

Environmental Sustainability

ACTIVITY-BASED COSTING/MANAGEMENT

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What is the issue?

Consumers, shareholders, and other stakeholders have become increasingly aware of environmental concerns and are pressuring organizations to consider environmental issues and how they relate to the organization's bottom line. Accurately quantifying the costs of environmental impacts and remediation efforts is a challenge.

Why is it important?

Understanding the costs of addressing environmental issues can help organizations make informed decisions which can minimize these costs and create a competitive advantage.

What can be done?

Proven strategic management accounting tools such as activity-based costing/management (ABC/M) can help organizations make better decisions and manage the costs of environmental sustainable business.

GUIDANCE

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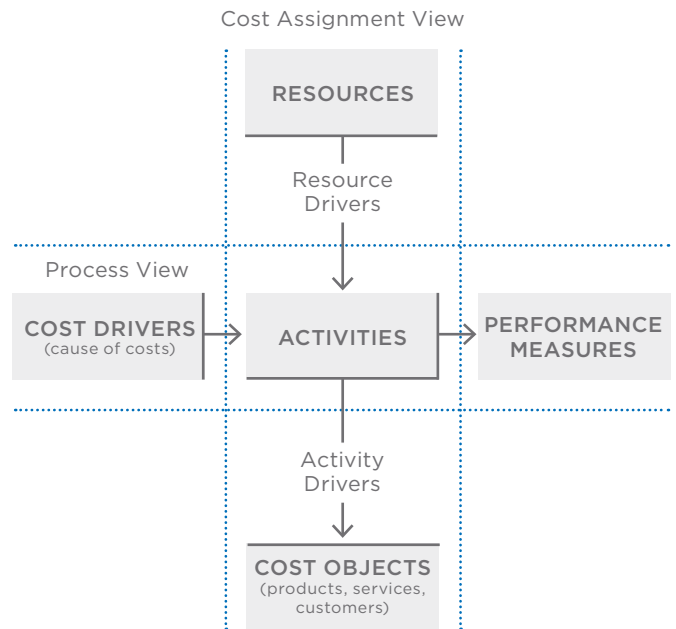
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Introduction

Activity-based costing / management (ABC/M) is an effective management accounting tool that organizations have used for a number of years to better understand and improve their cost structure. The Consortium for Advanced Management – International (CAM-I) pioneered ABC/M including the CAM-I Cross® (Figure 1), which combines the cost assignment view (vertical view of activity-based costing) and process view (horizontal view of activity-based management). Having both views allows an organization to better assign costs and improve its processes to reduce costs.



FIGURE 1 The CAM-I Cross®
(CAM-I’s expanded ABC/M model)



How to Apply ABC/M to Environmental Sustainability

Accurately quantifying environmental emissions — inventorying them over time — is not unlike financial accounting. Organizations can therefore track and manage emissions, such as greenhouse gases (GHG), in much the same way (employing financial management tools and techniques). As with financial accounting, inventory information alone does not provide significant insight into the performance of particular activities. Performance indicators provide information that allow for effective management. In order to make management decisions about resources organizations must understand what drives resources. Organizations achieve this understanding by building models that illustrate how activities drive resources to products and services. These models show how resources are consumed, why they are consumed, and who consumes them.

Numerous papers and articles have highlighted how ABC/M is capable of improving environmental management accounting. The International Federation of Accountants' (IFAC) international guidance document, “Environmental Management Accounting,” discusses current challenges in environmental management accounting. The article points out that environment-related costs are often “hidden” in overhead accounts. The guidance states:

“Organizations have taken different approaches to resolving the issue of hidden environment-related costs. One common solution is to set up separate cost categories or cost centres for the more obvious and discrete environmental management activities. The less obvious

costs that will still appear in other accounts and cost centres can be more clearly labeled as environment related so that they can be traced more easily. An assessment of the relative importance of environment-related costs and cost drivers of different process and product lines, in line with the general practice of activity-based costing (ABC) can help an organization determine whether or not the cost allocation bases being used are appropriate for those costs.”

The “Environmental Management Accounting Procedures and Principles” paper from the United Nations Division for Sustainable Development advocates a similar method:

“Whenever possible, environment-driven costs should be allocated directly to the activity that causes the costs and to the respective cost centres and cost drivers. Consequently, the costs of treating, for example, the toxic waste arising from a product should directly and exclusively be allocated to that product. Many terms are used to describe this correct allocation procedure, such as environmentally enlightened cost accounting, full cost accounting or ABC/M. ABC/M, ‘is a product costing system... that allocates costs typically allocated to overhead in proportion to the activities associated with a product or product family”

Simply put, ABC/M can help move GHG costs from the catch-all line item of “overhead” and directly assign them to particular activities and cost objects which can then be analyzed for performance.

How ABC/M Addresses a Firm's GHG Emissions

Traditional abc/m models can determine the cost of environmental measures. For example, an organization can use environmental costs as the resource inputs (e.g. electrical bills, building lease energy cost estimates, and energy-related portions of supplier selling prices). The model could also include significant

activities that consume the resources and the products and services that consumed the activities. Ultimately, such a model would define an organization's environmental costs in terms of its activities and outputs. The example below shows how an organization can determine the environmental costs of its activities.

TABLE 1 Traditional and Activity-Based View of Environmental Costs

TRADITIONAL VIEW		ACTIVITY-BASED VIEW			
	\$	COST POOL	\$	ACTIVITY	\$
Electricity	80,000	Electricity for HVAC	20,000	Develop schedule	7,500
		Electricity for manufacturing	40,000	Process raw material	15,000
		Electricity to run servers	15,000	Manufacture product	60,000
		Electricity for lighting	5,000	Ship products	22,500
Natural gas	30,000	Natural gas for manufacturing	25,000	HR management	10,000
		Natural gas for HVAC	5,000	Financial management	10,000
Petrol/diesel	25,000	Petrol for vans/forklifts	5,000	IT management	25,000
		Diesel for trucks	20,000		
Work-related travel	15,000	Work-related air travel	10,000		
		Work-related train travel	1,000		
		Work-related motor vehicle travel	4,000		
TOTAL	150,000	TOTAL	150,000	TOTAL	150,000

Alternatively, instead of quantifying resource inputs in terms of costs (e.g. the cost of electricity, natural gas, fuel, or travel), they can be quantified in terms of an environmental measure that is important to the organization, for example, the carbon dioxide equivalent (CO₂e) for each resource. This provides a true picture of the environmental impact of each of the organization’s activities. This activity-based view may look considerably different to the cost view as there is not necessarily a relationship between a resource’s cost and its GHG footprint. In the example below, “ship

products” and “HR management” are big contributors to the organization’s carbon footprint, yet these are not large cost activities compared to “manufacture product” (Table 2). The discrepancy has to do with the type of resource being consumed. In this example, “work-related travel” and “petrol/diesel,” while comparatively inexpensive, have large carbon footprints. And since “ship products” and “HR management” are the biggest consumers of these two resources, they receive the largest proportion of CO₂e.

TABLE 2 Traditional and Activity-Based View of GHG Footprint (Metric Tons of Carbon Dioxide Equivalent (MTCO₂e))

TRADITIONAL VIEW		ACTIVITY-BASED VIEW			
	MTCO ₂ e	COST POOL	MTCO ₂ e	ACTIVITY	MTCO ₂ e
Electricity	20,500	Electricity for HVAC	5,000	Develop schedule	3,750
		Electricity for manufacturing	10,000	Process raw material	3,750
		Electricity to run servers	3,500	Manufacture product	12,750
		Electricity for lighting	2,000	Ship products	22,500
Natural gas	3,500	Natural gas for manufacturing	2,500	HR management	13,250
		Natural gas for HVAC	1,000	Financial management	9,750
Petrol/diesel	25,000	Petrol for vans/forklifts	5,000	IT management	10,250
		Diesel for trucks	20,000		
Work-related travel	27,000	Work-related air travel	15,000		
		Work-related train travel	2,000		
		Work-related motor vehicle travel	10,000		
TOTAL	76,000	TOTAL	76,000	TOTAL	76,000

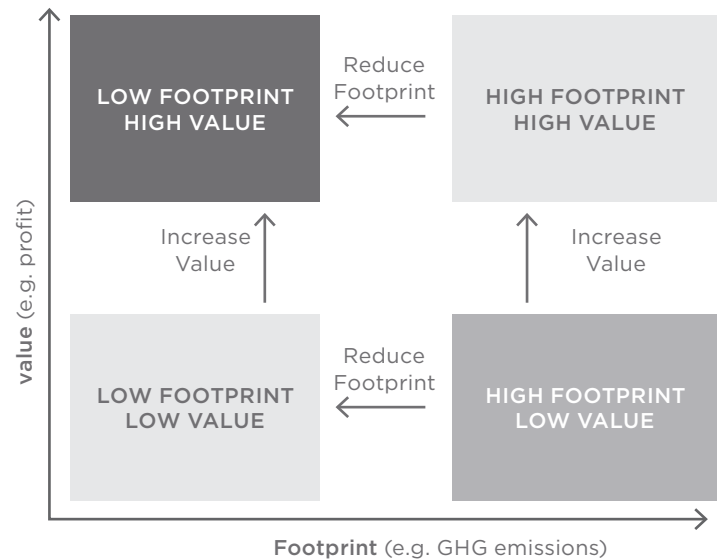
This methodology for capturing GHG emissions data differs from many non-ABC/M methodologies in that it truly captures overhead CO₂ in a meaningful way. However, the true power of an ABC/M methodology is in its integration of multiple value items. Consider an ABC/M model that combines cost, revenue, and GHG emissions as value items. Each of these value items flows through the model such that activities and products/services have a cost, revenue, and GHG footprint.

TABLE 3 Traditional and Activity-Based View of Cost Per CO₂e

TRADITIONAL VIEW		ACTIVITY-BASED VIEW			
	COST PER MTCO ₂ e	COST POOL	COST PER MTCO ₂ e	ACTIVITY	COST PER MTCO ₂ e
Electricity	3.90	Electricity for HVAC	4.00	Develop schedule	2.00
		Electricity for manufacturing	4.00	Process raw material	4.00
		Electricity to run servers	4.29	Manufacture product	4.71
		Electricity for lighting	2.50	Ship products	1.00
Natural gas	8.57	Natural gas for manufacturing	10.00	HR management	0.75
		Natural gas for HVAC	5.00	Financial management	1.03
Petrol/diesel	1.00	Petrol for vans/forklifts	1.00	IT management	2.44
		Diesel for trucks	1.00		
Work-related travel	0.56	Work-related air travel	0.67		
		Work-related train travel	0.50		
		Work-related motor vehicle travel	0.40		

Such a model provides a clear perspective on how the GHG footprint of particular products, services, and activities relates to profit (or anything else the organization values). Decision makers will be able to see (Figure 2) what has a high GHG footprint but little value as well as what has a low GHG footprint but high value. Managers will have a roadmap for prioritizing practices that yield the lowest GHG footprint and the most value. A company may extend this further to cover its supply and selling chains.

FIGURE 2 The Relationship Between Value Versus Footprint



Using ABC/M to track environment-related costs and measures allows an organization to incorporate sustainability into its ongoing management initiatives. ABC/M, already familiar to professional accountants, provides a transparent model for distributing GHG emissions through an organization to the final products/services. It is also an auditable and disciplined modeling approach (rather than an ad-hoc approach) for reporting the true emissions profile of an organization's individual products or services. ABC/M helps management actively manage its activities or processes to reduce emissions through more efficient techniques, greener sources of energy, or buying or selling emission permits. The benefits of this approach include:

- Identifying the GHG footprint of particular products and services;
- Providing a detailed understanding of the energy consumption and emissions of particular activities within a company;
- Better defining the emissions “boundaries” a company is responsible for;
- Understanding how energy and GHG intensity affect cost and how those costs are passed from producer to consumer;
- Building a valuable knowledge base to help measure and justify future corporate, environmental, and financial decisions;
- Enhancing a company's ability to evaluate and compare GHG intensity and cost implications of activities, products, and services;
- Articulating GHG-related costs, risks, and opportunities to shareholders and other stakeholders;
- Engaging staff with targeted energy reduction steps;
- Setting an example and an expectation for suppliers and contractors to be just as environmentally conscious;
- Enhancing the company's public profile and reputation as a good corporate citizen.

Is your organization ready to measure and manage its GHG emissions?

An organization must consider several factors before it begins using ABC/M to monitor and evaluate its GHG emissions. Here are some of those considerations:

QUESTIONS FOR CONSIDERATION	WHY THIS QUESTION IS IMPORTANT	SAMPLE RESPONSES	
		"MORE LIKELY TO SUCCEED"	"LESS LIKELY TO SUCCEED"
<p>IS THERE SUPPORT THROUGHOUT THE ENTIRE ORGANIZATION TO IMPLEMENT THIS INITIATIVE?</p>	<p>For a sustainability initiative to have the greatest impact, it must be undertaken by the entire company. If there is "buy-in" from all relevant decision makers, the organization is ready to undertake such an initiative.</p>	<p>This is core to our business strategy, and I give annual status reports to our executive teams.</p> <p>We feel that making improvements here will ultimately improve our efficiency and our bottom line.</p> <p>Everyone is on board; it's part of our culture.</p>	<p>Our organization has traditionally been closed to the idea; however, there seems to be a slow change in our peoples' perspective.</p> <p>Right now we're looking at the landscape and it seems like all of our peers are going this route and we don't want to be left out.</p> <p>While this is not part of our culture, I am sure we can convince people to participate.</p>
<p>DO THE PEOPLE SPEARHEADING THE INITIATIVE HAVE THE PROPER AUTHORITY TO MAKE CHANGE WITHIN THEIR ORGANIZATION?</p>	<p>For maximum benefit, a sustainability initiative must be fully integrated into an organization's decision-making processes. To a large extent, the success of the initiative will be determined by the ability of those in charge to directly influence key decisions.</p>	<p>I'm in charge of facilities and I work very closely with Tom in finance and Bob, who is in charge of fleet management, to implement what we need to hit our CEO's reduction target. If it makes sense, we can get it done.</p>	<p>My team acts as an advisor to the rest of the organization and delivers important information to the board. Management of energy is just one part of what I do. Much of our fleet management is controlled by a colleague I don't know very well.</p>

QUESTIONS FOR CONSIDERATION	WHY THIS QUESTION IS IMPORTANT	SAMPLE RESPONSES	
		"MORE LIKELY TO SUCCEED"	"LESS LIKELY TO SUCCEED"
HOW WILL THE INFORMATION BE USED AND WHO WITHIN THE ORGANIZATION WILL USE IT?	Sustainability information can be used in multiple ways, from reporting GHG emission levels to tracking emission trends and analyzing emission reduction and cost performance. Articulating the purposes for information clarifies an organization's plans for assessing its sustainability measures and speaks to the level of influence decision makers have in driving the initiative.	Our regional office managers need to know a couple of very important metrics we've defined as key to achieving our reduction goals. We also need to provide the leadership of our core business with details on where their emissions are coming from and what they can do to reduce them.	We've only just started measuring our footprint, however, it's unclear how we're supposed to get there and how exactly we'll manage performance. Once we start to see the numbers, I think we'll have a better idea of where we can make improvements.

QUESTIONS FOR CONSIDERATION	WHY THIS QUESTION IS IMPORTANT	SAMPLE RESPONSES	
		"MORE LIKELY TO SUCCEED"	"LESS LIKELY TO SUCCEED"
DOES THE ORGANIZATION HAVE THE CAPACITY TO GET ENERGY CONSUMPTION INFORMATION FROM INDIVIDUAL RESPONSIBILITY CENTRESE (BUILDINGS, VEHICLES, ETC.) AND ACTIVITIES?	The ability to carry out ABC/M is contingent on being able to collect and analyze unit information from individual responsibility centres. Organizations must be able to collect information from each of its responsibility centres to effectively assess the relative emissions, cost, and efficiency of each centre.	Our organization has installed a smart grid system that tracks energy consumption for each individual building at our office park. This allows us to track the consumption and relative efficiency of each building. Our organization does not utilize smart grid technology but we do have good metrics we can use to approximate energy consumption in each of our buildings/facilities.	To generate our GHG footprint, we get our organization's total energy consumption from the power company. We do not have the technology to get energy consumption data at the facility level, nor do we have metrics we can use to approximate energy consumption at each of our facilities.

QUESTIONS FOR CONSIDERATION	WHY THIS QUESTION IS IMPORTANT	SAMPLE RESPONSES	
		"MORE LIKELY TO SUCCEED"	"LESS LIKELY TO SUCCEED"
HOW MANY SUPPLIERS DOES THE COMPANY USE? HOW CHALLENGING WILL IT BE TO GET GHG EMISSION INFORMATION FROM THEM?	Tracking and reporting Scope 3 GHG emissions (e.g. those resulting from waste disposal, purchased materials, business travel, fuel usage for transporting outputs, and outsourced activities) requires receiving information from a company's supply chain. The company must be able to get this information in order to effectively track Scope 3 emissions. It is possible to build a GHG emissions model that does not include Scope 3 emissions, however, eventually it is recommended that any model built include Scope 3 emissions. As such, a "less likely to succeed" answer to this question should not deter an organization from going forward with modeling Scope 1 and Scope 2 emissions.	In reality, this is where we can make our biggest improvements. We have welcomed the emergence of Scope 3 because it gives us a chance to expand the playing field to areas undergoing massive improvement, areas each employee can impact.	We see Scope 3 as important, but the regulations are just now coming together, many of which are still abstract and lack direction. Plus, the data around this is very scarce. We're having a hard enough time collecting data for Scope 1 and Scope 2.

How to Move Towards a GHG Model Using ABC/M

How does an organization move from simple GHG compliance reporting (e.g. using a spreadsheet) to managing emissions with an enduring model? Insights from previous ABC/M implementations suggest there are four key steps:

1. Define the purpose, boundary, and scope of the model;
2. Find data sources necessary to support the model;
3. Build the model;
4. Document and use the model.

STEP 1

Define the Purpose, Boundary, and Scope of the Model

Before taking steps to build and implement ABC/M to capture GHG emissions, it is important to ensure the model has support throughout the organization. There should be a framework for supporting the ABC/M including designated financial and operational points of contacts for each business unit.

It is important for the organization to define the model's boundary (i.e. what specific entities it will monitor) and scope (i.e. what types of emissions it will monitor). Scope may include monitoring direct, indirect, or supply chain emissions. Once an organization selects an approach for consolidating GHG emissions it must use that approach consistently.

Boundary

The World Resources Institute's (WRI) GHG Protocol outlines two distinct approaches organizations can use to define boundaries and consolidate GHG emissions: the equity share approach and control approach. Under the equity share approach, an organization accounts for GHG emissions from operations according to each operation's share of equity in the operation. Under the control approach, a company accounts for 100 per cent of the GHG emissions based on which operations it has control over. The company does not account for GHG emissions from operations it owns an interest in but has no control over. In a voluntary setting, a company can use either approach as long as it uses that approach consistently. Where a reporting company wholly owns all its operations, its organizational boundary will be the same under both approaches. However, for organizations with joint operations, the organizational boundary and the resulting emissions may differ between the two approaches.

Another consideration for organizations defining the scope and boundary of an ABC/M model is that many jurisdictions have local and industry-specific standards organizations must follow.

FIGURE 3 Description of Scope 1, 2 and 3 GHG Emissions

	SCOPE 1	SCOPE 2	SCOPE 3
EMISSION TYPE	DIRECT Emissions from within the organization	INDIRECT Emissions from purchased electricity	EMBODIED Emissions embedded in inputs
EXAMPLES	<ul style="list-style-type: none"> • Electricity generation • Industrial processes • Fuel usage for transporting inputs • Fugitive emissions • On-site waste 	<ul style="list-style-type: none"> • Electricity consumption 	<ul style="list-style-type: none"> • Waste disposal • Purchased materials • Business travel • Fuel usage for transporting outputs • Outsourced activities
SUPPLY CHAIN	Impacted	Impacted	Impacted
MANDATORY REPORTING	Report (if > threshold)	Report (if > threshold)	Voluntary
EMISSIONS TRADING	 LIABLE (if > threshold and at point of obligation)	Impacts compensation calculations only	None
DIFFICULTY IN MODELING	Easy	Easy	Difficult

Source: KPMG Australia, July 2009.

Scope

Carbon emissions have been divided into three scopes:

- **Scope 1**— direct emissions from within the organization;
- **Scope 2**— indirect emissions through the use of electricity;
- **Scope 3**— while not yet completely defined (and not yet required for reporting purposes), Scope 3 emissions stem from organizational activities such as waste disposal, purchased materials, and business travel.

Current best practices indicates an organization start by modeling Scope 1 GHG emissions then add in Scope 2 GHG emissions. As knowledge and maturity

in the modeling process increases, Scope 3 emissions can be added. This allows the organization to leverage what has already been built.

STEP 2 Find Data Sources Necessary to Support the Model

A model's supporting data comes from both internal and external sources. Most organizations are in the early stages of environmental management and much of the required data may prove elusive. Therefore any model must be able to account for automated electronic source data collection as well as manual surveys or data entered directly into the model. The latter two are not ideal mechanisms for sourcing data: automated source data population should always be the end goal.

Several types of data are used for calculations in GHG emissions models:

- **General ledger information (expenses and revenue):** This data constitutes the expenses entered into the model. It includes discretionary expenditures, payroll expenses, supplier and raw material expenses, and other costs incurred by the organization.
- **Human resources information:** This data is typically used to determine where personnel work, what work they are performing (via job codes), and sometimes the hours they work on specified tasks.
- **Emissions data:** The measurement of this data, while sometimes achieved directly via sensors in smokestacks or exhaust piping, usually requires two key pieces of information.
- **Emissions factors:** The amount of emissions associated with a given activity (e.g. CO₂e per kWh or CO₂e per mile for a specific engine type). Emissions factors will vary based on geography and other variables. For example, electricity sourced in the northwest United States, which generates a large amount of hydroelectric power, will generally have lower emissions per kWh than electricity sourced in the mid-west United States, which predominately uses coal to generate electricity. Emissions factors are usually provided by a third party.
- **Resource/activity metric information:** The volume of “activity” that creates the emissions. For example, the number of miles a truck was driven (Scope 1 emissions) or the amount of electricity an activity consumes (Scope 2 emissions). In an IT organization, metrics would include CPU usage and HDD utilization.

Transactional data (emissions factors and activity metrics) “drives” emissions through an ABC/M model and serves two primary purposes: it increases automation, which speeds model development, and represents

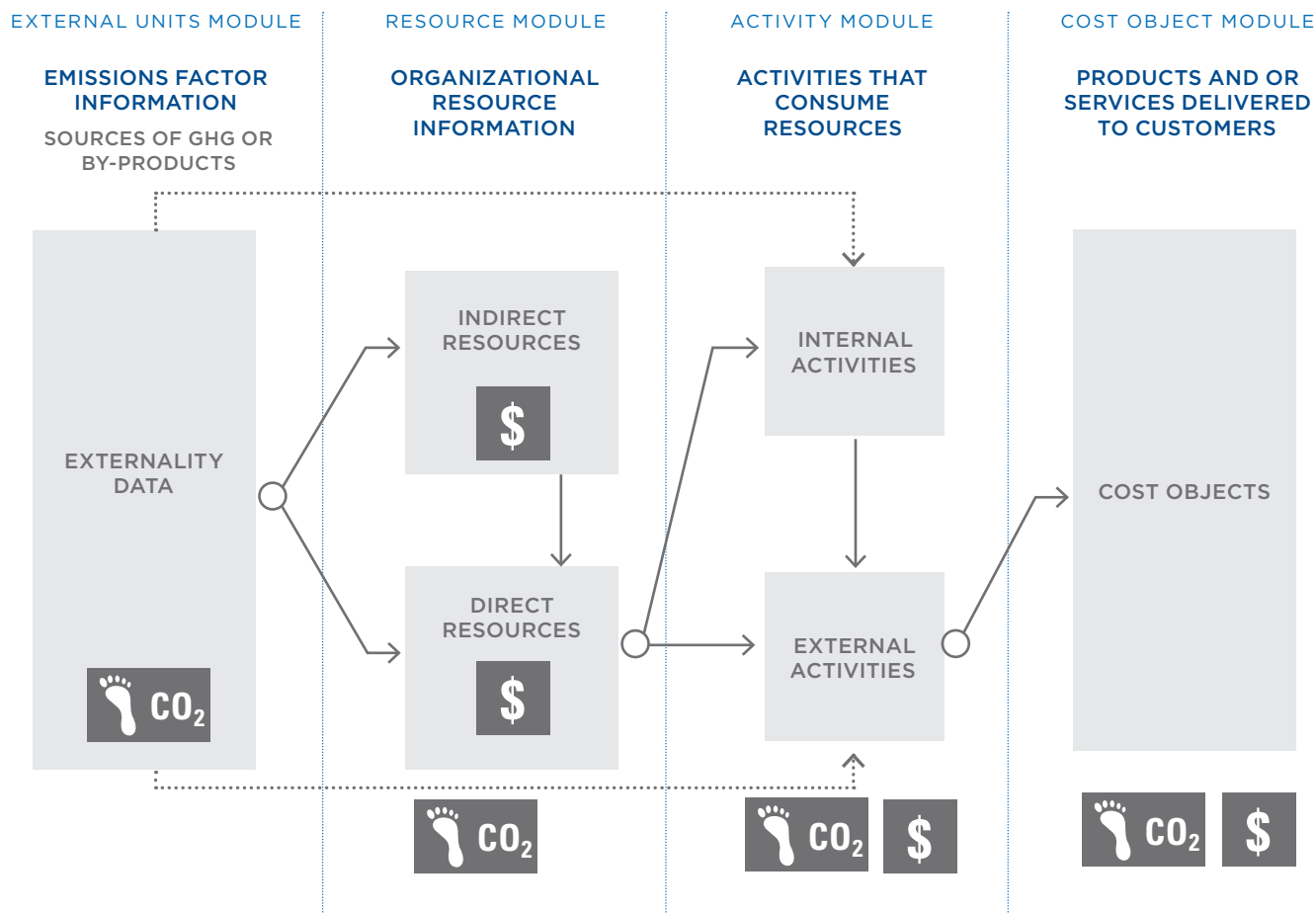
the best reflection of what drives the business. Ideally, automated mechanisms should capture transactional drivers and enter them into the model.

STEP 3 Build the Model

Once the purpose, boundary, scope, and data sources of the model have been identified, it is time to build the ABC/M GHG emissions model. While the exact structure of a model can vary, Figure 4 outlines a generic structure and how it functions. An activity-based GHG emissions model will have at least four modules, each of which would be structured to account for factors like organizational hierarchy and geography.

- **External units module:** Contains all of the model’s emissions factor information;
- **Resource module:** Contains organizational resource information (e.g. general ledger and human resources data). The scope, boundary and purpose of the model will determine the amount of data in this module and how it is structured. This module consumes the emissions factor information from the external units module;
- **Activity module:** Contains the activities of the organization, which consume the resources in the Resource Module. A good model intra-modularly allocates overhead activities to the activities that directly produce products/services. Activities can be defined at a variety of organizational levels from high-level strategic to low-level operational. The amount of detail used will depend on many factors including: the purpose of the model, required granularity and data availability.
- **Cost object module:** Contains the products and/or services of the organization. Cost objects consume the activities performed in the creation of the organization’s products/services.

FIGURE 4 Models of ABC/M GHG Emissions



Once these modules have been established, costs or externality data (e.g. emissions data) are assigned to cost objects consistent with modular relationships. These assignments are highly dependent on an organization’s specific criteria (e.g. activities, cost objects, needs, and available data), so there is not a “one size fits all” solution. In most instances, modular relationships “flow” sequentially from left to right; however, in some instances, indirect resources will be allocated to direct resources, which will then be allocated to the next module. In other instances, internal activities will be used to assign resources to external activities, which will then be assigned to the next module. Costs, as suggested by the model in Figure 4, will only arise as a result of resource consumption. Externalities, by definition, will only arise in the external units module.

STEP 4 Document and Use the Model

A well-documented system (e.g. documenting the purpose, boundary, scope, data sources, and tools) helps reduce the impact of personnel changes and facilitates a model’s auditability.

The methodology is the cornerstone of a model on which a system is developed because it guides the way activities are defined, the way resources are collected and assigned, and the way product/customer costs are calculated. Creating a methodology manual will help model users who want to understand the fundamentals of costing results so they can make better use of the data. If an organization wants to make changes to the model, it should refer to the manual to ensure the changes are consistent with the model’s underlying methodology and that the methodology remains coherent.

The first step in transforming the methodology into practice is to derive a set of rules from the methodology, rules that document how model resources, activities, and products are to be treated (e.g. defined, classified, valued, stored, and processed).

Management systems typically fail because they are not used appropriately after they are built. The exact use of an emissions model depends on its defined goals.

A good model will be multidimensional, facilitating reporting and analysis. Each dimension essentially provides a different perspective for viewing the data.

The use of model data will vary depending upon the stakeholder's perspective and needs. IT departments, for example, will likely be concerned about the energy consumption of its equipment and use a model to monitor this (with the goal of reducing overall consumption). Executive management will likely want the model to supply information required for regulatory reporting. ABC/M can help trace the activities that contributed to a product or service's large carbon footprint.

Summary

Understanding an organization's cost base has always been a critical element of doing business. The rise of environmental awareness is pushing organizations to go beyond simply understanding internal, line item costs. Companies must now understand that many of its behaviors have real environmental impacts and costs.

ABC/M has become an accepted form of cost analysis. Many organizations already have ABC/M models in some form and extending these models to account for non-cost measures is relatively simple. Combining cost measures and environmental measures within a single ABC/M model provides a common "language" for the basis of cost/profit and managing environmental measures. To manage carbon emissions or water usage without considering cost and profit is to manage half the issue. However, more often than not, organizations fail to capture costs in the same "language" as

environmental measures, which makes determining the impact of increased environmental stewardship on profit difficult. A well-constructed ABC/M model simplifies the process.

Ultimately an organization must view GHG emissions and impacts the same way it views costs because, ultimately, GHG emissions translate into cost. When an organization understands and manages its GHG emissions, it better controls its costs and has a positive environmental impact. ABC/M is just the tool to give organizations these abilities.

About CAM-I

The Consortium for Advanced Management—International (CAM-I) is a research organization consisting of companies and academia who collaborate to study and solve cost, process and performance management problems and critical business issues common to the group. For more information, visit:

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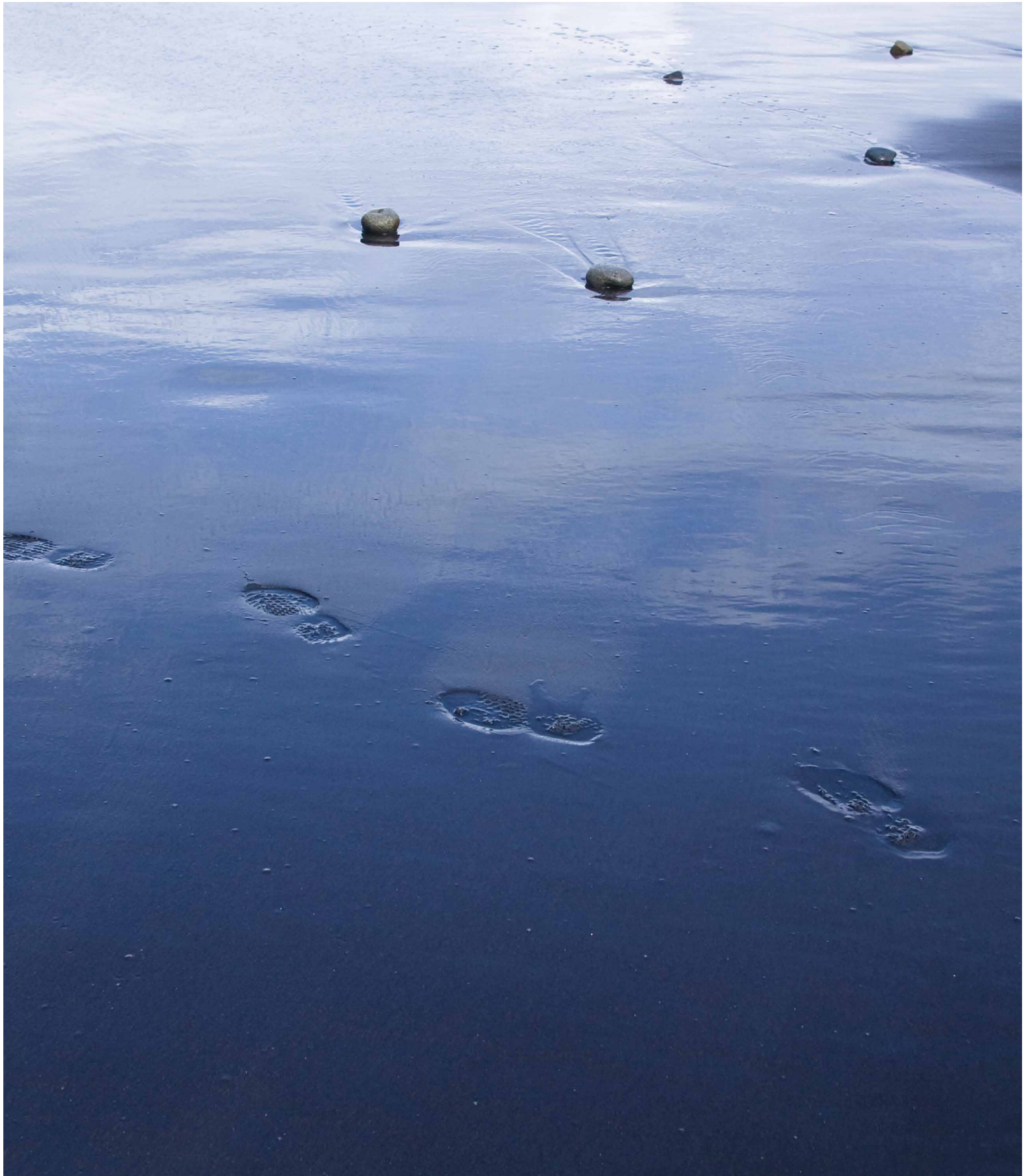
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This publication is one in a series on *Environmental Sustainability*. Guidance and Case Studies are also available on our website. For additional information, please contact Carol Raven, Principal, Strategic Management Accounting & Finance at 416-204-3489 or email craven@cpacanada.ca



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