Second-generation Cost Models
beyond ABC, new product/service cost models improve accuracy and encourage entrepreneurship

N. Dean Meyer

203-431-0029
http://www.FullCost.com

Internal service providers interested in calculating the cost of their products and services have spawned a plethora of cost models, ranging from home-grown spreadsheets to sophisticated products based on the concept of activity-based costing (ABC). *[1]* But most cost models introduce significant distortions in the calculations, to the point where they may be dangerously misleading.

Recently, a new kind of cost model, termed "second-generation," has emerged. Empirical evidence from pioneering implementations shows far greater accuracy, as well as other benefits such as cost savings and positive impacts on organizational culture.

Why Calculate Internal Product/Service Costs

Internal service providers such as IT, HR, facilities, engineering, and marketing are interested in calculating the cost of their products and services ("deliverables") for many reasons.

The most commonly cited motive is managing demand. Internal clients typically expect far more of these support functions than the internal service providers' resources can deliver. Unlike a traditional budget, which forecasts costs by general-ledger expense category (compensation, travel, training, etc.), a budget which describes the costs of proposed products and services explains which of the many requested deliverables can realistically be expected for a given level of funding.

A budget for deliverables also permits a rational, *investment-based budget process [2]* in which the enterprise decides what it will and won't "buy" from internal service providers based on return-on-investment analysis (rather than arbitrary benchmarks such as last year's budget plus or minus a percentage).

Another common reason to calculate the cost of deliverables is to provide a basis for *fair allocations* of internal support costs. Allocations assign costs to business units, giving a more complete view of their cost structures and profit contributions. Traditionally, allocations are based on high-level parameters such as total employees or revenues, leading to inequities and controversy. A budget describing the cost of deliverables can be used to link allocations to projected consumption of specific internal products and services.

The cost of products and services can also be expressed as rates – the cost per unit. Rates are fundamental to *empowering clients to decide the priorities* to be followed by internal service providers. Of course, simply rank-ordering projects is of little value since it doesn't define which projects will get done and which will not for lack of funding. Effective priority setting gives clients control of a "checkbook" created by the internal service provider's budget, and uses cost-based rates to decrement the checkbook as products and services are delivered. Thus, clients can adjust priorities throughout the fiscal year with a clear understanding of funds remaining and the cost of desired deliverables.

Rates are also the most meaningful basis for *benchmarking*. The most meaningful way to benchmark internal costs is not through high-level comparisons of total spending with industry peers, but rather to compare internal costs to the cost of buying similar products and services from vendors. This like-to-like comparison requires that internal service providers document their catalogs of products and services and calculate their rates.

Accurate rates are also essential to *chargeback* processes where clients supply some or all of the funding for internal services.

Cost models are also used to track historic performance, converting accounting data into product/service cost data. However, the greatest benefits (and lower implementation costs) come from using cost models within a business and budget planning process that sets rates for the year ahead. *[3]*

Enterprisewide cost modeling provides a sound basis for calculating product-line profitability.

Components of Cost

The cost of every product and service – both in total for budgeting, and per unit for rates – should include all direct costs plus a fair share of indirect costs.

Indirect costs result from support and sustenance activities such as infrastructure, innovation, process improvements, and administration. They are essential, and must remain in proportion to the size of the business. But they cannot be charged separately to clients because clients do not have the right to decide not to buy them. Allocations of indirect costs only serve to raise political controversy while adding no value to decision making. And direct funding of indirect costs badly understates product/service costs and rates, misleading decision makers.

The *Full-cost Maturity Model [4]* describes four types of indirect costs:

* The cost of staff's "unbillable" time for sustenance activities such as their own training, new-product research, process improvements, and client relations.

* External-indirect costs that are within a managerial group. For example, a manager may spread the cost of training and equipping his/her staff, or the costs of infrastructure, among the deliverables produced by his/her group.

* Internal-indirect costs which arise when one group within an organization "sells" its services to another group. For example, infrastructure engineers sell upgrades to the

operations group. Whether or not money is actually transferred between groups, this cost should be spread over all the services sold by the operations group.

* Overhead that's spread across all the products and services throughout an organization.

The most difficult challenge in calculating accurate costs is the amortization of indirect costs. They must be spread among just the right products and services, in just the right proportions.

Internal-indirect Costs

Internal-indirect costs are the least familiar, but critical to cost calculations and to understanding the difference between first- and second-generation cost models.

Internal-indirect costs result from support services produced by one group for others within the organization. These costs can be considered products and services "sold" by one manager to peers. (I use the word "sell" to describe a customer-supplier relationship *whether or not money changes hands*.)

Many such interrelationships can be found within any organization. Below are some examples of internal customer-supplier relationships within IT:

* Infrastructure operators sell services such as electronic mail to everyone in IT (as well as to clients), and computer time to applications engineers and infrastructure engineers for development and testing.

* Computer operators sell applications hosting of the incident-management system to the help desk, and hosting of asset management and billing applications to other infrastructure operators (while also hosting client-owned applications).

* Network operators sell connectivity to computer operations to link their servers to the backbone network (as well as desktop connectivity to clients).

* Computer operators sell access to directory services to network operators.

* Infrastructure engineers sell performance tuning, repairs, and upgrades to infrastructure operators (as well as PCs, servers, and LANs to clients).

* Infrastructure engineers sell their time to applications engineers as part of applications development teams.

* Applications engineers sell asset management and billing applications to infrastructure operators, and an incident-management system to the help desk (as well as many applications to clients).

* The help desk sells support of infrastructure to infrastructure operators (as well as support of PCs and client-owned applications to clients).

Some of those activities support other internal activities, which, in turn, support both external and other internal products and services.

The Circularity Problem

Internal-indirect sales introduce the problem of circularity in the calculation of costs.

If Group A sells to B, and B sells to A, then circularity occurs. Group B must increase its price to cover A's costs, including the price it charges A. Now A must increase its price, including its charge to B, causing B to again raise its price. The result is akin to hyperinflation.

To illustrate with just a few examples of circles, in the IT department with a Georgia university:

* The help desk supports the telephone system, and of course is a significant consumer of telephone services.
* The help desk also supports computer services, and is the buyer of applications hosting for its trouble-ticket system.
* The network services group depends on computer services for its billing application; and the computer services group uses the network to connect its servers.
* The applications-hosting group runs an application used exclusively by the data center to manage its computer resources; and the applications-hosting group buys computer services from the data center to run this application.
* Infrastructure engineers sell most of their time to the above operations functions, and buy services like electronic mail and network connectivity.

In real-life business models, myriad internal services and team-based processes form a spider web of internal customer-supplier relationships. Complex circularity occurs when multiple groups are involved – A sells to B, and B sells to C, who sells to A and B, etc. – and when groups are involved in multiple circles.

In very simple models, iterative calculation resolves this circularity. Some of the costs of internal services are applied to external sales, so the amount applied to internal sales diminishes with each iteration. Eventually, the successive increases in internal charges (due to the additional internal costs with each iteration) become immaterial and the model stabilizes.

However, if the full web of internal customer-supplier relationships is represented in a cost model, the complexity is so great that iteration is impractical. There are hundreds, even thousands, of internal sales, the costs of which are amortized onto many or all of the internal buyers' sales.

While possible, iterative calculation of a cost model can take a large computer a long time (well beyond what can be done in Excel on a PC). Iterative cost models are unwieldy, slow, and expensive to operate. This makes them impractical in a planning environment where managers interactively adjust their assumptions based on feedback from the model.

There's also the possibility of errors in the data such that iterative calculations cannot resolve circularity, when an internal cost is applied only to itself. For example, in a state government IT department, the procurement group sold vendor management services to the applications-hosting function for the purchasing system that the procurement group exclusively used. In fact, the vendor management services for this system should have been treated as "unbillable time," a self-benefiting cost of running the procurement business. Finding such errors amidst a miasma of internal indirect-cost relationships can be daunting.

First-generation ABC Models

First-generation cost models avoided the challenge of complex circularity by simplifying the cost model. Indirect costs are accumulated in cost pools. With activity-based costing, these pools are labeled as "activities."

These cost pools are then allocated among the organization's external products and services – those sold to clients outside the organization – in a proportion based on consumption of each activity (or some reasonable cost driver).

Using IT as an example, a cluster of computer servers may incur costs including vendor maintenance agreements, power, floor space, operator staff, and depreciation.

> This cost pool is spread to the various services that utilize that cluster, such as applications hosting, electronic mail, etc.

More sophisticated first-generation models permit the assignment of cost pools to other intervening cost pools, which in turn may be amortized to lower-level pools before reaching the external products and services – termed a "cascade" process.

To avoid the problem of circularity, pools are only amortized to lower-level pools in the cascade, never sideways or back upward. Of course, all costs must ultimately cascade down to the organization's external products and services.

For example, the operators in a data center incur costs such as salaries, benefits, training, HR services, etc.

> This cost pool may be assigned to the next level of cost pools such as a server cluster, storage devices, printers, networks, etc.
>
> > The server-cluster cost pool is then assigned to services such as applications hosting and email (external services), and also perhaps to another cost pool such as applications development staff (for development and test cycles).
> >
> > > The cost pool for applications development staff will cascade down to applications projects.

Resulting Distortion

First-generation cost models introduce distortions which are often material.

One source of distortion results when practitioners oversimplify reality. For example, some models put the entire cost of infrastructure engineering staff in a pool assigned to infrastructure-based services (like applications hosting and electronic mail) sold to clients. This ignores the fact that many infrastructure engineers also contribute to applications project teams.

If all infrastructure engineering is embedded in the costs of infrastructure services, and all of that is charged to clients, then infrastructure services will appear more expensive and applications engineering (which uses both the infrastructure engineers and infrastructure services) will be underpriced.

Even if such obvious mistakes are avoided, cascading costs downward creates distortion.

To isolate the source of distortion, presume that indirect cost pools are amortized in just the right proportions to subordinate cost pools or to external products and services. Even so, first-generation cost models overprice some products, while assigning too little cost to others.

For example, some infrastructure services (like electronic mail, network services, and shared storage) are consumed internally by IT staff, many of whom in turn support the infrastructure. If this is ignored and all costs are assigned to services sold to clients, then the cost of infrastructure services will appear too high while applications engineering will appear low.

Research Method

To measure the potential distortion, we studied the actual business processes and costs in three IT departments. IT provides a good basis for research because it is one of the largest and most complex of the internal service providers.

These three organizations were utilized because they were early adopters of second-generation cost models. This allowed us to isolate the sale of products and services within the department, costs which otherwise would have been mixed into pools applied to external sales.

We examined specific provider groups within the IT department which sold their products and service to both internal and external customers. The actual cost of their internal sales was divided by the cost of external sales to calculate the percentage by which external costs would be inflated in a first-generation model.

This calculation may slightly overstate distortion, since some portion of the cost of internal sales might be applied to other internal sales which are sold back to the provider group. However, these secondary effects were not material.

The purpose was to assess the *potential* distortion induced by simple ABC models. Average distortion was not measured, and many costs would have been reasonably accurate in a first-generation model.

Findings focused on cases where distortion was significant.

Findings: Distortion from First-generation ABC Cost Models

A state government IT department in the mid-West has a total budget of approximately $60 million. Its primary purpose is to serve state agencies (though many agencies also have decentralized IT groups of their own).

Applications-hosting services are generally at the bottom of a cascade – a fully assembled product sold to clients. In this organization, applications hosting represents approximately 10 percent of the total costs (and revenues).

Their applications-hosting group supports numerous client applications, and also supports many internal applications including the Geographic Information System (GIS) which is owned by IT and run as a service (ASP), the telephone billing system, and general operations support (e.g., billing, scheduling, asset management).

APPLICATIONS HOSTING SERVICES

Customer	Cost		
Clients	$6,056,190		
Internal:			
GIS		$431,320	
Telecommunications		$ 71,564	
Operations support		$111,525	
Other		$129,681	
TOTAL INTERNAL		$744,090	
TOTAL			$6,886,493

If internal sales were ignored and all applications-hosting costs were applied to client sales – consistent with a cascade cost model – then rates to clients would increase by an average of 12 percent ($744,090 / $6,056,190). *[5]*

Of course, all costs in every corner of the IT department will ultimately be paid by clients. However, in this case, a simple cascade cost model would over-price applications hosting and under-price a wide range of other services (the other 90 percent of the IT department's sales).

This additional three-quarters of a million dollars in the apparent cost to clients of applications hosting could be enough to tip the balance in favor of outsourcing or decentralization.

Some applications suffer more distortion than others, and hence are particularly vulnerable to outsourcing. In this IT department, internal applications consume a higher-than-average quantity of data storage. When the storage cost which should be applied to internal applications is spread onto the client applications in proportion to their consumption of storage, applications which are storage-intensive absorb a greater portion of this internal cost and suffer greater distortion.

DISTORTION BY APPLICATION

Application	Accurate cost	Cascade cost	Distortion
SABHRS HR	$1,063,319	$1,209,272	14%
Motor Vehicles	$ 120,592	$ 139,253	15%
IRIS PVATS	$ 297,685	$ 378,252	27%

Outsourcing these vulnerable applications-hosting services may not actually save money. The remaining applications-hosting services would then have to absorb the $744,090 cost of internal applications-hosting services, making them the next targets for outsourcing. This could lead to a death-spiral that shuts down the applications-hosting business, even if it is actually more cost-effective than outsourcing.

As another example, in the IT department of an industrial-packaging company in North Carolina, 17.8 percent of the usage of Notes (their electronic mail and calendar system) is consumed by the IT department itself. Had this been burdened on the cost of Notes services to clients, rates would go up by more than 20 percent.

Even worse, the IT department in a California county government sells electronic mail services to just a subset of the county agencies, as well as to the staff within the IT department itself. If the entire cost of the electronic mail service were assigned to the clients, their rates would increase by over 30 percent ($70,774 / $224,433).

COST OF EMAIL

Customer	Cost
Clients	$224,433
Internal	$ 70,774
TOTAL	$295,207

Although not every product and service suffers such significant distortion, these are not rare cases. In every organization in which we've developed detailed cost models, the simple cascade approach would have introduced material distortions in some or many product lines.

Of course, these limited examples do not provide a sufficient sample to project the overall magnitude of the problem. Nonetheless, they clearly demonstrate the weakness of first-generation cost models such as ABC. And even if only a few rates are materially affected, that alone is sufficient to mislead decision making. Risks include the following:

* Inappropriate outsourcing or decentralization.

* Inappropriately avoiding good investments because they're overpriced, or making poor investments because they're underpriced.

* Insufficient resources for delivery of underpriced services as demand for the overpriced services which subsidize them dwindles.

Second-generation Models

New second-generation cost models represent the rich web of internal sales to peers, applying costs downward, upward, and sideways to amortize indirect costs to the right consumers, internal and external. This requires two new functions not available in first-generation models – the practicalities needed to make second-generation cost models work.

First, second-generation cost models require tools to break circularity without introducing material distortions.

In the two-party situation (A sells to B, and B sells to A), only one of the two needs to break circularity by not applying incoming internal costs to the services sold internally to peers. Choosing where to break the circle is critical. Two factors determine a group's sensitivity to distortion:

* If A sells most of its services to clients and only a few internally, while B sells primarily internally, then A is the better choice. The relatively small proportion of internal costs that would have been applied to A's few internal services can be spread over many client services.

* If A buys very little from peers, while most of B's costs are the services it receives from peers, then A is the better choice. The cost of internal services is a relatively small portion of its cost structure, and hence the percentage impact on rates will be small.

There are two ways to break circularity within the chosen group:

Option 1: Incoming internal costs may not be applied to internal services sold to groups on its supplier list; this breaks two-party loops, and introduces a little distortion.

Option 2: Incoming internal costs may not be applied to any internal services that the group sells; this breaks complex loops of three or more parties, but introduces more distortion.

By analyzing the web of internal relationships and breaking circularity in just the right places, using Option 1 wherever possible, a second-generation model introduces a minimum in distortion. In all the above case studies, worst-case distortion was reduced to less than 1 percent.

Second, second-generation models require the ability to find circularity caused by errors in the data. In the process, they may also find situations where recasting the business model in a way that eliminates circularity would be preferable to breaking the circularity.

Benefits of Second-generation Models

The obvious benefit of a second-generation cost model is *significantly improved accuracy*. Minimizing distortion means that costs quoted in a budget and incorporated into rates approach the true, full cost to shareholders/taxpayers/donors of each product and service.

Accurate costs provide a fiscally sound basis for budget decision making, allocations, demand management, chargeback rates, and benchmarking against outsourcing. They also provide a basis for analyzing the costs of new projects that arise during the year, and for understanding total cost of ownership before making investment decisions.

Another financial benefit is greater frugality, i.e., the opportunity for *cost savings*. By representing internal support services as sales of products and services to peers (not just cost pools), second-generation cost models engender a rational, value-based process of deciding which internal support services are worth funding. In addition to scrutinizing indirect costs within their groups, managers think carefully about what they buy from one another.

Beyond financial benefits, second-generation cost models have a positive impact on culture.

Support functions are not considered just "activities." They're businesses that must deliver products and services to customers at a competitive price, just as external-facing functions do. All products and services – internal and external – are placed in the catalog, and all are treated with equal respect. There are *no "second-class citizens."*

Defining internal customer-supplier relationships improves *teamwork and alignment* throughout the organization. It's no longer a matter of one manager doing another a favor "as time permits." In the culture cultivated by second-generation models, sales to internal customers are commitments, just like sales to external clients. Better teamwork means more reliable external delivery.

Defining one's products and services and developing rates builds a culture of customer-focus and entrepreneurship. ***[6]*** Second-generation cost models induce an *entrepreneurial culture in groups whose customers are within the department* as well as those who sell their products and services to external clients. Like everybody else, they plan their sales and manage their costs to deliver good value.

An interesting side benefit is that staff learn to distinguish the various lines of business under each manager. They develop a common language for labeling the lines of business, and managers often discover that a given line of business is scattered throughout the organization. This has frequently led to *insights on structural changes* that could improve the organization's performance in the future.

For example, in IT it's not uncommon to see a manager with responsibility for both infrastructure engineering and infrastructure operations. Analysis generally reveals that $100/hour engineers are doing work that $20/hour operators could be doing, and perhaps doing so without the discipline one expects of an operations group – 24-hours-per-day monitoring, physical and logical security, routine backups, business continuity planning, etc.

As a result of these insights, engineering managers in the county government IT department chose to transfer their operations functions to the groups that specialize in infrastructure operations (the data center) and focus their expensive staff strictly on engineering, resulting in cost savings and improved delivery of both engineering and operational services.

Summary

Cost models are the basis of a rational budget process that decides funding based on the investment opportunities at hand; a demand management process that matches clients' expectations to available resources; and a product/service catalog with rates that drives investment analyses, outsourcing comparisons, and chargebacks.

The hard work of developing a cost model is in identifying products and services – what each group sells, and to whom. Once that's done, cost models amortize indirect costs to the organization's external products and services. Although ABC has made an immeasurable contribution to cost modeling over the last two decades, now there's little incentive to stay with first-generation models when second-generation cost models offer many compelling benefits for very little additional effort.

Footnotes

1. Cooper, Robin and Kaplan, Robert S. "Measure Costs Right: Make the Right Decisions." Harvard Business Review. September, 1988.

2. Meyer, N. Dean. "Investment-based Budgeting." White paper published by N. Dean Meyer and Associates Inc. 2008.

3. ABC proponents have come to this same conclusion. Cf.: Kaplan, Robert S. and Anderson, Steven R. "Time-Driven Activity-Based Costing." Harvard Business Review. November, 2004.

4. Meyer, N. Dean. *Full-cost Maturity Model*. Ridgefield, CT: NDMA Publishing. 2008.

5. The secondary affect is minimal, no more than a fraction of a percentage point. This applications-hosting group buys nothing from the GIS group. The overhead of their telecommunications services is a fraction of a percent of their cost structure. And while their purchases from the operations support functions is a significant part of their cost structure, their sales to these operations support groups represents less than 1 percent of those other groups cost structures.

6. Meyer, N. Dean. *Developing Leaders' Business Acumen: how a new budget process turned into Entrepreneurship 101 at the University of Maine*. Ridgefield, CT: NDMA Publishing. 2009.