

IEs Can Improve Management Decisions Using Activity-Based Costing

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Managers have to make decisions. This includes making decisions about how to spread available resources, how to price products, when to drop a line, to add new machine processes, and to change strategies. Information is the basis for these decisions; generally the better the information the better the decision. We talk of Decision Support Systems to highlight the "systems" nature of this information. Historically, the major source of information, and only source of profitability information, has been the accounting system. Yet accounting has never been able to fully focus on the task of supporting managers in their full range of decisions.

Because accounting has to serve external groups, such as investors, bankers, and regulators, accuracy and validity have been compromised for uniformity and simplicity. Many IEs can attest to this fact. When I was manager of IE at a company's manufacturing division I watched as the division's accounting system was changed to match the one used by the mining divisions. The new system was much less useful to management but satisfied the financial department's external need for uniformity. The accounting system is important because it is assumed to be a "model" of the company. When the model is flawed, the behavior based on it will also be flawed. IEs have a strong interest and responsibility for the models of the firm.

The accounting system needs

improvement. There are significant compromises in a key part of the system, the costing out of products, which mask and misrepresent the true behavior of the business. Specifically, overhead has been allocated in such a simplistic manner that initiatives taken in our plants to regain competitiveness have not been captured in the accounting reports. For example, the accounting system may show little benefit from installing a JIT system. Managers can be misled, develop inappropriate strategies, and make bad decisions.

However a recent development, Activity-Based Costing (ABC), provides an opportunity to bring these overhead allocations into line with the way the plant actually operates and to significantly improve the functioning of accounting as a Decision Support System for strategic moves in rebuilding competitiveness. This is a breakthrough in accounting and an opportunity for the IE. The new system can be much closer to the one IEs would desire; closer to the systems IEs use in estimating and project justifications. Also, IEs have a major contribution to make in their unique role as integrators and facilitators. This is a project most IEs should explore.

Product costing history

The full cost of a product includes direct labor, material, variable overhead and fixed overhead. Direct labor and material are observed and measured by the IE staff and maintained as "standards." Overhead costs are captured and reported by responsibility centers, de-

partments or plants, etc. The difficult decision is what to do about tying overhead costs to products. Accountants have long debated the value of two approaches — "full absorption costing" in which all costs are allocated to the products and "variable costing" in which only variable costs (material, labor) are allocated. Those advocating "variable costing" state that overhead costs are "sunk" or fixed and will not change with most management decisions. Therefore, overhead costs are expensed monthly as a general cost of doing business.

However, advocates of "full costing" state that the cost of the product must show the full cost of getting the product out. More costs are capitalized (held out of current expenses) and put into inventory with the product rather than being expensed when they occurred. These costs will not impact the P&L statement until the individual products are sold. Thus, we see this decision about the costing approach affects inventory costs and the timing of profit, which explains the strong external interest in a company's approach. Reporting to the financial community and for tax purposes has created a strong pressure for accounting systems to emphasize economy-wide uniformity over fit or usefulness in a particular industry or business. This force for "generally acceptable accounting principles" (GAAP) has caused accounting to generally reject variable costing for full absorption costing for external reporting. Usually the internal system also conforms. In summary, the accounting system has not focused on modeling the

company's operations for management decision making and this has important implications.

A 1986 study by the Harvard Business School showed that the typical business used a two-step system for absorption costing in which costs were accumulated in a pool, for example, the tooling shop, and then allocated to the products based on the direct labor hours utilized in making the product. The wide use of direct labor hours as an allocation basis is mainly a historical one, going back to the development of these systems in the early part of this century.

At that time labor was a major cost and a target of management attention. Industry was much like a "frontier" with extensive room to expand and little need for complexity. For the last 20 years the IEs have realized that this model is oversimplified; many costs were more related to other causes than labor. But Accounting wanted everything related to labor hours and it was "their" system. In other projects, such as bid estimations or project justifications, the IE and other plant staff used a more systematic approach to determine what costs would be incurred. Thus, industry patched over and made do with this discrepancy between how the plant really worked and how accounting modeled it.

Present competitive change

American industry has been changing steadily for 50 years and in recent years has even been "reinvented." Every company uses less labor; 25 years ago labor was often 40 percent of production cost whereas today it's just as often five percent. Expensive machine systems, automation, cells and flexible manufacturing systems require few operators but large support staffs. The cushions of large inventories and long lead times have also been removed.

In this environment, responsiveness and flexibility are the keys to remaining competitive. With this "Information Age," costs have shifted from the plant floor into so-called "overhead." The net result is



Figure 1. Types and Examples of Cost Drivers

that the traditional accounting assumptions are inappropriate: focusing on direct labor cost is no longer justified, treating overhead as some miscellaneous expense misses the point, and allocating overhead on the basis of the diminished labor cost hides the true costs and benefits of company strategies to compete. It is time to update the accounting system.

Activity-Based Costing

A new approach to costing is available to solve some of these problems and provide management with better information. Activity-Based Costing (ABC), developed by Harvard's Robert Kaplan and Robin Cooper, allocates staff and overhead costs to products on the basis of how the products actually consume or cause these activities. The process is similar to the one long used by industrial engineers

and estimators in developing a bid or estimations of the cost of a project. They find as many systematic, cause and effect linkages between the product and costs, before resorting to gross, across-the-board allocations.

In ABC these linkages are called cost "drivers." Companies are using as drivers such things as: labor hours, machine hours, floor space used, number of set-ups, orders, movements, size and weight, complexity, and sales costs (Figure 1). Costs are first accumulated as before, but then are allocated to the product by the appropriate drivers, i.e. cause. A product using 30 percent of the space might get 30 percent of the space costs, one having 20 percent of the engineering change orders might receive 20 percent of that cost. The result is a more accurate, and often very different, picture of the costs and profitability of products and product lines.

Brian Gilligan (*IE*, April 1990) provided a good, detailed example of the ABC calculations for a standard product and a "special" product of the type undercosted in the traditional accounting system. When there is an ABC system, he states, "Marketing will have a harder time selling specials. More and more customers will order standard products. Product proliferation starts to diminish. Support staffs will have more time on their hands." Further illustrations of ABC's use are described below.

Case illustrations

Kaplan and Cooper described Siemens Electric Motor Works (EMW) which in the 1980s changed from producing standard motors to producing customized motors in response to competition from countries with low labor costs. This strategy led to the development of an advanced, highly automated plant producing a large number of small orders. They found that their traditional accounting system was not accurately reflecting the change in operations. An extensive study revealed that seven percent of total costs were explained by number of

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orders and number of special components in a custom motor, and that size of order did not affect these. Their existing cost system was overcharging long runs and undercharging small, complex products. The new cost information led them to accept only half the orders they were offered and achieve the benefits of their new strategy.

Cooper and Kaplan described the problems of a support division of John Deere which had been established to provide parts to other divisions. Policies required that outside bids were to compete with the parts division's costs. In 1984, the parts division was low on only 21 percent of the bids. More disturbing, they were getting the orders for low-volume items which were not what the plant had been designed for. Management suspected, and found, that the cost system, which was fine for overall inventory valuations, was too unrealistic for bidding. Overhead was being allocated on labor and machine hours to the advantage of small orders since it failed to reflect the fixed-nature of costs associated with an order. Their new system, utilizing seven drivers, moved 41 percent of overhead off of machine and labor hours and resulted in more successful bidding.

Kaplan and Cooper also described the case of an electronics manufacturer, Tektronix (TEK). TEK had long been successful competing on strong engineering design and not price. But then the Japanese entered the market, cut prices 25 percent and dealt TEK a hard blow. TEK undertook a program of "continuous improvement," including JIT, TQC and new management approaches, to cut inventory requirements and cycle times. Again overhead had been allocated on la-

bor, only four percent of total cost. Before they realized the need to change this, an informal system had already emerged in engineering.

A study showed that in reality 50 percent of overhead was related to materials, more specifically just the existence of a unique component, not its volume. When overhead was charged in this more realistic manner, the systems dynamics changed; the proliferation of unique, low-volume parts was discouraged which improved inventories, lead time, and costs. The cost system supported the right decisions.

Paul Sharman reported on a pilot program at Northern Telecom. Northern Telecom identified over 40 drivers to allocate overhead. Under the new system the costs of only 17 percent of the products were within 20 percent of their original costs. Several high-volume products had been overcharged, some by as much as eight times. The majority of products (78 percent) had been undercharged by more than 20 percent. Sharman concluded that low-volume, complex products, the niche many U.S. companies are being driven into, are not as profitable as the traditional cost systems make them appear.

The case of a \$100-million-a-year plumbing fixture manufacturer was described by Michael O'Guin. After extensive modernization of the new processes had overhead costs of 60 percent of cost of goods sold, the company was still losing money and initiated a comprehensive study. An early observation was the inaccuracy of the cost system. With overhead spread on traditional factors, the punch press department, for example, actually consumed 40 percent of the tooling department's resources but was al-

located only nine percent because it used less direct labor. Overhead activities, such as scheduling and order processing, were spread to all products based on direct labor. Therefore a small order, which actually took the same amount of set-up and scheduling as a very large one, received only a small share of the overhead costs. In summary, he said, "American factories are filled with one-of-a-kind parts every plant manager knows are loss leaders."

This company undertook the development of an ABC system. They examined every cost to determine what really caused it. Tooling was theoretically a cost related to the adoption of a new product, i.e. transaction driven, but in reality no new tools were being built, only old ones repaired, so it was a volume driven cost. This work resulted in a costing database which could be applied to any product mix to predict the resources used and costs generated. The now-typical pattern of over-costing high volume products was seen. Even more interesting was their observation that whole product lines were likewise misrepresented, low volume lines were wrongly encouraged, which brought about a broad product line. The president instigated a market study which showed that customers actually valued short lead times over broad product lines. Simulations with the ABC database predicted that selling the residential division would increase profit from \$2 million to \$11 million per year. The number of parts handled would be cut by some 80 percent.

The company used the ABC simulations to rethink overall strategies of vertical integration and outsourcing. They were able to evaluate many options including JIT and a Maquilladora. In the end they selected a "focused factory" strategy of matching the facility to the product. O'Guin stated, "Activity costing justifies the 'focused factory', which is critical to making U.S. companies competitive. The company succeeded by implementing both product-line reductions and manufacturing configuration changes. Without activity costing,

we never could have convinced the client of this dependency.”

Hewlett-Packard, at the forefront in developing new costing methods, had already abandoned direct labor accounting by the mid-1980s. Using labor as a base, some products had carried overhead allocations of 1000 percent. Their new approach begins with directly charging many activities to product lines. If, for example, some engineering staff is directly associated with a product line, they go ahead and make the charge. Many companies now make extensive use of this approach.

Other overhead is spread on an ABC basis developed with management help during the budgeting process. The costing system reflects a more accurate understanding of actual operations. Management has training in ABC and works with Accounting to build an accurate model. This system leads management to identify where all costs are coming from, to challenge and improve costs, and then to see that the costs go into the accounting system in a way which reflects reality. Recognizing the conflicting demands placed on accounting, some plants have two systems, one for stock valuation and one, using ABC, for management decision making. Jim Rigby, a division controller, pointed out previous problems of misidentification of cause and effect relationships, improper design initiatives, pricing errors, and improper capacity decisions. He went on to say there are several benefits attained by H-P divisions adopting ABC. These include the following:

- The cost system now reflects how the factory is managed, a series of processes with assigned responsibilities, thus providing greater visibility to trends, successes and failures and improved goal setting;
- Designers can now recognize the cost impact of their decisions on design tradeoffs, with cost penalties for non-standard, unique solutions;
- There are fewer transactions;
- Reduction in clerical staffing;
- Improved appreciation of cost data, helpful in bidding large contracts and pricing scenarios;

- Clearly established cost and productivity goals for a process.

H-P has adopted many advanced manufacturing approaches, particularly just-in-time, and sees these changes in costing as an essential step.

A number of companies, including Hewlett-Packard, General Electric and Motorola, are taking innovative steps forward in their cost accounting systems. To avoid problems of allocation of manufac-

turing overhead, some IBM plants have the workers responsible for their own quality control and maintenance. Caterpillar has established over 1,000 overhead “budgets,” so larger machines, with larger budgets, will receive a higher share of overhead costs. General Motors is working with new systems for product costing at 19 different locations. Emig and Mazetta add, “Hopefully, a greater number of companies will continue along these

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innovative lines in order to achieve the individualized cost accounting data required to make company-specific decisions."

ABC is a new tool; *Management Accounting* reported only 110 installations by August 1990, with 77 percent of these in two major firms. This does not mean it's a risky undertaking. Applying ABC is less like applying some new technology and more like refining an internal reporting system. The amount of effort and change can be managed to fit a company's situation at the time.

When ABC is needed

The editor of *Management Accounting* summarized developments in ABC and called activity accounting a technique for understanding costs. Every company should be making some improvements using the concept of ABC. It is difficult to estimate the potential costs from running a business with inaccurate information. ABC is an opportunity offered by the accountants which every company should take to improve the accuracy of the accounting reports in modeling the company.

Where a company produces a narrow range of similar products, ABC may offer limited benefits. However, the traditional volume-based cost system is likely to report distorted product costs for firms which produce a diverse range of low-volume and high-volume products. In those circumstances an ABC system is likely to be justified.

Cooper suggests it's time for a new cost system when:

- Functional managers want to drop seemingly profitable lines
- Profit margins are hard to explain
- Hard-to-make products show big profits
- Departments have their own cost systems
- You have a high-margin niche all to yourself
- Competitors' prices are unrealistically low
- Customers don't mind price increases
- Results of bids are hard to explain

plain

He suggests that your current system may be outdated if you have made significant technological changes in your process or added automation, adopted new manufacturing philosophies such as JIT, seen changes in the use of support departments, or changed your product market strategy or corporate strategy.

Developing the system

ABC is clearly a team effort; there should be representation from operations, industrial engineering, and accounting. The team will have to become familiar with ABC principles and experience, typically through an examination of the Harvard cases and articles about the experience of others.

Their next step is to document and understand the manufacturing process, focusing particular attention on centers of support activities and product line activities. The team then goes into the plant to identify the cost drivers which explain why and how costs are incurred. It is not uncommon to identify 40 or 50 drivers, but 10 is believed to be closer to an optimum number. After narrowing to the final set of cost drivers, the team will finalize the paperwork system to allocate costs via the drivers to the products. A computer system will probably be required to handle the calculations. Stand alone systems are now the norm and software packages are available. With the clearer understanding of the plant, it is important throughout the process to make improvements in operations, especially rethinking overheads.

Gathering data

The team will first need an understanding of the manufacturing process — how direct labor and material are used. Then they can

move on to find out how indirect resources are used. There are more manufacturing processes and indirect activities in a plant than one first realizes, thus the team will prioritize and limit its search. Cooper and Kaplan say three rules should guide this process.

1. Focus on expensive resources.
2. Emphasize resources whose consumption varies significantly by product and product type; look for diversity.
3. Focus on resources whose demand patterns are uncorrelated with traditional allocation measures like direct labor, processing time, and materials.

The team would interview the overhead department managers and supervisors asking: Where is their time used? What causes it to increase or decrease? Can the work be predicted by product, department, or plant activity? Any records kept of their work would be of interest as a possible means of changing their activities. Maintenance departments often record where they work on their time cards; this would allow changing much of their costs directly.

The objective is to get costs properly assigned to products. The best way is to directly change activities. This would be one byproduct of a "focused factory," in which a plant might focus on a single product line. In a mixed plant, if certain engineers, marketing staff people, or maintenance staff work primarily with a line, they can be changed directly. AT&T and others have actively pursued this approach. When this avenue has been exhausted, cost drivers are the next best approach. Lastly, the old allocations are used (Figure 2).

Cost drivers

Many costs are already assigned to products, but others are

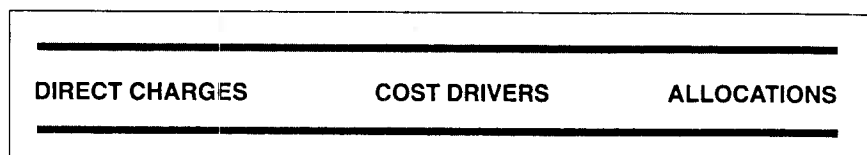


Figure 2. Means of Distributing Overhead

less obviously associated with the products, including production control, inspection, materials functions, maintenance, tooling etc. All of these costs arise from running the facility; the study of the processes should clarify how the costs arise. Beaujon and Singhal, have classified five levels of activities for drivers. At the "unit level" are machining costs, for example, which occur with each part made. Set-ups, scheduling, and inspection go along with a "batch." Special machines, designs, engineering or marketing might be identified to a "product" or a "process" level. Lastly are costs at the "plant level," such as building maintenance. The final set of drivers might include ones at any or all of these levels.

Lee described the experience of an electronics manufacturer. The accountants, working with the manufacturing staff, identified 23 key manufacturing processes (drilling, imaging, inspection, procurement, waste treatment) and 19 potential drivers (number of holes, set-ups, parts per panel, engineering hours, and lot size, thickness of laminate). A matrix was developed between processes and drivers which experienced staff used to identify strong and weak relationships. From this a limited set of drivers was selected. "It was agreed that cost drivers should be meaningful parameters of operating controls; measured in reasonable, quantitative terms; and used as the convenient bases of calculating overhead allocations for product costing purposes," he said. It was a challenge to keep the workload from the ABC system to a manageable level. As a compromise they selected drivers which were consistent with operational measures already available in the plant, then grouped and assigned these to cost centers (Figure 3).

Analyzing and Reviewing

Ochs and Bicheno, in *Industrial Management*, emphasized the importance of using the work involved in developing the ABC system to improve the productivity and organization of these supporting

activities. "ABC analysis helps management focus on designated activity areas such as white-collar productivity and associated competitive advantage issues," they said. Rarely does overhead get such a complete and systematic scrutiny. This is an outstanding opportunity for the IEs to apply their skills.

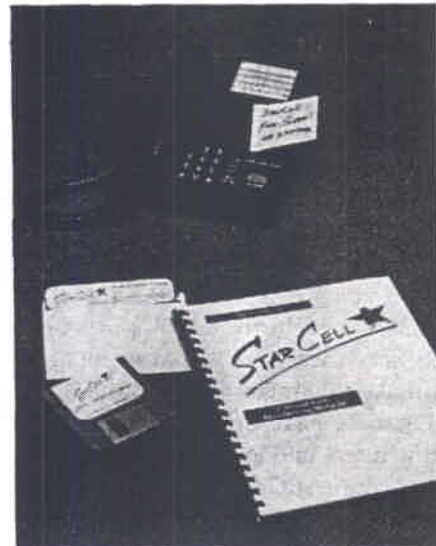
Costing

Costs can now be assigned to the products with the drivers. The

total cost of the engineering department, for example, is divided by the number of engineering hours to yield a cost per engineering hour. A record is kept of the engineering hours used on a product or product line and then the engineering department cost is spread on that basis. Other overhead costs are similarly spread. A stand-alone computer system usually handles the necessary calculations.

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Soldermask	Number of sides
Component legend	Number of sides
Maintenance	Work hours

Figure 3

costs of products which more closely reveals how the costs are generated in the facilities. This model reveals the cause and effect behavior and supports better decision making.

ABC is not a fad or a panacea for all that ails U.S. industry. It is a natural progression of the information systems of industry. These systems are only useful to the extent they model the company's operations. In many companies, the traditional system no longer supports the difficult decisions management must make. Sharman observed that the Japanese have driven Western manufacturers into low volume, low profit niches. ABC is a Western in-

vention which can help in the drive back. "Activity-based costing is the scalpel management accountants can provide to their companies to carve out strategy for the next competitive battle, that of economic survival," he said.

Romano summarized the advantages of ABC by saying, "It has been reported that strategic insights have been gained simply due to a dramatic shift in the perceived profitability of a company's product line. This allows the company to react, alter its product strategy, and better plan for the resources and activities required to support this approach." In practice, Siemens Co. found half of the orders it

could get would be unprofitable. John Deere was able to get its bidding in line and utilize its support plant. TEK reestablished its direction and stopped the proliferation of low-volume work. Northern Telecom was better able to prioritize and focus its cost reduction efforts. The plumbing fixture company was able to improve profitability by establishing a focused strategy of tying products to plants. All of this was the result of improved information models which accurately reflected plant operations. ABC is change that IEs have long awaited, and the IE has a major role to play in this important project. IE

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