

# MEASURING PERFORMANCE IN AN ADVANCED MANUFACTURING ENVIRONMENT

*Shrinking margins are triggering reactive decision making.*

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Photo by Jeff Smith/The Image Bank.

Improvements in technology and procedures always have been associated with higher standards of living in the United States. The ability to innovate has been touted as one of our major strengths, and we have relied upon "Yankee ingenuity" to solve our problems and provide us with a competitive edge in the world marketplace.

It seems ironic, therefore, that our current lack of competitiveness is due in large part to technological improvements in manufacturing processes and procedures. Perhaps, as suggested by Richard J. Schonberger in *World Class Manufacturing: The Lessons of Simplicity Applied*, this turnabout can be traced to postwar complacency which turned the task of running a manufacturing enterprise into gentlemen's work. Manufacturing firms were no longer run by the experienced manager who had dedicated his career to a single entity, but rather by people two and three times removed from the manufacturing process, many of whom had never even stepped foot onto the manufacturing floor.

Today, the scene is changing. Once again, managers are beginning to manage their companies rather than just the numbers. Many are doing it to survive, others because they recognize they must adapt to the new manufacturing environment if they are to maintain their competitive edge. In order to achieve manufacturing excellence, though, companies must begin to proactively and intelligently incorporate advanced manufacturing techniques and performance measurement system changes into their strategic plans.

## THE PATH TO MANUFACTURING EXCELLENCE

Advanced manufacturing technologies and process modifications are changing how companies do business, and are forcing companies to make complementary changes in their performance measurement systems. Organizations striving for manufacturing excellence and the attainment/maintenance of a competitive edge in the marketplace must proactively manage the change from traditional manufacturing and accounting

techniques to those that support excellence, efficiency, and effectiveness in the new environment.

Manufacturing excellence arises from one basic goal—to provide the best product at the lowest price. The manufacturing objectives arising from this goal include high quality, low cost, and high customer responsiveness. A pursuit of excellence entails, therefore, high performance on more than one product attribute and is achieved by providing the customer with a product that surpasses all others in value and reliability.

The performance measurement system provides the first step on the path to manufacturing excellence. These measurements should capture the key elements in the manufacturing strategy, expose nonvalue-added costs to aid in their elimination, provide accurate and timely data on cost drivers, and serve as accurate records for product costing decisions. In sum, they should ensure attainment of company goals.

People, quality, delivery, and cost are the four critical success factors that need to be measured at every level of activity. Unfortunately, accountants traditionally have been myopic, focusing solely on cost and ignoring the “nonfinancial” critical success factors. Yet the companies accountants work in are multifaceted, needing more than cost information to survive.

In order to achieve manufacturing excellence, companies not only need high levels of performance on all four critical success factors. Their management accounting and control systems should include performance measurements on multiple aspects of the organization. Some criteria for evaluating management accounting and control systems in an advanced manufacturing environment are:

- Rapid feedback;
- Sensitivity to profit contribution of various activities and products;
- Flexible and migratory measurement systems;
- Holistic product costing and control measures;
- Identification, measurement, and elimination of nonvalue-added costs;
- Focus on variance reduction in such areas as quality, cycle time,

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and product complexity, (e.g., total parts);

- Reclassification of costs based on assignability and value-adding characteristics;
- Enhanced traceability of costs to specific products and processes to decrease allocations and their distortions.

These characteristics are an inherent part of a well functioning performance measurement system, and are intricately linked to the critical success factors. They provide the framework for designing a performance measurement hierarchy for integrating and coordinating activities in an organization. This hierarchy would be a set of interdependent subsystems of performance measurements designed to meet the operating objectives and information needs at the market, business, plant, and shop levels.

A performance measurement system should monitor changes in market demands, establish and evaluate progress toward business objectives, assure attainment of performance targets at the plant level, and serve as performance indicators on the manufacturing process itself.

### **A REVOLUTION**

**T**he original objective of our study was to examine only changes in cost accounting systems in a just-in-time (JIT) setting. However, it was soon recognized that the revolution and change taking place in the field went far beyond this level of analysis. JIT is just one step in a migration path of technologies leading toward manufacturing excellence. Therefore, we

expanded our study to capture the range of technologies and their impact on the management accounting and control system.

Five companies were studied—designated as Company A through Company E.

Company A is a \$337 million enterprise involved in the design, manufacturing, and marketing of complex precision metal products and components for foreign and domestic industrial and consumer markets. The plant studied is part of the diesel systems division of the automotive products group.

Due to downturns in the domestic diesel market, Company A is facing a period of declining profits and sales. This situation has triggered the conversion to JIT work cells, as the company seeks to reduce costs and increase quality in order to survive.

In addition, it is using MRP II for scheduling, installing statistical process control throughout the plant, adopting a vendor certification program, and employing robotics and flexible manufacturing systems in isolated areas (e.g., are automating only where necessary). Within the management accounting and control systems specifically, local solutions are being used that have not been formally accepted or approved by corporate management.

Company B is a member of the electronics and telecommunication industry. The plant used in this study produces printers, keyboards, display terminals, and controllers. It provides nearly \$200 million per year in revenues. A slowdown in the growth of the computer industry, as it moves into maturity, has created the need to control costs and standardize products. A JIT line was designed and partially installed in the Company B plant, in a true “factory-within-a-factory” setting, complete with performance measurement systems and incentives. Currently, MRP II is used plant-wide, the corporate vendor certification program is moving forward, and robotics are being employed at various locations throughout the plant.

Company C is a leader in the electronics industry. Two plants were visited during the course of this study; both produce PC components, such as tape drives, memory, and printers. The majority of the

data collection was focused in the tape drive assembly plant, which has sales exceeding \$170 million per year and employs over 800 workers. This site has the most highly developed JIT lines, as well as advanced MRP II systems, and has made significant changes in its management accounting and control systems.

As a result of the ability to measure the critical success factors and focus improvement in this manner, cycle time has been reduced from an average of 22 days to 1 day, overhead per unit has been decreased 30%, and a two-tiered overhead system has been devised to compensate for distortions inherent in using a direct labor base in a JIT setting. The objectives stated for Company C's control systems are simplicity and relevance.

Company D manufactures integrated circuits at the site we studied. It is currently changing its manufacturing processes over to a "focused factory" approach using work cells to replace traditional functional departments. To date, 29 cost blocks have been converted to 11 work cells. The primary objectives in this changeover are to decrease the cycle time by improving the linearity of production, reduce inventories, eliminate excess scrap, and improve product quality. The most significant change to the management accounting and control systems is the use of cycle time variances, the substitution of actual costs for standards, and the de-

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velopment of an hourly rate for applying, evaluating, and controlling cell costs.

Company E is a large multinational producer of office equipment, computers, and related items. The site used in this study builds laptop computers for the domestic market using computer-integrated manufacturing (CIM). At this site, accounting measurement has become routinized and automated, which is best described as a "no-brainer" situation. The primary emphasis is on zero defect production, decreased cycle times, and the development of a "direct charging" accounting system designed to assign overhead costs directly to the products/processes creating them. The management accounting and control system is a complex, transaction intensive system focused on highlighting the value added to the fi-

nal product by each process and person.

**WHAT WE FOUND**

The majority of the companies that adopt advanced manufacturing technologies in their production processes are doing so on a limited basis as a means of responding to increasing competition and decreasing margins. Companies C and E appear to have a more integrated approach to technology adoption and are known for their proactive management styles and dedication to innovation. Even in these firms, the speed of adoption of such technologies suggests that shrinking margins are triggering reactive decision making.

Secondly, it appears that the changes in the management accounting and control systems are best described as "islands of accounting" that match the degree and type of automation used. It would appear that the progression in the management accounting and control system is mirroring the technology migration path.

Companies are recognizing that the existing system does not form a basis for adequate coordination and control in a modern environment. It is unclear from the data whether the technology has actually changed the environment or if it has instead served to amplify existing shortcomings.

Most of the firms we studied are

**MEASUREMENTS USED BY TECHNOLOGY**

COMPANY	BASIC CONTROL	MRP	JIT	CIM
A	Modified	Mature	None	Not Relevant
B	Traditional	Advanced	Pre-Pilot	Not Relevant
C	None	Essential (Evolved)	Advanced	Not Applicable
D	Traditional/Pre-Pilot	Immature	Pre-Pilot	Not Relevant
E	None	Evolved	Not Relevant	Complex/Transactions Intensive



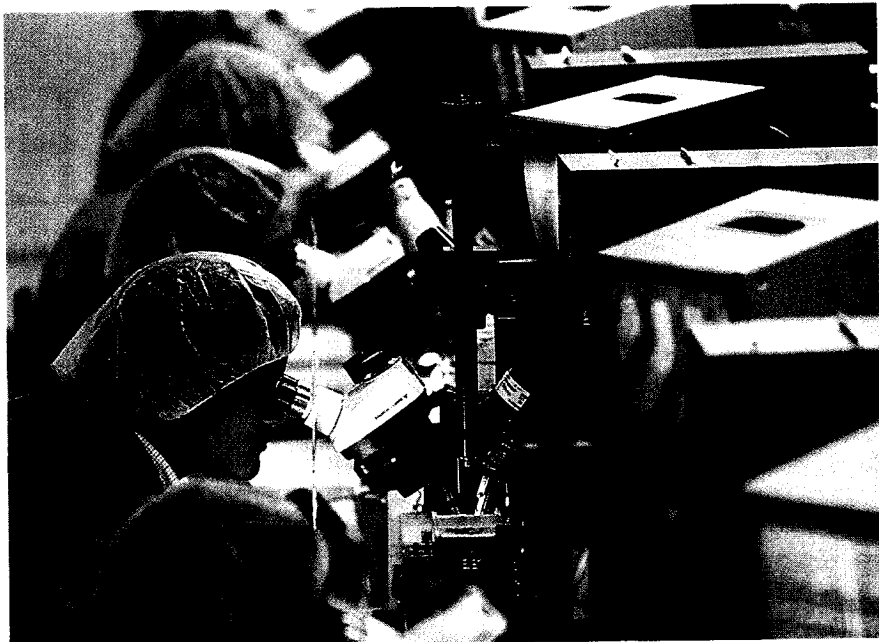
adopting an actual cost system, although the abandonment of the traditional standard cost accounting system is not obvious. Given the costs of maintaining the information system, and the confusion created by the existence of multiple data sources, it seems likely that this multiplicity of measurements is only a temporary phenomenon.

The continuing demand by corporate controllers and management for the traditional standards-based reports hinders the adoption of innovative, and critically needed, changes in the accounting systems, such as the use of actual costs. Until top management becomes comfortable with the concept of an adaptive performance measurement system, it will be difficult for individual plants and divisions to adopt sweeping accounting reforms.

The use of JIT techniques does appear to be moving control closer to the point of production, and to be more clearly matching responsibility with controllability of costs. Company A has instituted a "checkbook" for cost control within the work center, which focuses solely on direct (e.g., traceable) costs for supervisor evaluation. Company A's internal reports are being revamped to isolate the overhead that is controllable only at the plant management level. These items are being reported as a lump sum figure in a contribution, margin-based reporting system. The responsibility for controlling these costs belongs to top management.

There is tremendous diversity in the level of acceptance of JIT and other advanced manufacturing techniques at the various sites. While all of the management personnel interviewed touted their JIT/CIM lines as revolutionary and leading edge, actual adoptions and change are quite rudimentary for the most part, and encompass only a small percentage of the companies' total productive capacity. Company C was the only firm to have a mature JIT environment.

Project justification remains an unsolved problem. Managers are adopting technology based primarily on intuition and faith. They are abandoning the traditional capital budgeting techniques where necessary, or if this cannot be done within the existing corporate structure, they are completing the necessary



Manufacturing microchips.

forms using cash flows fabricated to meet investment criteria. It appears that, to date, the firms in our study have not determined how to quantify the qualitative benefits provided by these technologies.

### SLOW AND CAUTIOUS

In summary, the progress made in advanced manufacturing technologies appears to be inconsistent and isolated within the organizations studied. Islands of technology characterize the majority of the production facilities examined. Notable exceptions also have been detailed, indicating that the statement, "JIT is a journey, not a technique," may be the most appropriate way to characterize the adoption process.

Although the MACS at each site is being modified, once again an "islands" portrayal is most accurate. We find this encouraging, rather than discouraging, in its implications for the future. Change is happening slowly and cautiously, but it is happening.

The most distressing finding is the reactive nature of the change process in most organizations. Theoretically, companies should proactively manage the adoption of technology and accounting system modifications based on the organization's strategic objectives.

In reality, however, accounting changes and technology adoptions

appear to be reactive. Firms facing declining profits are adopting technology in an attempt to regain viability in the marketplace, and the accounting system modifications, in all cases, are happening after the technology is already in place.

Proactive management suggests that changing measurements and incentives are critical for successful technology adoption. As the diffusion of technology accelerates, it will be necessary to more actively manage the process of change in the performance measurement/management accounting system. The management accountant will need to expand his horizons, become an agent for organizational change, and assume a key position in the management of the firm. ■

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