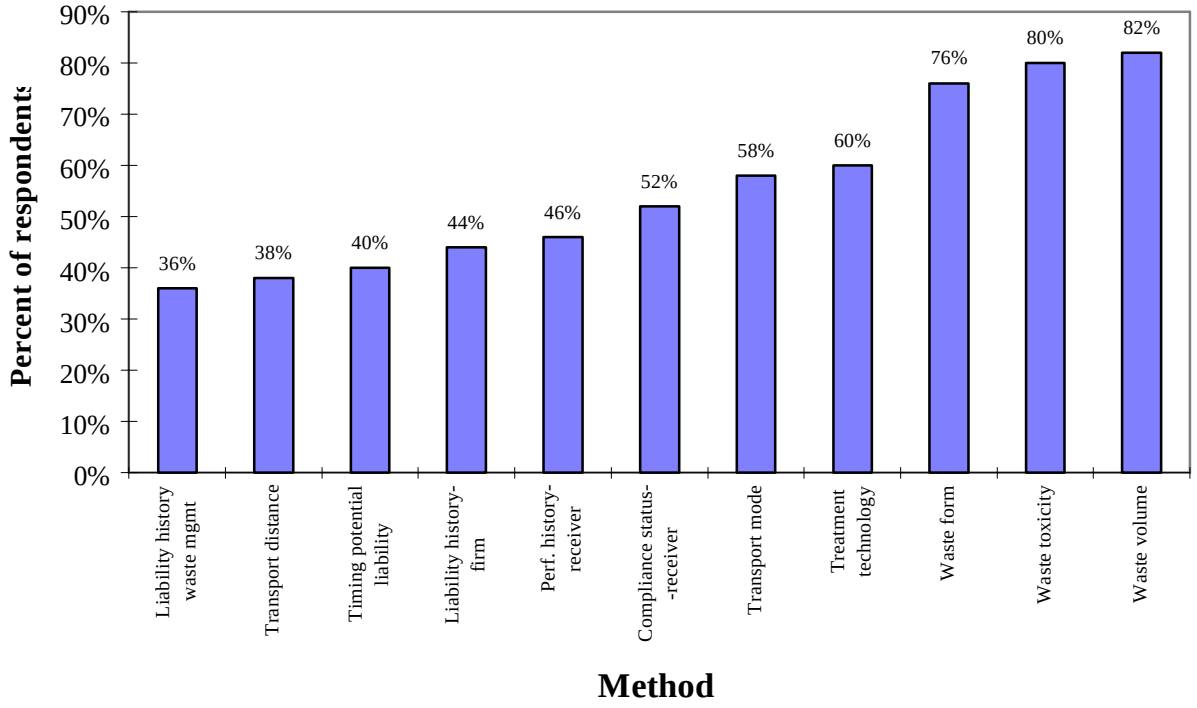
Figure 12. How Superfund is handled
n = 50



Whether quantified or not, the firms that consider liability in any form report a variety of approaches and staff responsibilities. The most common situation (42%) among the three specific options given in the survey is consideration by financial or legal staff when reviewing appropriations requests prepared by environmental or other staff. This suggests that if liability is considered in any form, it appears after financial evaluation is complete and a project is brought to upper management for final review and approval. At this juncture, liability benefits of a project may be handled in a side bar, discussed as a less tangible or contextual variable in a column of the appropriations request typically labeled "other considerations" or "non-quantifiable issues." In fewer instances, liability is left to the individual preparer's judgment (22%) or, alternatively, this same individual follows guidelines from financial or legal staff (26%). That only a quarter of all respondents report the latter is consistent with earlier findings that most firms -- owing to either legal concerns or skepticism about quantifiability -- remain hesitant to systematize their consideration of liability in project financial evaluation. For the few who do, the most common (74%) approach is a method developed internally. For the remainder, the EPA Pollution Prevention Benefits Manual (U.S. EPA 1989) is a distant second.

Many variables form part of the liability equation, but a few dominate the methods used by those respondents who consider liability in any form. Figure 13 shows that waste volume, waste toxicity, and waste form (solid, liquid, gaseous) are the three most frequent variables, followed by treatment technology, transport mode, and compliance status of receiving facility. These variables comprise the core considerations in the engineering approach to liability estimation, in which risk is assumed to be driven principally by the hazard level of the material, transport mode, and receiving facility (MacLean 1987, General Electric Corporation 1987, Aldrich 1994). An alternative approach adopts an actuarial perspective in which risks are based on the frequency of past incidents and legal verdicts in cases roughly analogous to the conditions under consideration, i.e., similar chemical composition and volumes, similar waste treatment methods, and similar type and size of manufacturing firm (White, Savage, and Dierks 1995). Both approaches have their strengths and limitations. From the responses in this survey, it appears that the engineering

Figure 13. Factors accounted for by Superfund liability assessment method (n=50, multiple answers accepted)



approach remains dominant.

From the perspective of all respondents, including those that do not currently consider liability in the project evaluation process, what stands in the way of quantifying liability in the future? By a substantial margin, the most frequently cited hurdle (58%) is difficulty in estimating *if* liability costs will occur. Following this is the difficulty in estimating the *magnitude* of costs (45%) and *when* liability will occur (29%). Contrary to conventional wisdom, remarkably few

identified "If I quantify, I may be subject to toxic torts" (5%) and "If I quantify, I have to disclose to the SEC" (3%). The conventional wisdom holds that legal repercussions are a significant barrier to disclosure. Our findings suggest, however, that this is not the case: methodological barriers are a far greater impediment to calculating liability.

The "when" of liability estimation is a particularly critical variable of financial evaluation owing to the powerful effects of discounting and the time value of money. A liability cost incurred in year 5 of a project's life has a dramatically greater impact on project profitability than a cost incurred in year 10. Of course, all three barriers -- estimation of if, at what magnitude, and when liability costs will materialize -- lie at the heart of any risk analysis. The perception that these are the key barriers may be related to the unfamiliarity of the management accounting community with the techniques of risk analysis as well as the reluctance to deal with *expected* values (rather than the customary solid and certain costs) in managing the firms' economic resources. This suggests an opportunity and need to bring risk analysis techniques to the attention of the accounting community to strengthen its capacity to handle key less tangible costs.

What does the future hold for incorporating Superfund liability in the capital budgeting process? A total of 61% of all survey respondents indicated that Superfund liability was either very important (27%) or somewhat important (34%) in determining priorities for environmental projects. This is almost double the number who currently consider liability in developing project appropriation requests. The results suggest that the general appreciation of liability avoidance as an environmental project benefit far exceed concrete steps to formally bring this cost into the project evaluation process, a situation undoubtedly linked to the methodological issues mentioned earlier. When asked if they have plans in the next two years to consider liability in the budgeting process, only 23% of those who currently do not consider this cost item plan to change practices during this time frame. This suggests that relatively few respondents are poised to dramatically depart from current practices.

COST ALLOCATION

When firms incur environmental costs that they do not link to processes and products, managers are deprived of a clear picture of where and how costs are generated. Even in modest-sized manufacturing firms with two or three production lines, the costs of licensing, monitoring, waste storage, emissions controls, environmental staff time, off-site disposal, insurance, future regulatory compliance, and even liability are not driven equally by each production line. Some process lines may be more hazardous materials-intensive, generate more emissions per unit output, require more frequent and intensive inspection and monitoring, and generate greater quantities of waste requiring off-site disposal. Similarly, particular processes, or products, may cause a disproportionate share of costs associated with training and reporting to government agencies, or give rise to risks which may result in higher insurance costs or risks of future personal or property damages. In short, when it comes to environmental costs, not all processes and products are created equal.

Numerous observers have recognized the complexity, consequences, and necessity of rationalizing accounting systems to ensure proper allocation to the sources within the firm that are responsible for such costs (Johnson and Kaplan 1991, Cooper et al. 1992, Todd 1994, Ness and Cucuzza 1995). Understanding cost drivers and allocating costs accordingly is the conceptual cornerstone of activity-based costing (ABC). ABC has evolved rapidly since emerging as a new management tool in the 1980's. It is an approach to cost management that moves management focus beyond the traditional emphasis of short-term planning, control and decision-making, and product costing to a more integrated, strategic, competition-sensitive way of looking at internal costs structures. It is especially germane to environmental costs because of the diffuse, long-term, and less tangible nature of so many environmental costs, all attributes that make allocation particularly challenging from an accounting perspective.

In its first generation, ABC helped redefine cost drivers to move beyond factors such as simple volume measures to include "transaction" cost drivers such as setups, work orders, product lines, and others with a non-linear relationship to output levels (Mecimore and Bell 1995). At the same time, first-generation ABC articulated the critical difference between value-added and nonvalue-added components, thereby directing management attention to eliminating those steps in the production process that added nothing to product value yet consumed the firm's resources.

In rapid succession, second-generation ABC defined process-related costs - those linked to but distinct from the narrow confines of production (e.g., distribution, selling, and various subcomponents of administrative expenses, such as procurement of people, supplies, and equipment). Ignoring these costs is incompatible with the modern concept of continuous improvement since such improvement requires an integrated and encompassing perspective of stages in the product cycle and the cost implications of each stage.

Most recent, third-generation ABC enlarges the scope of costs to focus on the business unit (versus only the cost center), the firm's activities (versus only products and processes), internal and external costs (versus only manufacturing, administrative, and selling), and "value chain costing" (versus only product costing and process-costing). Through this enlarged vision of where and how costs are created, it enables managers to think and act strategically, and to attend to activities upstream and downstream of the immediate production process.

While improved allocation cannot help but rationalize management decisions, it is neither without cost itself nor without consequences for product line and facility managers. The value of disaggregating cost information must always be weighted against the benefits of doing so. Setting up and maintaining the accounting infrastructure to collect, analyze, and report on a continuing basis highly disaggregated information requires staff hours to both operate the system and digest its outputs. Though modern information technology allows for such intricate cost accounting systems, and even the co-existence of two systems (for internal and external reporting), start-up costs can be high even if amortized over many years of decision-making.

In addition to resource requirements, another organizational barrier to ABC is noteworthy. Improved allocation may be good news to some managers struggling to justify facility expansion when pooled savings or revenue streams (environmental or otherwise) are removed from overhead and applied to specific processes and products. However, the converse also is true. New allocation methods may be unwelcome news to product or facility managers whose operations appeared to be profitable under the old overhead allocation methods but who are suddenly tagged with formerly pooled costs. Temporary protection against penalizing such managers is essential to building staff investment in the accounting methods while avoiding the dispiriting effects of winners abruptly becoming losers.

The allocation challenge is further complicated by the recognition that even processes and products may not provide an adequate basis for allocating costs. Instead, it is "activities" of the firm -- introducing a new product line, set-up time, distribution, marketing -- that are the true cost drivers (Cooper 1989; Cooper and Kaplan 1991; Cooper et al. 1992). In any case, the challenge is certainly not confined to environmental costs; misallocation of any type of cost distorts the information which management depends on to conduct a host of essential and routine business functions. These functions include: pricing products, determining product mix, evaluating opportunities for cost control, rewarding plant managers for efficiency gains, and justifying plans for capacity expansion.

Environmental costs are just one target for correcting typical allocation practices. However, because they traditionally are lumped into overhead/administrative accounts, and because of their often less tangible and difficult-to-quantify nature, environmental costs are particularly susceptible to disconnection from the products, processes, or activities responsible for their creation. Yet, learning from recent studies, misallocating costs that may represent as much as 20% of the controllable operating costs of a facility cannot help but have adverse consequences for management of many business decisions (Ditz, Ranganathan, and Banks 1995).

To obtain a glimpse of current practices, we asked respondents to describe their current cost allocation across a range of 17 environmental costs (Table 7). These were selected from the earlier cost inventory list based on experience in assessing the capital budgeting procedures in a wide variety of firms (Tellus Institute 1993). For each cost, one of four responses was possible, ranging from allocating "always to overhead" to "always to product/process," with the latter representing the practice most consistent with the objective of linking costs to sources.

Table 7. Initial assignment of costs

	1 Always to overhead	2 Usually to overhead	3 Usually to product/ process	4 Always to product/ process
On-site air/wastewater/hazardous waste testing and monitoring	58	23	12	7
On-site air emission controls	56	24	15	5
On-site wastewater pre-treatment/treatment/disposal	57	22	16	4
On-site haz. waste pre-treatment/treatment/disposal	58	23	15	4
On-site hazardous waste handling (e.g. storage, labelling)	56	22	18	5
Manifesting for off-site hazardous waste transport	58	29	9	4
Off-site hazardous waste transport	58	28	10	5
Off-site wastewater/haz. waste pre-treatment/treatment	53	28	14	6
Energy costs	44	22	23	12
Water costs	51	23	18	9
Licensing/permitting	60	29	8	4
Reporting to government agencies	65	28	6	1
Environmental penalties/fines	67	24	8	2
Staff training for environmental compliance	64	27	7	1
Environmental staff labor time	68	26	4	2
Legal staff labor time	74	23	2	1

A number of findings in Table 7 are noteworthy. First, for every cost item, "always to overhead" is the most frequent response. Virtually all costs fall in the 55-75% response range, with the notable exceptions of energy and water costs. That these should be allocated with

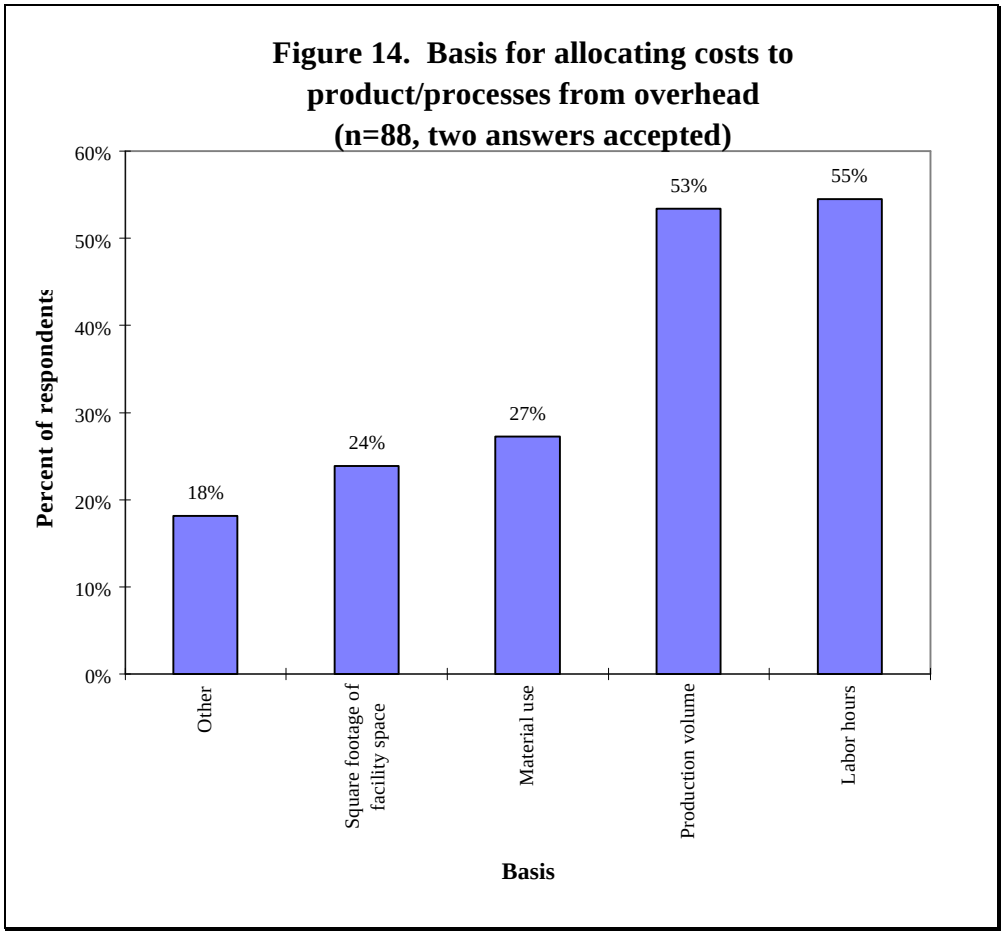
slightly greater frequency to products or processes is not surprising: relative to other cost items, they are more measurable and physically traceable to processes that are energy and water consumers. But at 44% for energy and 51% for water, the difference is small and certainly falls well short of consistent allocation to processes and products.

Second, those costs with the highest column 1 percentages -- from licensing/permitting to insurance costs -- are those most typically associated with central staff functions or plant-, division-, or corporate-wide overhead costs. Legal, environmental, and training staff, for example, typically charge their time to general accounts which bear no relationship to the processes, products, or activities which require their services.

Third, the pattern of highest to lowest percentages across rows holds for all costs in Table 7, with the sole exception of energy showing a slightly higher percentage response in column 3 versus column 2. Thus, while there may be as much as 20% difference in column 1 figures, the pattern of diminishing frequency from overhead to product/process allocation holds steadily for all entries, regardless of how tangible they happen to be. This finding comports with earlier anecdotal evidence gathered in case studies of corporate environmental cost management, which suggests that environmental costs, at least in the initial stage of accounting, are pooled into overhead accounts (Ditz, Ranganathan, and Banks 1995).

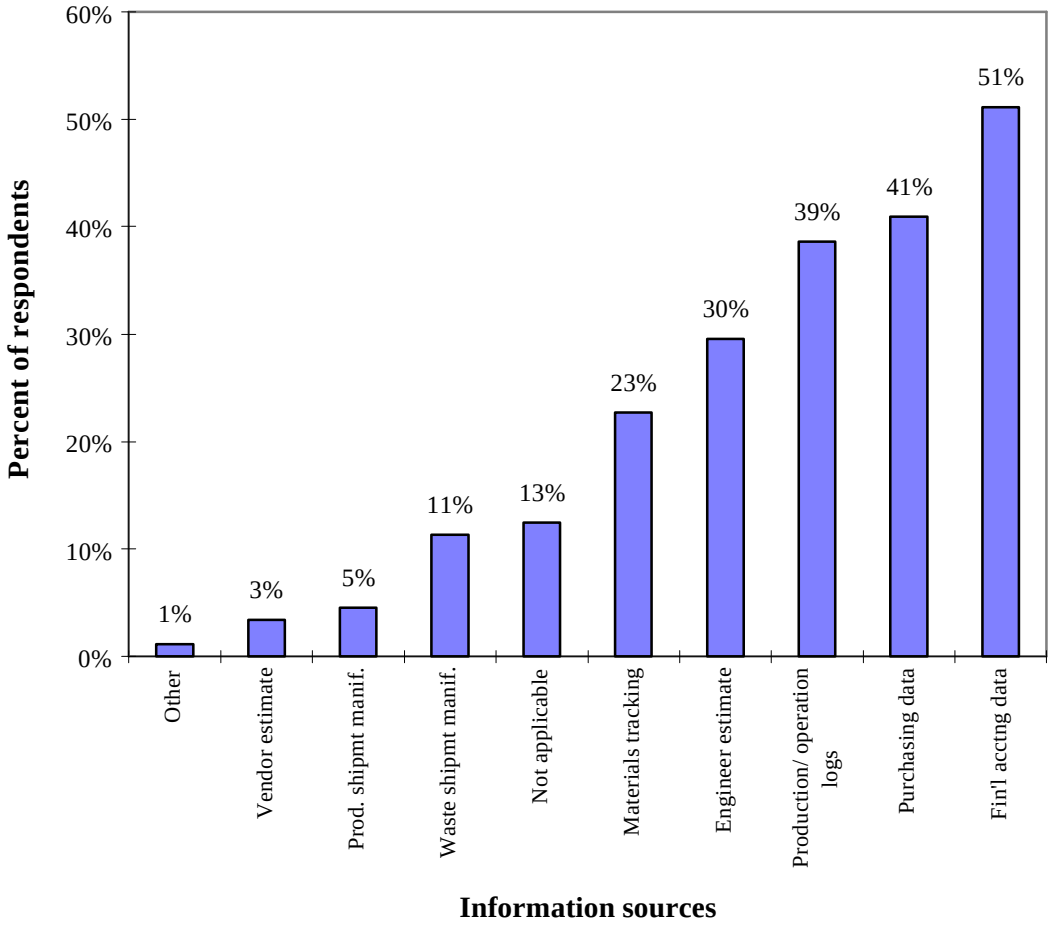
For some firms, initial allocation to overhead is not the last step in the accounting process. When asked "if some or all costs are initially assigned to an overhead account, do you later reallocate to a product or process," 58% of the sample answered "Yes." Thus, for roughly 70-80% of respondents (depending on the specific cost item) who "always" or "usually" first allocate to overhead, well over half then proceed to move such costs to products or processes using some type of allocation formula. Taking 75% as the average of those who always or initially allocate, and multiplying that figure times the 58% who subsequently shift costs to products or processes, we find that about 44% of all respondents follow this two-step procedure.

Allocation requires some driver, or basis, for partitioning costs across processes and products whether it occurs initially (as in the case of 15-20% of respondents) or in a second step (as it does for 44%). Figure 14 shows the range of such cost drivers when firms were given five choices and asked to identify the two most commonly used. Labor hours (55%) and production volume (53%) are by far the most common, followed by materials use (27%) and square footage of facility space (24%). An assortment of "other" drivers were mentioned, including: machine/equipment hours, engineering estimates, the speed with which products flow through the facility, head count, number of set-ups, and tons made. One respondent noted that "each overhead account has its own unique driver that is used to allocate costs," and another answered that the driver "depends upon the origin of the cost and the relationship to a product line activity, and could be any or a combination of the above."



Finally, Figure 15 provides some insight into the sources of cost information used to make allocation choices. With each respondent allowed to name up to three sources, financial/accounting systems data is the most frequent source (mentioned by 51% of respondents), followed by purchasing, production/operation logs, engineering estimates, and materials tracking, all with scores of at least 20%. This diversity of sources reaffirms what is increasingly evident in environmental accounting case studies: essential environmental cost information is spread through multiple staff functions, and modifying accounting systems to better track and allocate such costs necessitates a cross-functional approach to ensure completeness and compatibility of information. It is fair to say that as firms move toward greater coverage in their environmental cost inventory and better assignment of costs to processes and products, more and more staff functions are inevitably drawn into the environmental accounting process.

Figure 15. Sources of Cost Information When Assigning Costs to Products/Processes (n=88, three answers accepted)



FINANCIAL INDICATORS: THE BOTTOM LINE

Improving cost inventory and cost allocation methods are major steps toward improving the evaluation of environmental projects in the capital budgeting process. However, there remain two other variables that play a decisive role in determining whether projects survive the intense competition for scarce capital resources: the choice of project financial indicators and the related issue of time horizons.

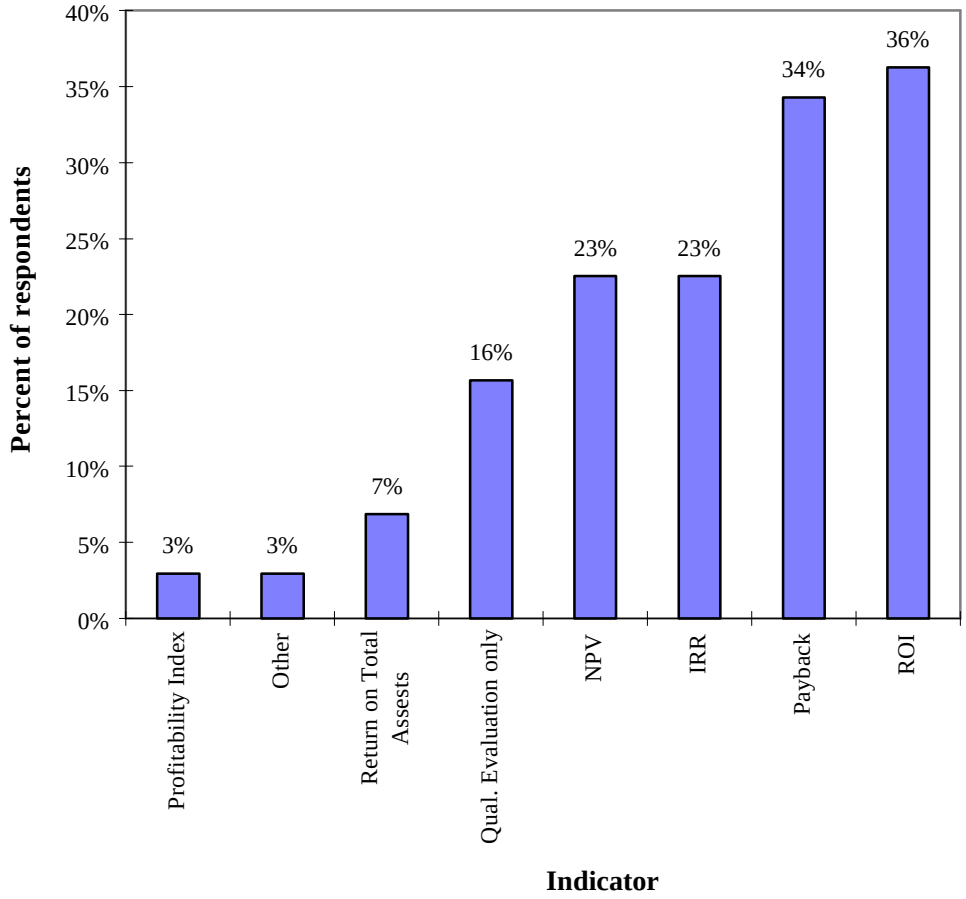
In addition to their less tangible and contingent nature, many environmental costs and savings materialize only in the mid- and long-term. In contrast to costs of activities such as on-site air and hazardous waste testing, monitoring, handling, and manifesting, other costs (or savings/revenues) linked to corporate image, liability, and green product sales are by nature those with longer-term time horizons. In the case of future compliance costs, its very definition implies a cost that will materialize only some years into the future. Thus, if any of these costs form part of the cost/benefit calculation of a proposed environmental project, an analytical method that is insensitive to mid- and long-term cost and revenue streams will be incapable of capturing the long-term profitability of a proposed project. Pollution prevention projects are especially vulnerable to this shortcoming because many rely on product redesign, process modification, and materials substitutions that may be capital intensive but yield attractive returns beginning 3-5 years after the initial capital outlay.

To take stock of current practices, we asked respondents a series of questions regarding their current selection and application of profitability indicators for evaluating environmental projects. Seventy-four percent of respondents indicated they perform "a less detailed/informal screening" of environmental projects prior to a detailed financial analysis. This common practice allows firms a quick glimpse of a project's economics before committing the resources required for a full financial evaluation. If a project appears profitable at this juncture, many firms do not conduct a more in-depth evaluation. If a project does <u>not</u> appear profitable after the first quick screening, then expanding the cost inventory and more rigorously allocating costs to depict the true costs of a current practice may make the difference in illustrating the benefits of an alternative practice. This tier-type approach -- beginning with conventional, tangible costs and then moving, as necessary, to less tangibles, was first advocated in EPA's Pollution Prevention Benefits Manual (U.S. EPA 1989). Of course, an enlarged cost inventory may reveal hidden costs as well as savings, thereby making a project less, rather than more, profitable.

For those firms performing any initial screenings, Figure 16 shows that Return on Investment (ROI, 36%) and Payback (34%) are the most commonly used financial indicators. These are followed by Internal Rate of Return (IRR) and Net Present Value (NPV), both at 23%. Interestingly, 16% of respondents report use of qualitative methods only. ROI, IRR, and NPV fall into the category of discounted cash flow methods, which take into account the time value of money. They usually, though not necessarily, cover a time horizon longer than the 1-2 year period typical of Payback analysis, which does not incorporate discounting methods. Many firms may look at ROI, IRR, or NPV over a relatively short horizon, say five years or less. In these cases, excluding the long term costs and benefits of a P2 project (e.g., omission of the expected

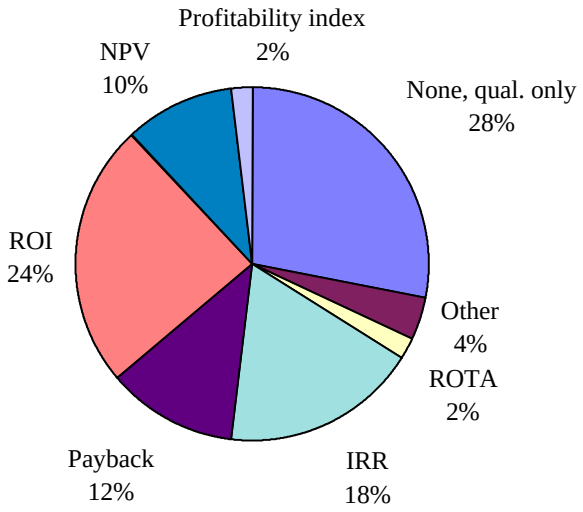
value for the avoided liability in Year 8, or anticipated compliance costs in Year 6) may bias the profitability analysis to the disadvantage of the proposed P2 project. In any case, over half of those firms who do screen use some form of discounted cash flow method.

Figure 16. Financial indicators used for screening projects (n=102, multiple answers accepted)



Turning to the full project justification, a somewhat different pattern emerges (Figure 17). Once again ROI is the leading quantitative indicator, followed by IRR at 18%. However, for 27% of respondents, the single most frequent response reported in Figure 17 is that their "evaluation is qualitative only." This strikingly high figure is nearly twice as high as the comparable figure for the project screening phase.

Figure 17. Financial indicators used for full project justification



How might one explain this finding? While we cannot be certain from the survey data, a clue may reside in a follow-up question as well as in side comments from a handful of respondents who noted (unsolicited) that environmental projects are "legally required," "mandated" and "required." When asked if the preferred financial indicator is used for "regulatory compliance projects as well as non-compliance, or discretionary, projects," 44% responded "No." This suggests that some, perhaps most, who report qualitative evaluation during full project evaluation are those who lump all environmental projects into the "must-do" category. This, more often than not, unfortunately leads to the concurrent and often erroneous conclusion that systematic financial analysis of environmental projects is not necessary and may be a waste of the firm's resources.

The choice of hurdle rates -- the threshold economic return to gain project approval -- offers still another perspective on how environmental projects are handled *vis a vis* other projects which enter the capital budgeting process. Among all respondents, 56% indicate no "standard hurdle rate, or threshold" is required before approving an environmental project. This suggests that a slight majority of firms exercise discretion in reviewing the profitability of projects, perhaps taking into account the less tangible benefits that, in their view, are not amenable to quantification.

Among those respondents who use Payback at any stage of project justification, 1-2 years is by far the most common (50%) hurdle rate required for project approval (Figure 18). Only 8% report payback periods of greater than 4 years. Limiting the analysis to this time frame introduces a substantial probability of omitting outyear benefits common to many P2 projects. For IRR users (Figure 19), hurdle rates are defined in percentage terms. Here the most frequent range is 10-19% (48% of respondents), followed by 20-30% (25%) and greater than 30% (18%).

Figure 18. Payback period used, payback users only (n=72)

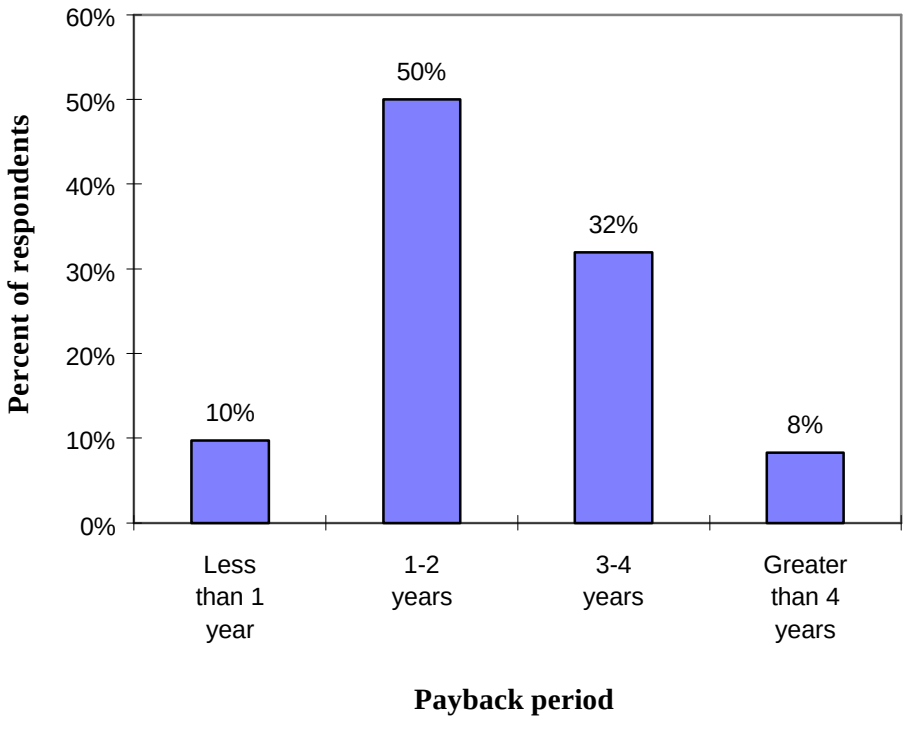
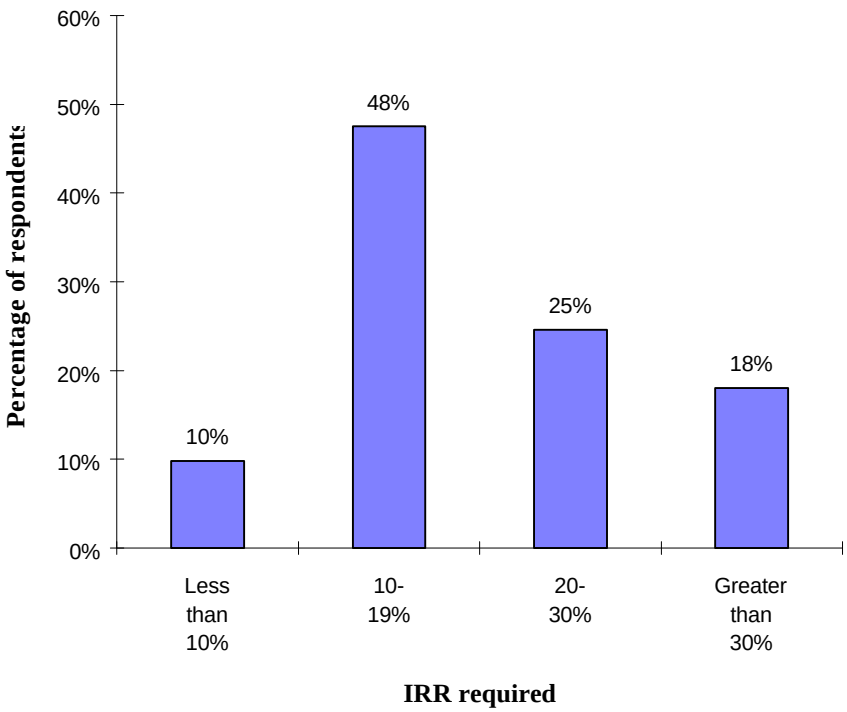


Figure 19. IRR required for approval, IRR users only (n=61)



Time horizon also may play a decisive role in the environmental project approval process. For those who use NPV, or normalized NPV, 47% use a 6-10 year time horizon and another 6% use 10 years or greater (Figure 20). For IRR users, the comparable figures are 49% and 3% (Figure 21). Thus, consistent with the underlying differences between Payback versus NPV and IRR, those who use discounted cash flow methods are markedly more inclined to take a long-term view of the economics of their environmental investments.

Figure 20. Time horizon for NPV, NPV users only (n=51)

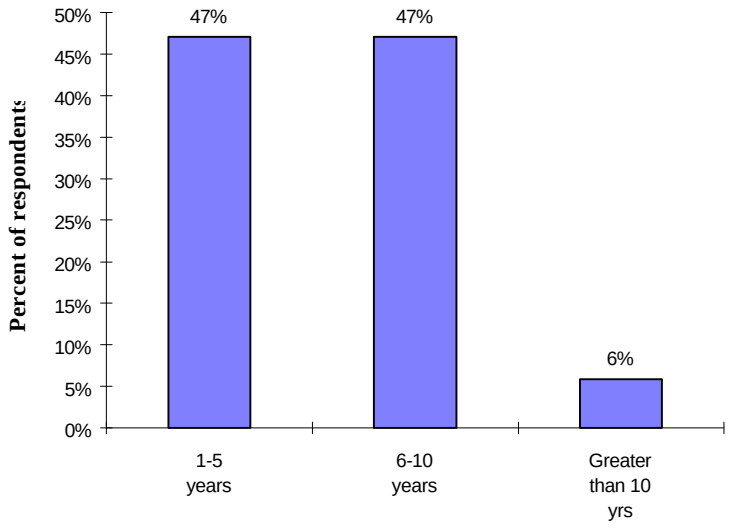
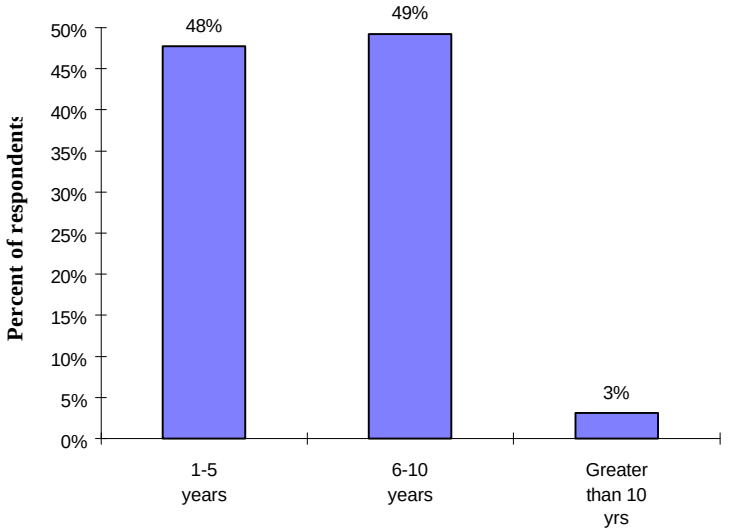
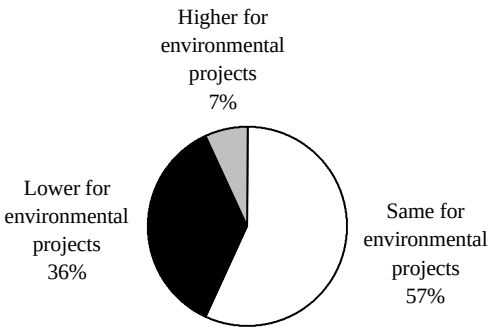


Figure 21. IRR time horizon used, IRR users only (n=65)



Finally, we queried respondents as to whether hurdle rates for environmental projects differ from those applied to non-environmental projects (Figure 22). Again, the earlier bias toward special treatment of environmental projects becomes evident. While a majority (57%) report equal hurdle rates, a notable 36% report that hurdle rates are lower for environmental investments. These respondents undoubtedly include a range of perspectives, from those who use no threshold whatsoever (the "must-do" viewpoint) to those who exercise discretion owing to the knowing exclusion of, but appreciation for, the less tangible costs associated with environmental projects.

Figure 22. Approval thresholds for environmental projects compared to non-environmental projects



How persistent this practice has been over time must remain conjecture since we do not enjoy the benefit of an earlier survey against which to benchmark our findings. The reported different hurdle rates stand in contrast to the finding, discussed earlier, that the vast majority of firms (86%) do not maintain separate budget pools earmarked for environmental projects. Some recent evidence suggests that environmental issues increasingly will blend into the more general practices and trends that continue to redefine corporate organizational and competitive strategy (e.g., re-engineering, total quality management, product stewardship). The meshing of overall corporate strategy with environmental performance certainly bodes well for P2 projects. Projects that focus on upstream processes and materials (as P2 normally does) often simultaneously increase efficiency and enhance systems performance, while reducing pollution. These joint results render moot the traditional distinctions between environmental and non-environmental projects.

Equal treatment is rational management provided that cost inventory and cost allocation methods are systematic, rigorous, and applied equally across all types of projects, and financial analysis provides a clear picture of true profitability. The evidence collected in this survey suggests that many firms still are inclined to quickly dismiss environmental projects as "must-do" mandates, subjecting them to perfunctory or no systematic profitability assessment. In so doing, opportunities often are lost for discerning between alternative methods for achieving environmental compliance. While barriers to P2 persist, regulations increasingly allow flexibility in meeting standards. Simple distinctions between compliance and non-compliance projects increasingly are obsolete; multiple options for achieving compliance include P2 approaches, which, if thoughtfully conceived, promise to make positive contributions to broader

corporate strategic objectives. It is these dual and commingled benefits that may elude those firms who are too quick to pigeonhole all environmental projects as capital drains with negative rates of return.

Whether a single budget pool and uniform hurdle rates for *all* projects are becoming the norm in U.S. manufacturing firms (not just relatively larger ones which dominate our sample) can only be answered in future studies.

CONCLUSIONS

Among the many internal business functions served by environmental cost information, capital budgeting for environmental projects is one of the principal beneficiaries. Accounting systems to identify, compile, analyze, and report environmental cost information in a timely and rigorous fashion is a prerequisite to understanding the sources and magnitude of environmental costs in the firm. Only if these are understood can managers maintain a clear picture of the true costs of current production processes and products. This, in turn, allows managers to direct attention to minimizing compliance costs, reducing operating costs, and fully meshing the environmental and financial performance goals of the organization.

With few exceptions, this survey of management accountants of U.S. manufacturers confirms anecdotal evidence based on earlier case studies of capital budgeting for environmental investments in large and medium-size firms. Some key findings consistent with earlier studies include:

- The budgeting function normally is a tiered process, with participation of plant, division, and corporate levels the single most common arrangement.

- Discretionary spending of $100,000 or less on capital projects is allowed in virtually all firms.

- Environmental cost information is gathered by many staff functions located throughout the firm; production/operations, environmental, and finance/purchasing are the most frequent contributors.

- Tangible, quantifiable environmental costs are normally considered by well over half of all firms; less tangible, more difficult to quantify environmental costs are less often normally considered in the capital budgeting process.

- Costs that are considered at all are generally quantified; the more tangible and quantifiable they are, the more often they are monetized in project evaluation.

- Only a third of respondents consider the effect of a proposed environmental project on the firm's Superfund liability exposure, and only 7-14% regularly quantify such costs.

- Initial allocation to overhead accounts is the most common practice for a majority of firms for virtually all types of environmental costs; routine initial allocation to products or processes is reported by under 10% of respondents for virtually all environmental costs.

However, some unexpected findings also emerged from the survey:

- Over eight out of ten respondents -- 86% -- report a single funding pool for all projects, environmental or otherwise.

- A majority of firms (71%) track environmental costs in some form at the corporate level.

- Among the few firms that quantify liability, three quarters use methods developed internally as opposed to those available through EPA or other public sources.

Concerning the key issues of environmental cost inventory and cost allocation methods, the survey suggests that much work remains before business practices can provide managers with a comprehensive and transparent look at "true" costs of processes and products. While most firms quantify the more obvious and measurable environmental costs, substantially fewer have grappled with those that are less tangible, uncertain, and difficult to quantify. Estimates of environmental costs in the range of 3-20% of facility operational or product line costs as reported in other studies may, after a closer look, be substantially understated when the less tangible costs are added.

Dealing systematically with these types of costs is not new to corporations. In the normal course of business, managers regularly look into the future to forecast everything from the price of oil to consumer demand for a new line of computers. Applying these approaches, including those drawn from risk analysis, to estimate less tangible costs would represent a major step toward characterizing current and future environmental costs.

Cost allocation, too, remains a major challenge. Most firms continue to place most environmental costs initially into overhead accounts. Though some subsequently allocate these costs to products or processes, the basis upon which these allocations are made are often ill-conceived. When proper allocation does not occur, managers receive distorted signals regarding the true costs and benefits of retaining or changing processes and products. Moreover, like incomplete cost inventories, misallocation of environmental costs stands in the way of effective performance monitoring, product pricing, incentive and reward systems, and other activities essential to maintaining a competitive enterprise.

Upgrading the capital budgeting system through improved environmental accounting systems is best viewed in the broader context of strategic planning. With multiple forces working to fuse environmental and financial objectives of the firm, it is critical to exercise an even hand in evaluating the returns to all capital investments, environmental or otherwise. When cost inventory and cost allocation practices fail to provide a level playing field for all investments, managers are left without the information they need to make optimal use of limited resources. In particular, those environmental projects with strong pollution prevention content, as well as those with side benefits unrelated to environmental improvement per se -- e.g. process optimization and yield, market penetration, corporate image -- are particularly vulnerable to the adverse effects of incomplete cost information.

While many social benefits may result from improved internal environmental accounting, the case for such improvements may be made purely on the basis of the firm's self-interest. This is

the central message that public policymakers, professional associations, trade associations and stakeholders should deliver to firms seeking to understand and apply environmental accounting techniques to their capital budgeting processes.

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APPENDIX A

ADVANCE AND FOLLOW-UP LETTERS TO SURVEY RESPONDENTS

APPENDIX B

SURVEY QUESTIONNAIRE

Figure 1. Respondent's product line (by SIC code)

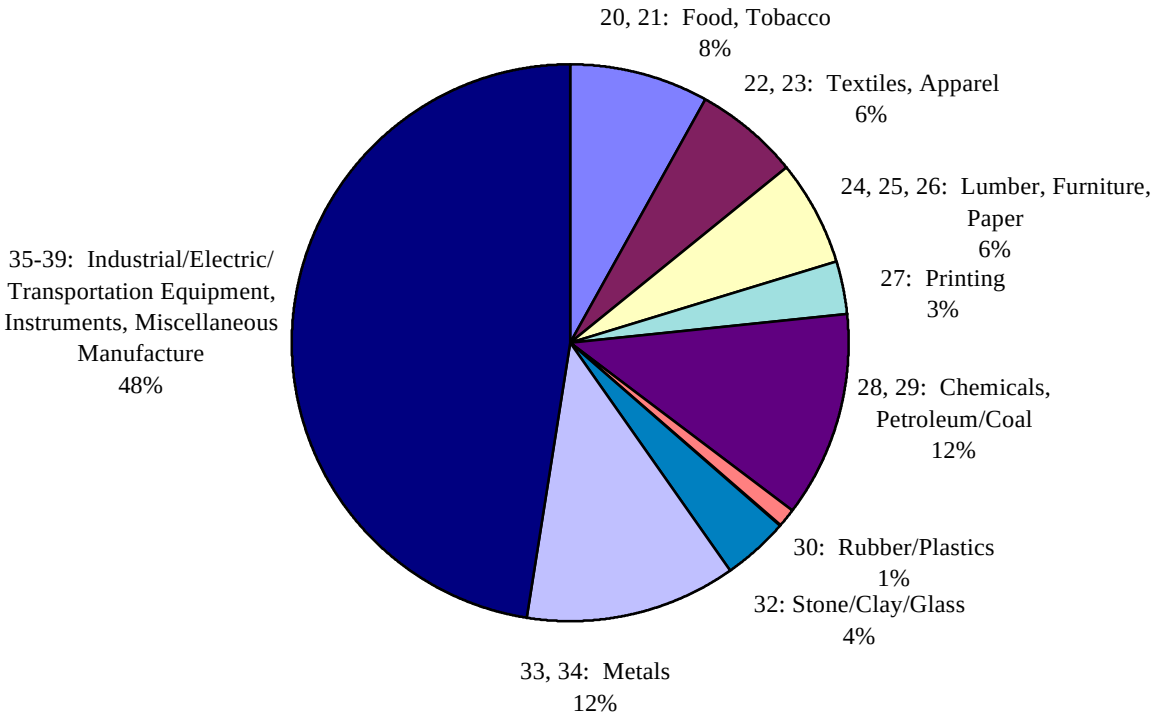


Figure 2. Respondent's position at firm

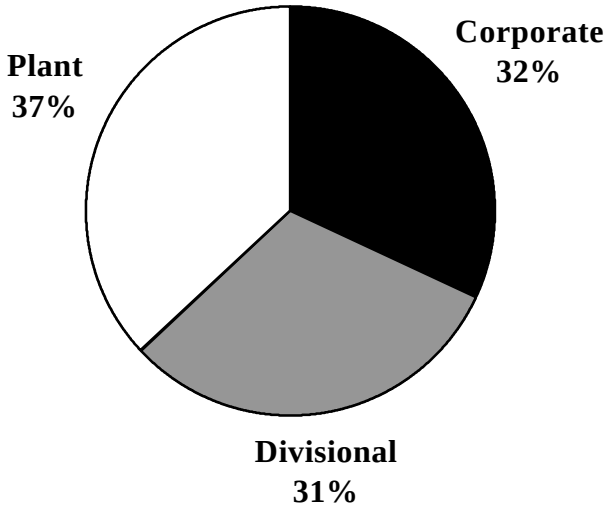


Figure 3. Number of employees worldwide

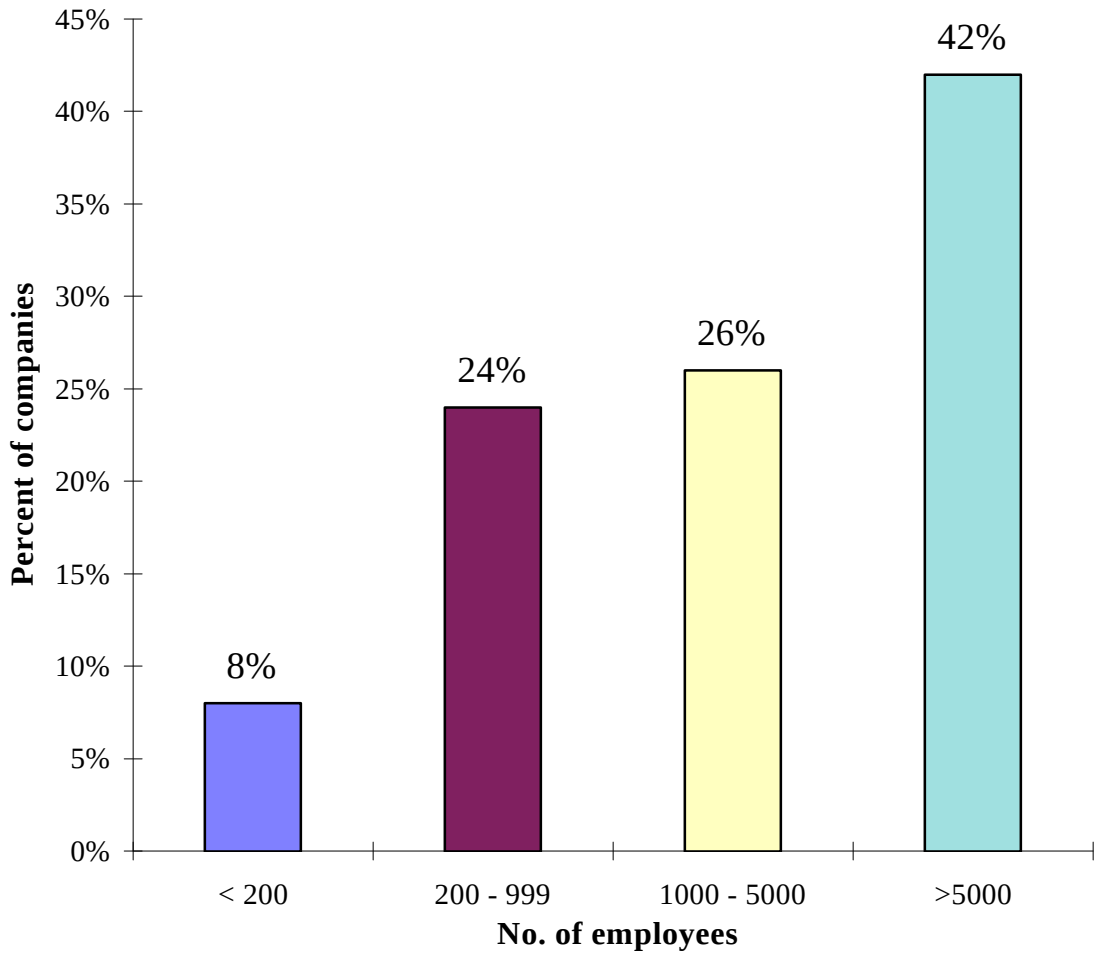


Figure 4. Most recent annual sales

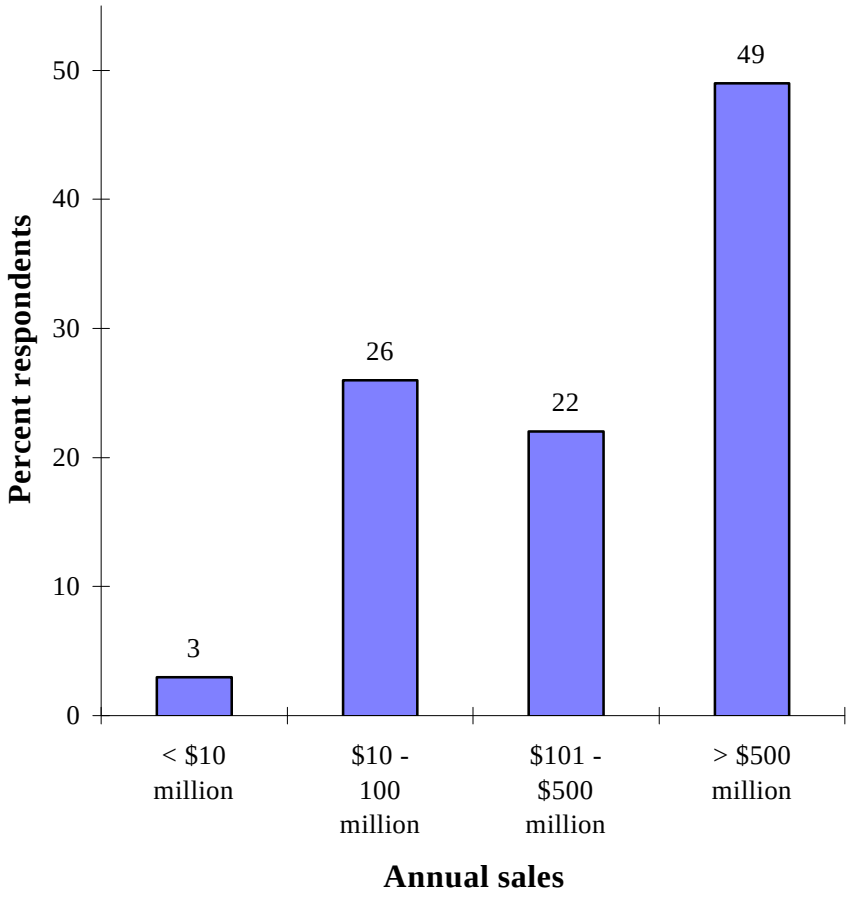


Figure 5. Annual corporate budget

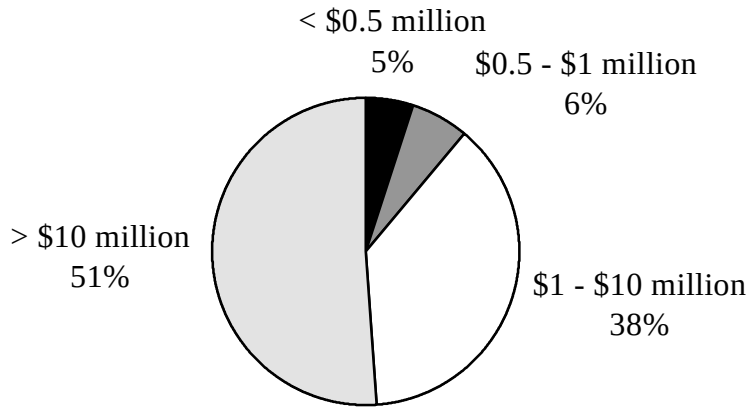


Figure 6. Level at which capital budgeting occurs

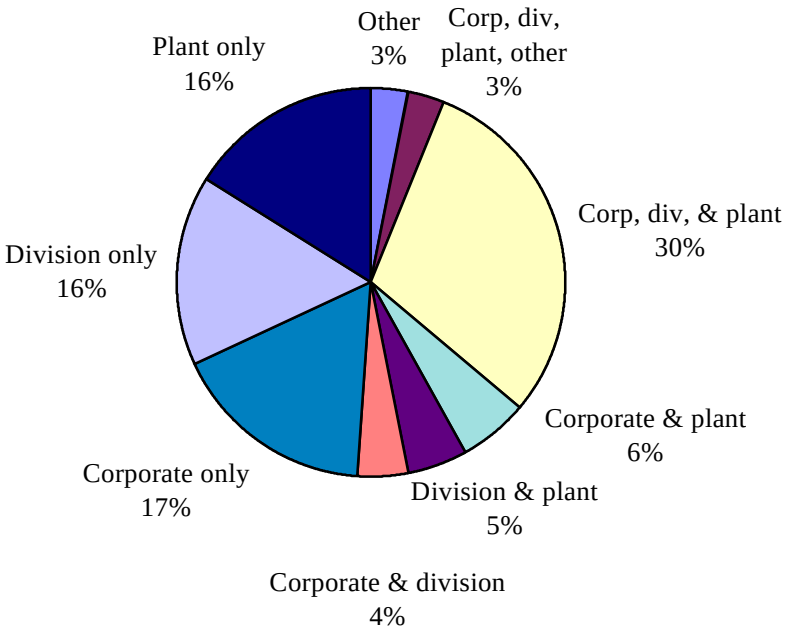


Figure 7. Limit on discretionary capital spending

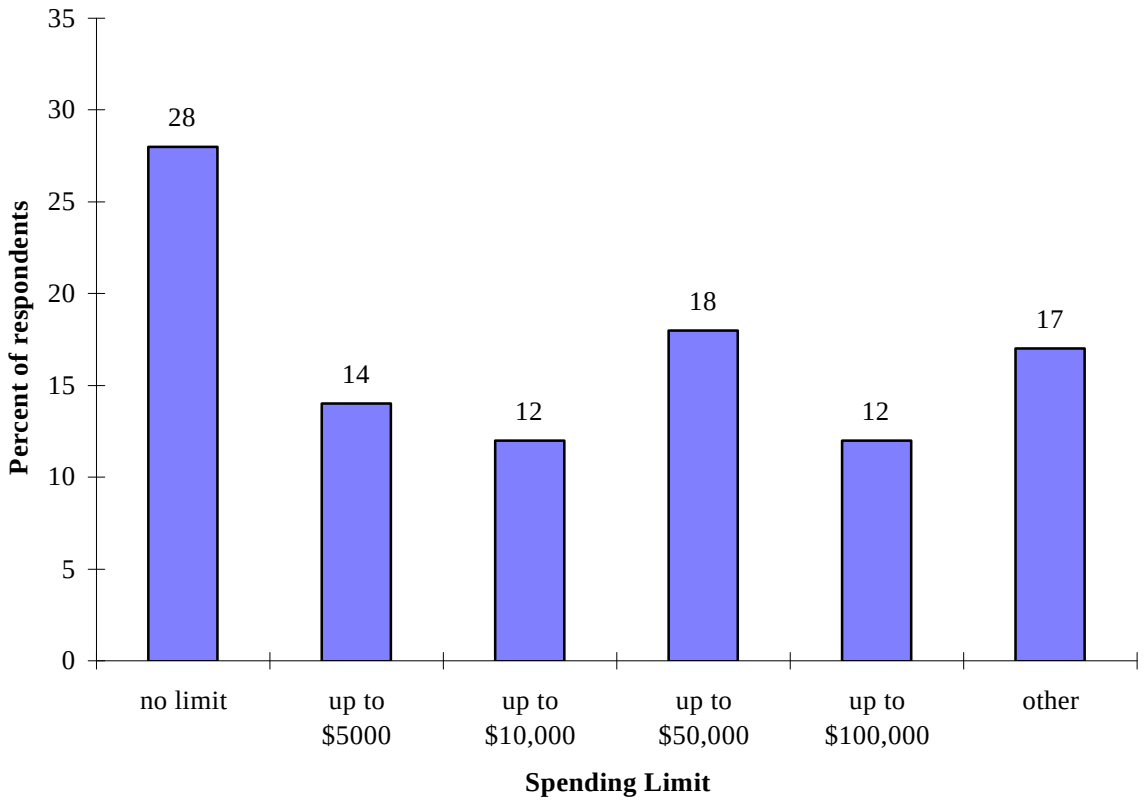


Figure 8. Who makes the initial decision to place an environmental project in a particular category?

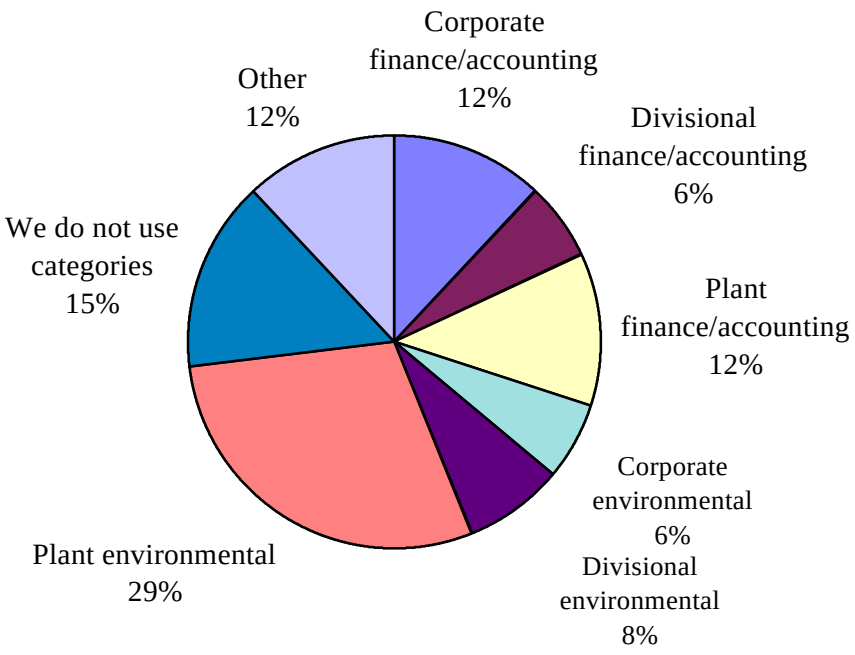


Figure 9. Level at which environmenta costs tracked (n=104, multiple answers accepted)

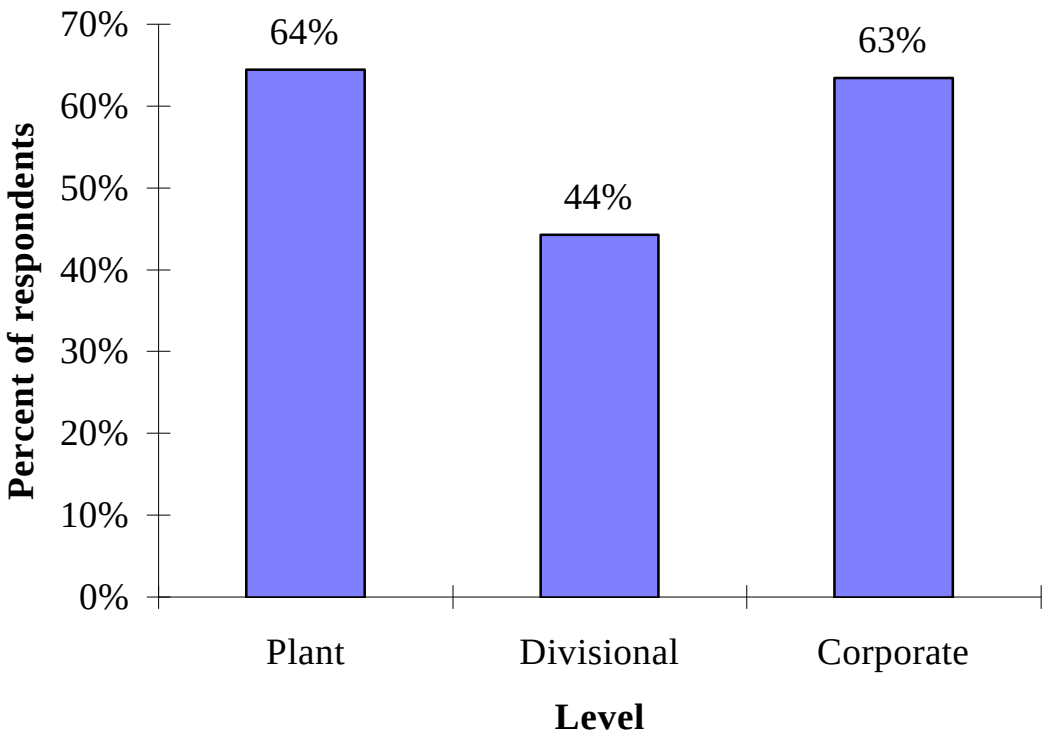
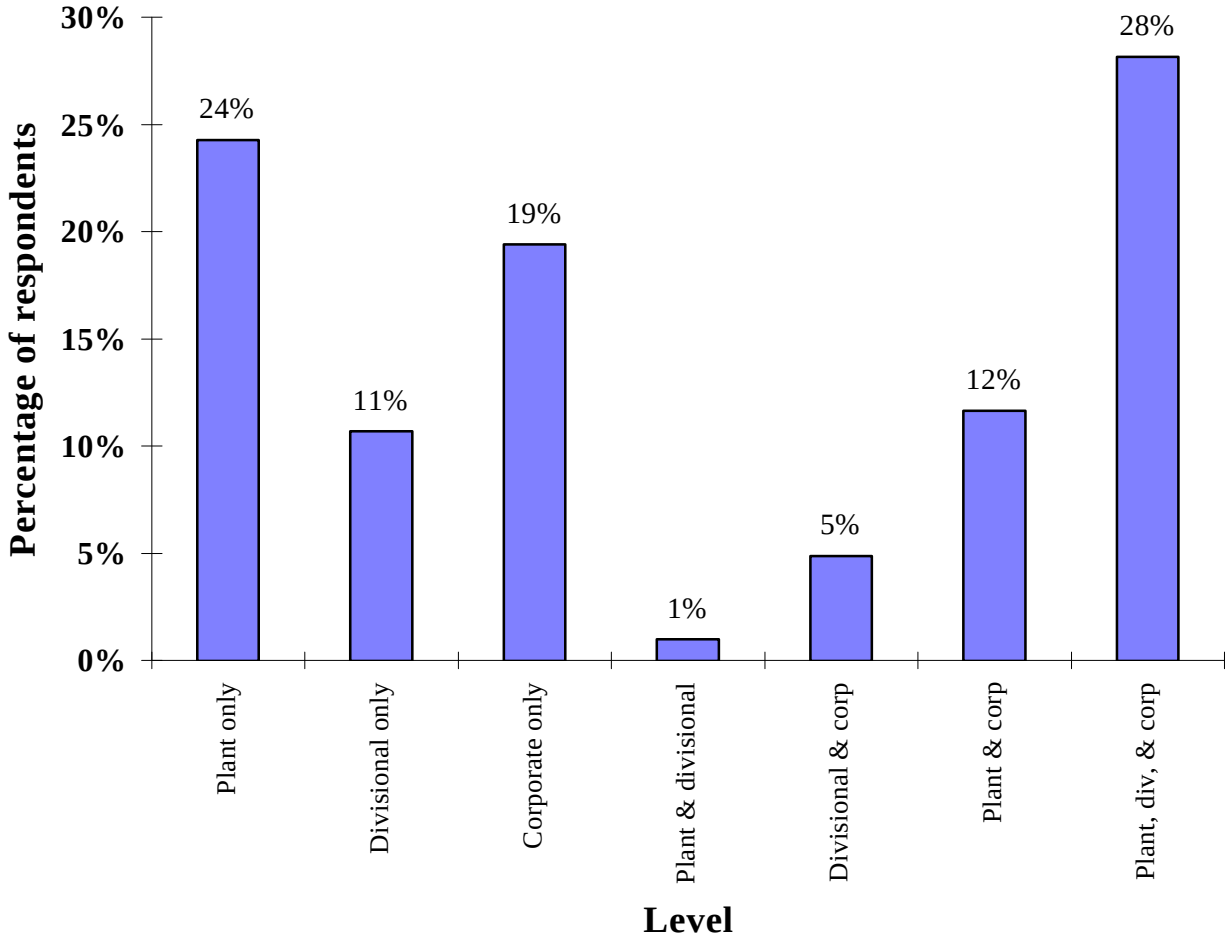


Figure 10. Level at which environmental costs tracked

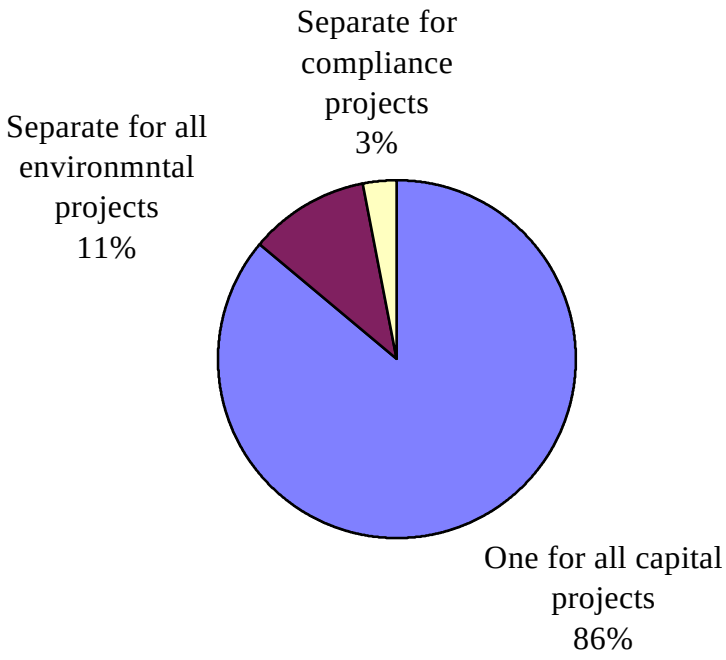


Q17a-c	
Plant only	24%
Divisional only	11%
Corporate only	19%
Plant & divisional	1%
Divisional & corp	5%
Plant & corp	12%
Plant, div, & corp	28%

< $10 million	3
$10 - 100 million	26
$101 - $500 million	22
> $500 million	49
Other	3
Corp, div, plnt, oth	3
Corp, div, & plant	30
Corporate & plant	6
Division & plant	5
Corporate & division	4
Corporate only	17
Division only	16
Plant only	16

Q12 data	
One for all capital projects	86
Separate for all environmental projects	11
Separate for compliance projects	3
Q13 data	
No set cap	40
Cap on total amount	5
Cap on % of total annual corporate bu	1
Varies from year to year	54

Figure 11. Budget pools



Q7 Level capital budgeting occurs in firm				
(n=149)				
Plant	61%			
Division	58%			
Corporate	61%			
Other	5%			
Q17.Level at which environmental costs are tracked				
(n=104)				
Plant	64%			
Divisional	44%			
Corporate	63%			

Figure 12.
Typical annual spending

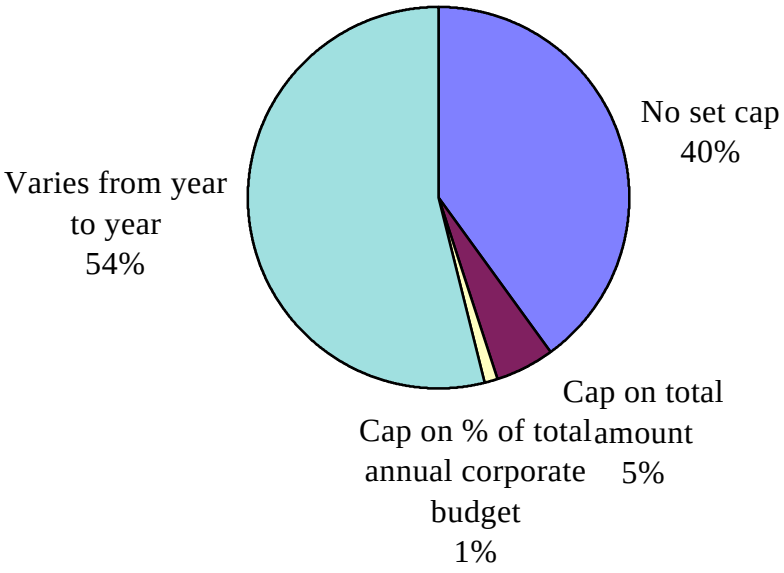
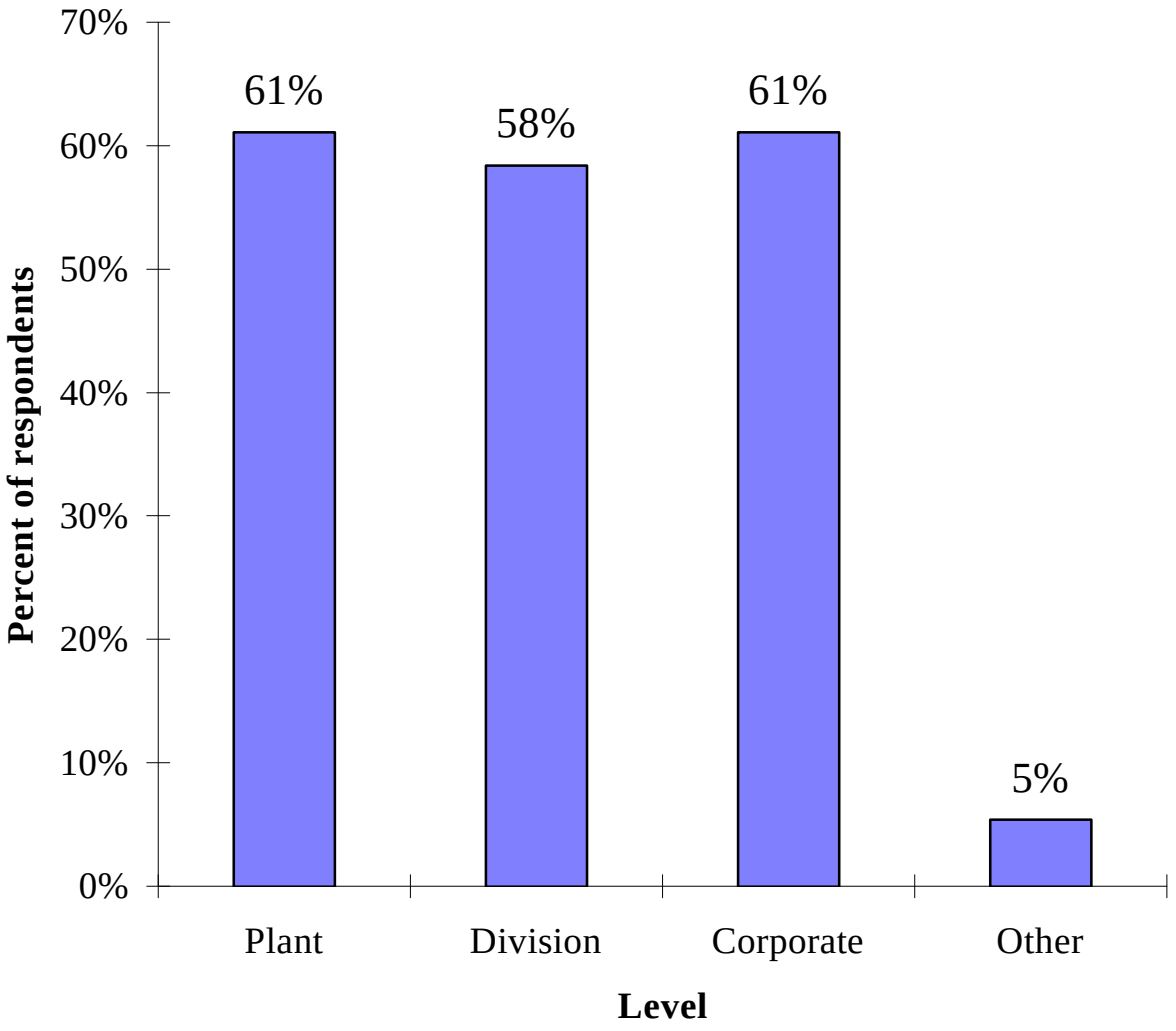


Figure 6. Level at which capital budgeting occurs (multiple answers accepted)



Q1		
20, 21: Food, Tobacco	8	
22, 23: Textiles, Apparel	6	
24, 25, 26: Lumber, Furniture, Paper	6	
27: Printing	3	
28, 29: Chemicals, Petroleum/Coal	12	
30: Rubber/Plastics	1	
32: Stone/Clay/Glass	4	
33, 34: Metals	12	
35-39: Industrial/Electric/Transportation Equipment, Instru	47	

	8
	6
	6
	3
	12
	1
	4
	12
	47

no limit	28
up to $5000	14
up to $10,000	12
up to $50,000	18
up to $100,000	12
other	17
< $0.5 million	5
$0.5 - $1 million	6
$1 - $10 million	38
> $10 million	51

< 200	8%
200 - 999	24%
1000 - 500	26%
>5000	42%

Q2 data	
Corporate	32
Divisional	31
Plant	37
Q11 data	
Corporate finance/accounting	12
Divisional finance/accounting	6
Plant finance/accounting	12
Corporate environmental	6
Divisional environmental	8
Plant environmental	29
We do not use categories	15
Other	12

Figure 12. How Superfund is handled
n = 50

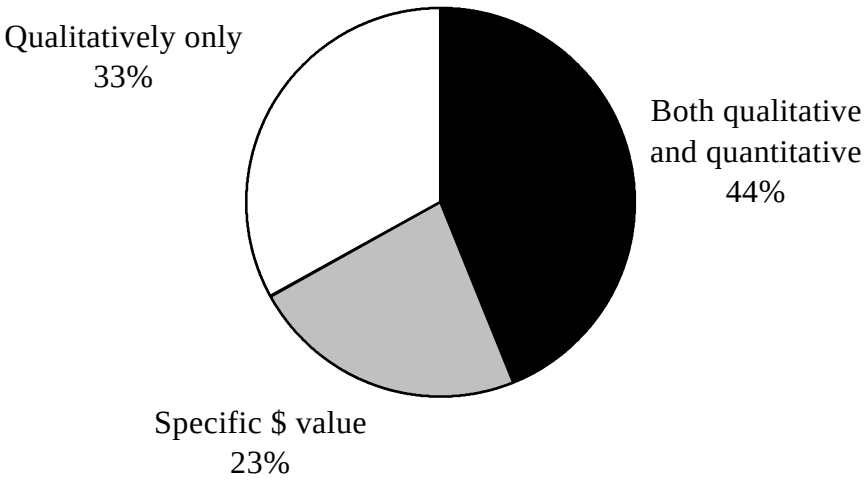


Figure 13. Factors accounted for by Superfund liability assessment method
(n=50, multiple answers accepted)

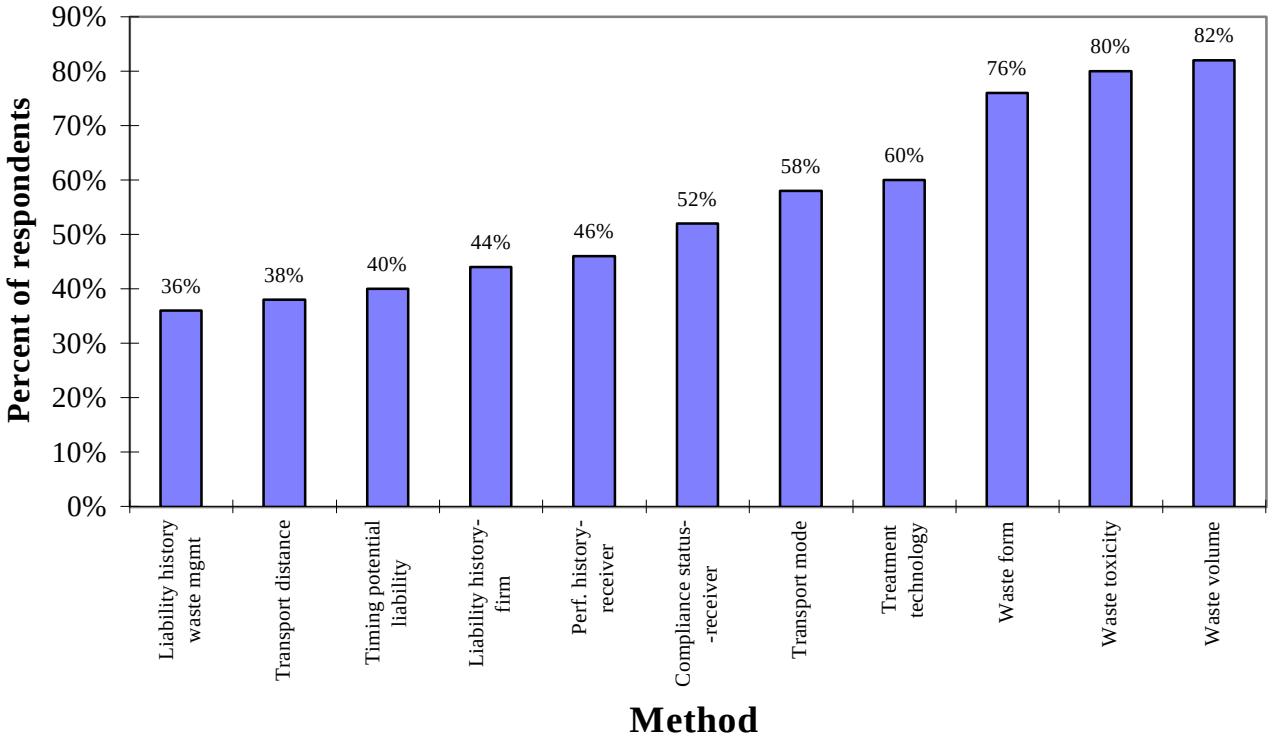


Figure 14. Basis for allocating costs to product/processes from overhead (n=88, two answers accepted)

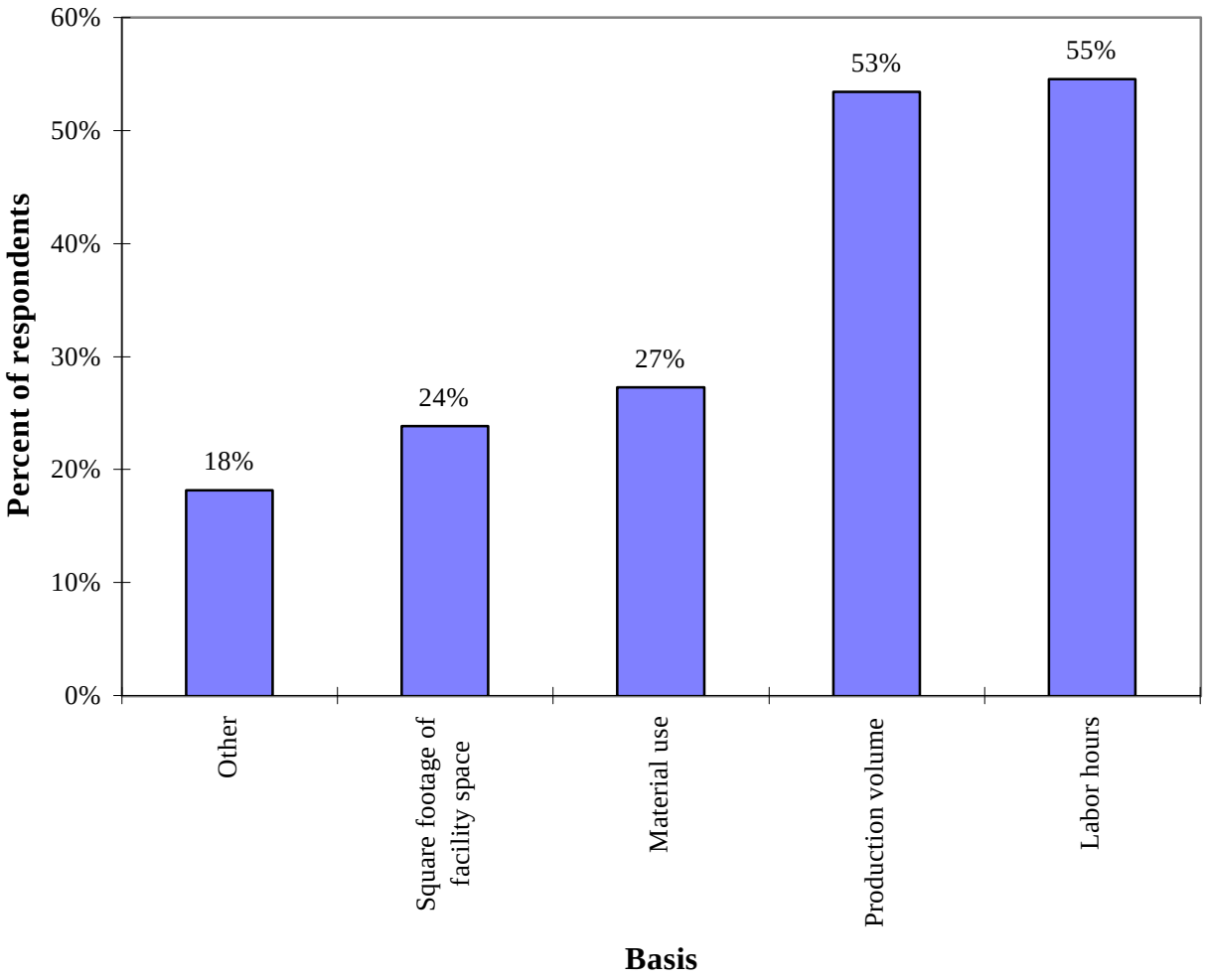


Figure 15. Sources of Cost Information When Assigning Costs to Products/Processes (n=88, three answers accepted)

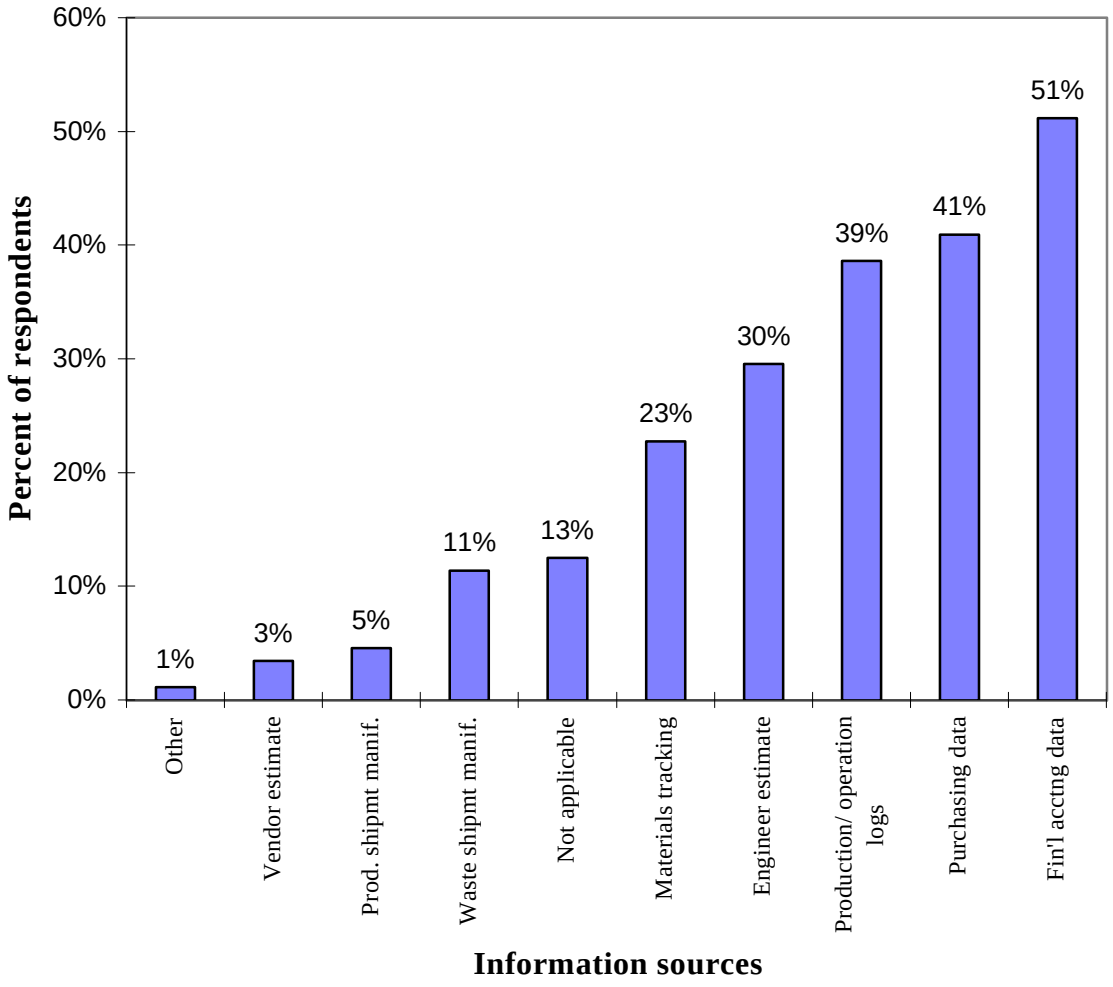


Figure 16. Financial indicators used for screening projects (n=102, multiple answers accepted)

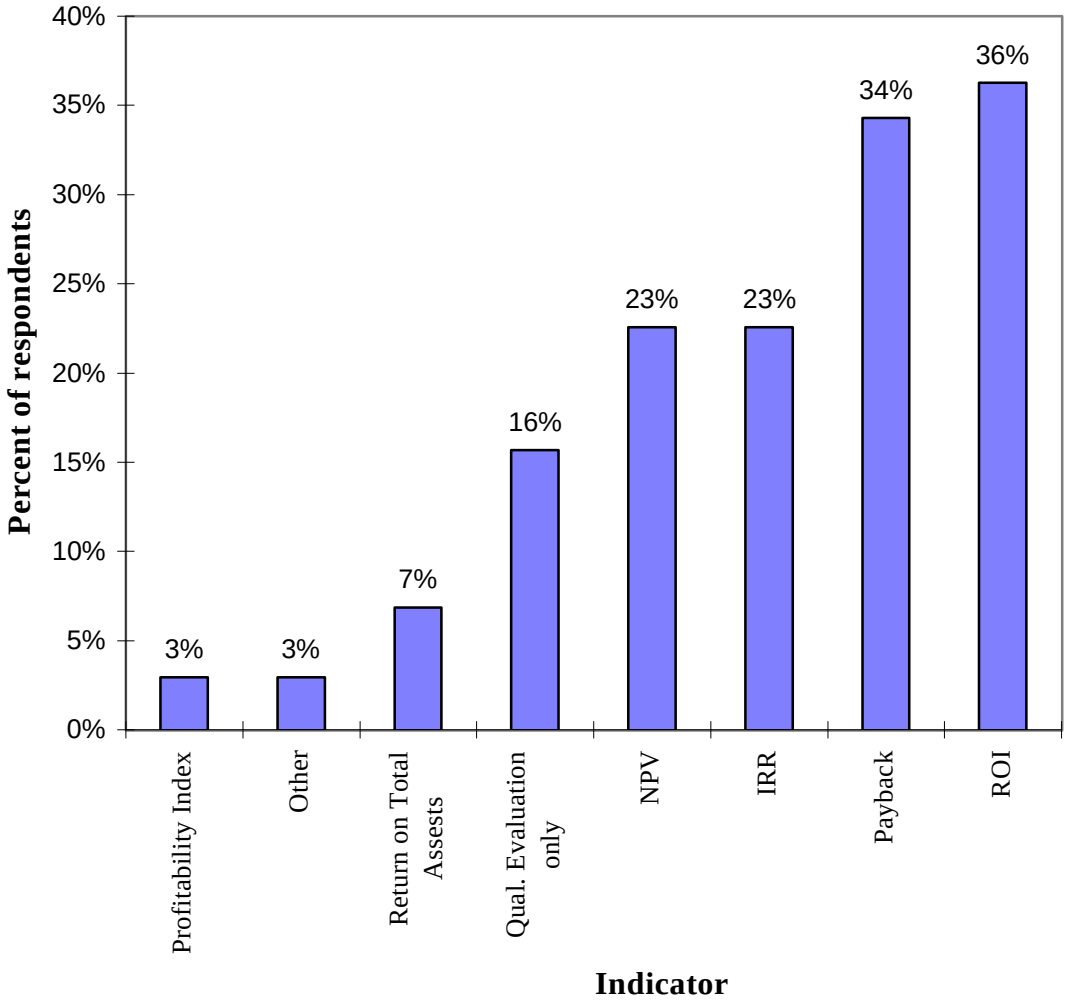


Figure 17. Financial indicators used for full project justification

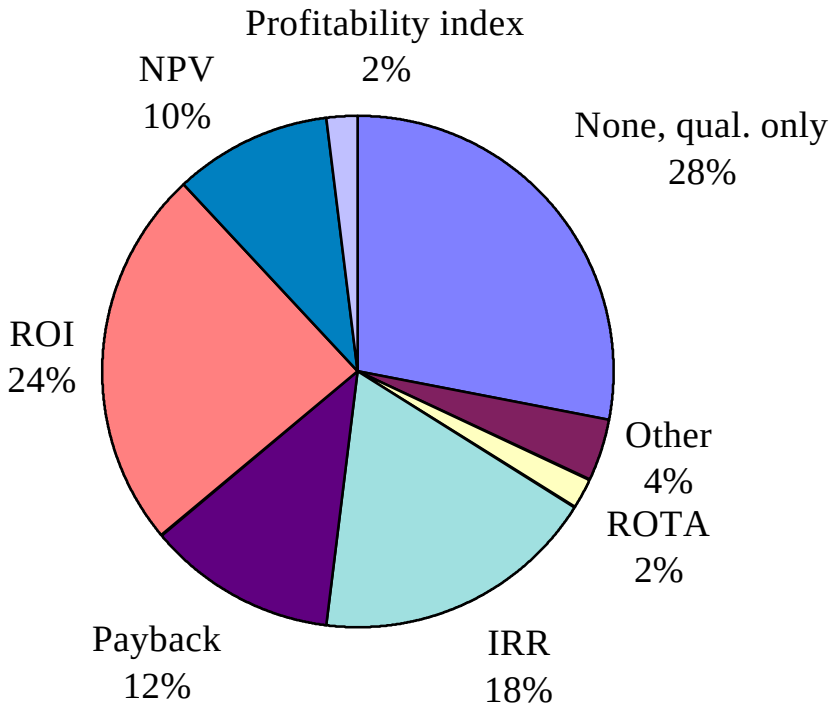


Figure 18. Payback period used, payback users only (n=72)

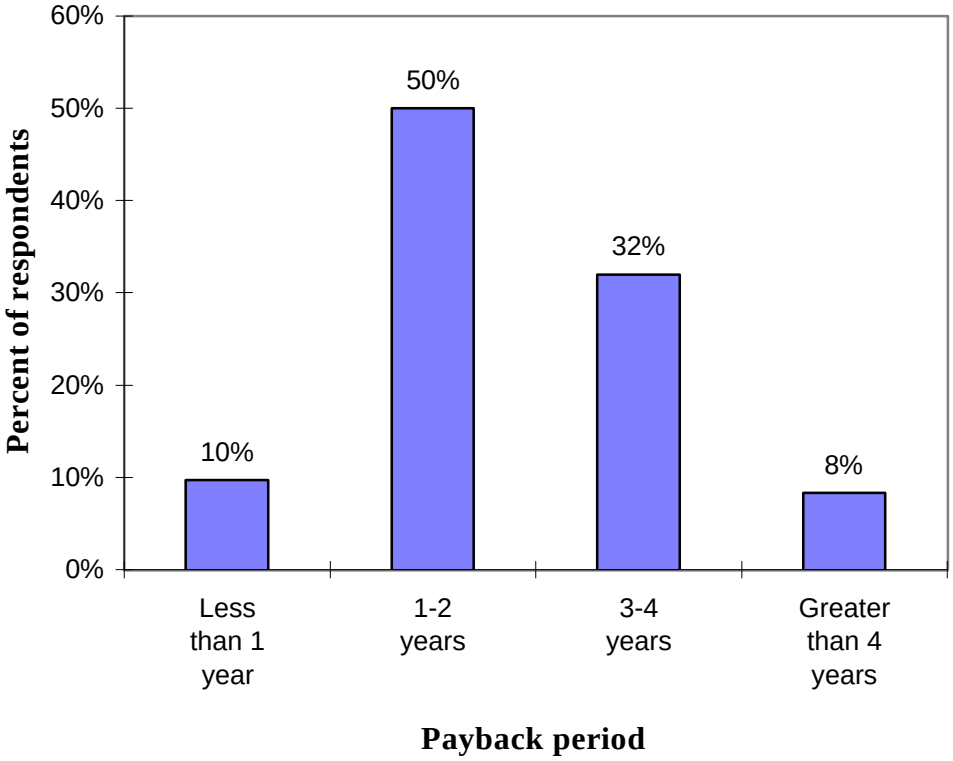


Figure 19. IRR required for approval, IRR users only (n=61)

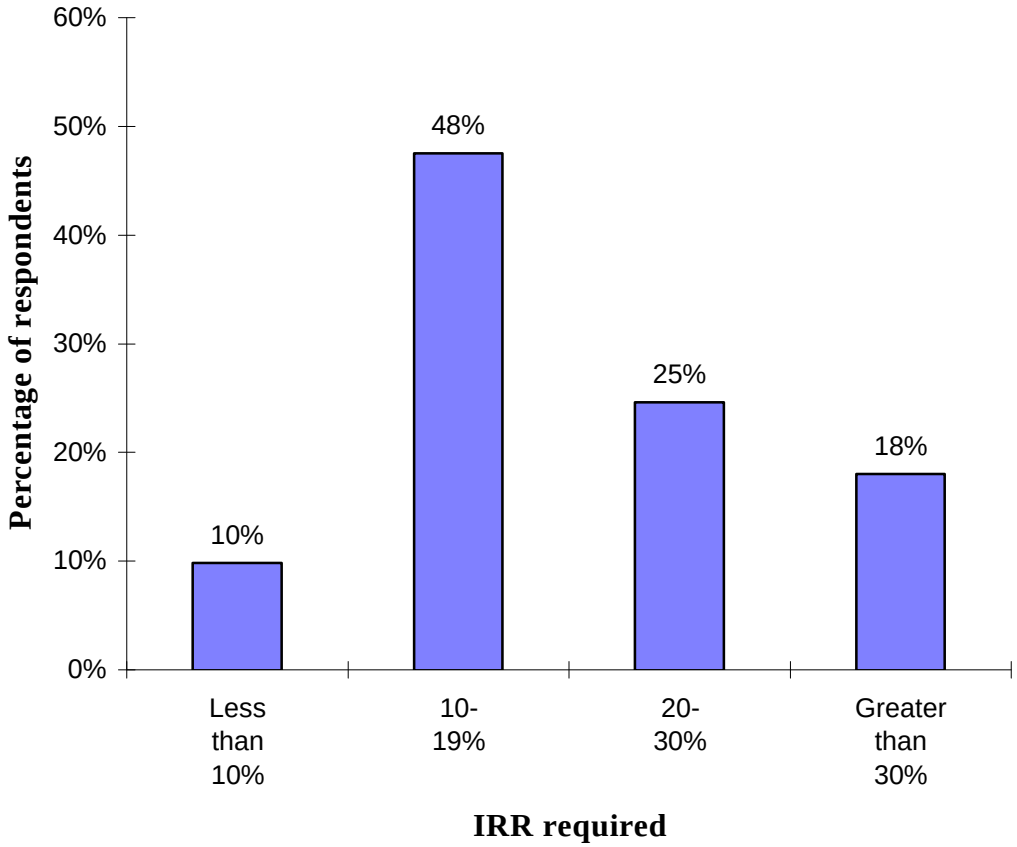


Figure 20. Time horizon for NPV, NPV users only (n=51)

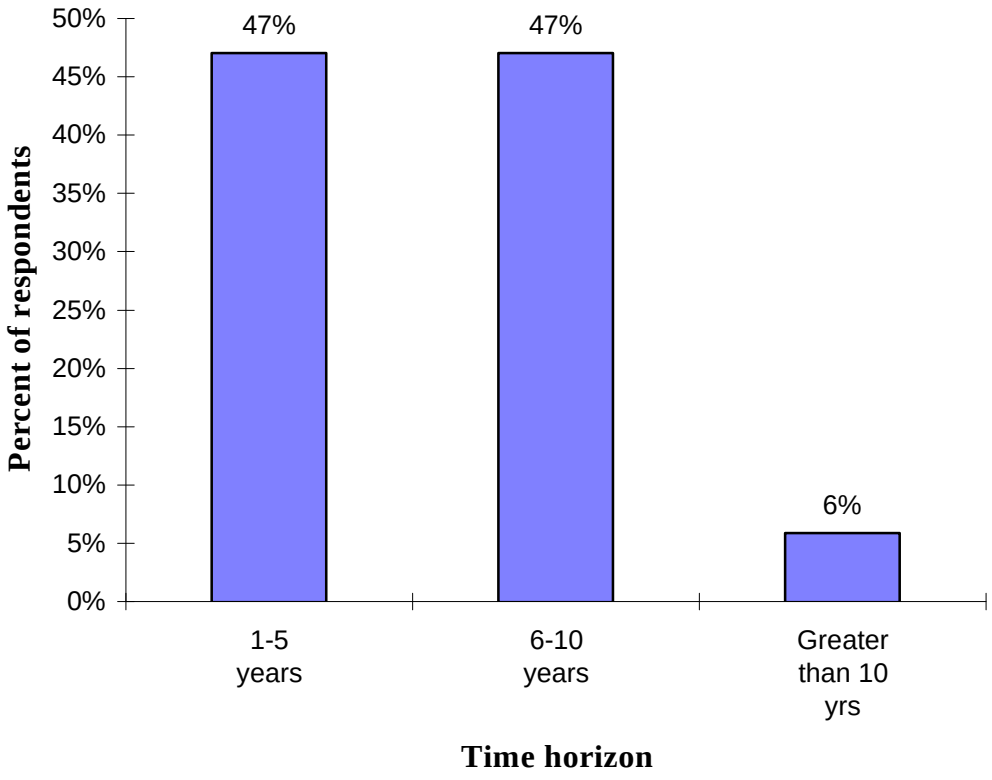


Figure 21. IRR time horizon used, IRR users only (n=65)

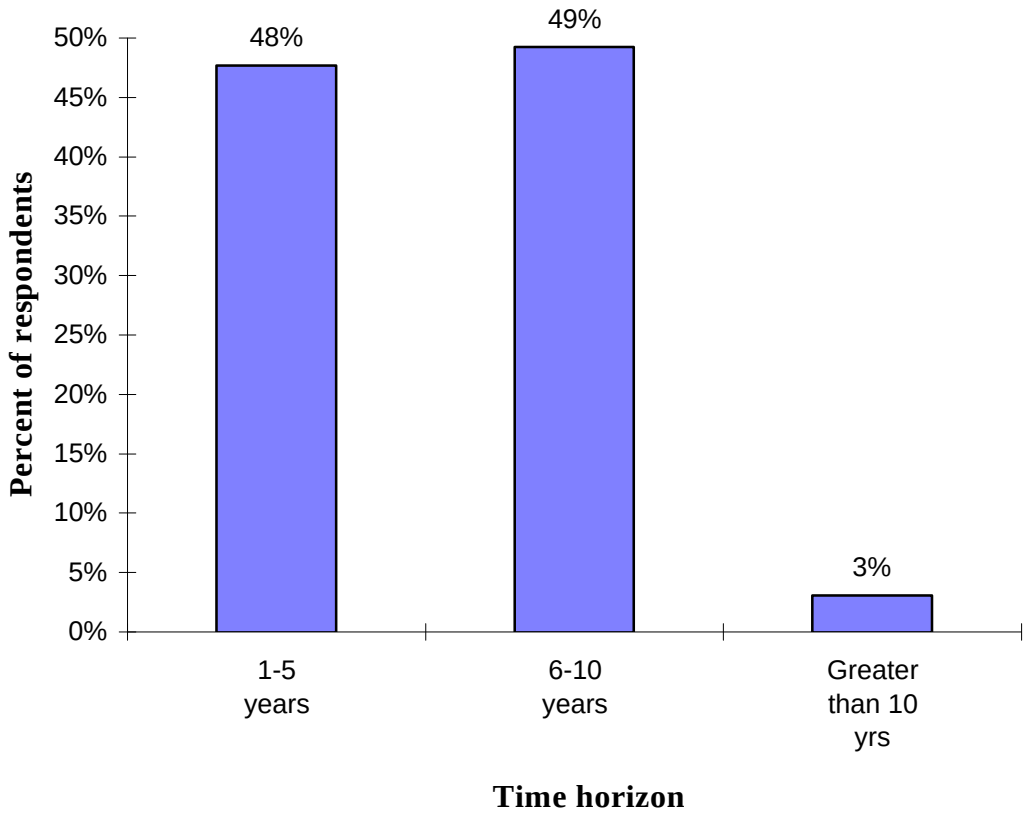
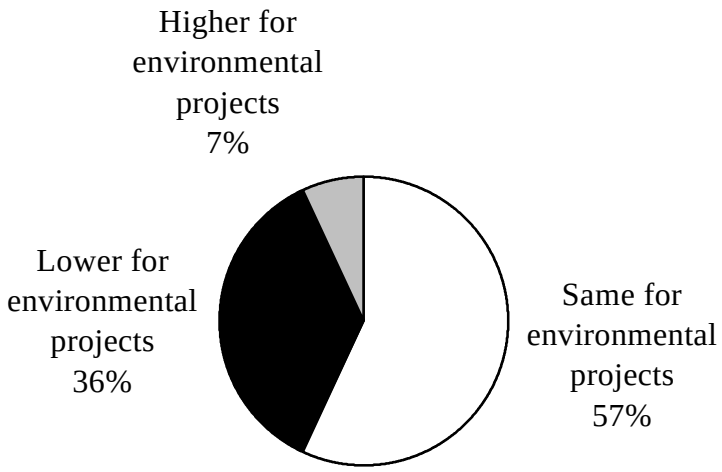


Figure 22. Approval thresholds for environmenta projects compared to non-environmental projects



Q49. Liability assessment method						
(n=50)						
General Electric	0%					
Other	10%					
EPA P2 Benefits	20%					
Internally develo	74%					
Q50. Factors for which liability method accounts						
(n=50)						
Liability history v	36%					
Transport distan	38%					
Timing potential	40%					
Liability history-f	44%					
Perf. history-rec	46%					
Compliance stat	52%					
Transport mode	58%					
Treatment techn	60%					
Waste form	76%					
Waste toxicity	80%					
Waste volume	82%					
Q51. Barriers to quantifying Superfund liability						
(n=149)						
Disclosure to SE	3%					
Subject to toxic	5%					
Other	7%					
Estimating WHE	29%					
Estimating magr	45%					
Estimating IF lia	58%					
Q72. Basis for allocating costs to product/processes from overhead						
(n=88)						
Other	18%					
Square footage	24%					
Material use	27%					
Production volur	53%					
Labor hours	55%					
Q73. Sources of cost information when assigned costs to product or process						
(n=88)						
Other	1%					
Vendor estimate	3%					
Prod. shipmt ma	5%					
Waste shipmt m	11%					
Not applicable	13%					
Materials trackin	23%					
Engineer estima	30%					
Production/ oper	39%					
Purchasing data	41%					
Fin'l acctng data	51%					

Q75. Financial indicator used in initial screening test						
(n=102)						
Profitability Inde	3%					
Other	3%					
Return on Total A	7%					
Qual. Evaluation	16%					
NPV	23%					
IRR	23%					
Payback	34%					
ROI	36%					

q79	
Less than 1 year	10%
1-2 years	50%
3-4 years	32%
Greater than 4 years	8%
q80	
1-5 years	47%
6-10 years	47%
Greater than 10 yrs	6%
q81	
Less than 10%	10%
10-19%	48%
20-30%	25%
Greater than 30%	18%
q82	
1-5 years	48%
6-10 years	49%
Greater than 10 yrs	3%

Both qual. and quant	44
Specific $ value	23
Qualitatively only	33
not important	39
very important	27
somewhat important	34
Same for env. proj	57
Lower for env. proj	36
Higher for env. proj	7
None, qual. only	28
Other	4
ROTA	2
IRR	18
Payback	12
ROI	24
NPV	10
Profitability index	2
	100