
The “SMART” Way to Define and Sustain Success

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Just-in-Time techniques and Computer Integrated Manufacturing technologies are revolutionizing the manufacturing sector. But to ensure sustained success, a firm needs to do more than clarify business strategies and articulate and implement structural changes.

At Wang Laboratories, Inc., headquartered in Lowell, Massachusetts, the Experimental Process Improvement Challenge (EPIC), a Just-in-Time work cell approach, reduced throughput time and improved quality and worker morale. Based on the lessons learned from EPIC, the entire factory was restructured.

The results on the production floor were striking. Gone were the mountains of work in process, the handling systems to move it, and the tracking slips to control. In their place were independent work teams capable of assembling and testing an entire printed circuit board. Impressed with early results, but not completely satisfied, manufacturing management pondered what else needed to be done to further increase productivity and flexibility.

The answer: Institute a management control system with performance indicators designed to define and sustain success.

WHY A NEW APPROACH?

After EPIC was implemented, managers realized that by relying on traditional performance measures—such as utilization, efficiency, productivity, and other variances used for financial purposes—they were not getting the information they needed to make critical business decisions. And their frustration with the division’s “critical success factors” (CSF) and the monthly budget operating report was manifested in their sporadic review of the CSF and financial reports.

Manufacturing managers also had four major complaints about the way their operations were being evaluated:

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- Unless the performance measures were specifically tuned to their strategies, they were yielding either irrelevant or misleading information, or worse, provoked behavior that undermined the achievement of their strategic objectives.
- Measures that tracked each dimension of performance in isolation were distorting management's understanding of how effectively the organization as a whole was proceeding with strategy implementation.
- Traditional performance measures did not take into account the requirements and perspective of internal and external customers.
- Bottom line measures (such as profitability) came too late for mid-course corrections and remedial actions.

Even when established measures were aligned with manufacturing strategy, reporting of performance information to management was fragmented: Cost measures were reported by the accounting department; quality measures were produced by the quality department; delivery measures were reported by distribution, and so on. The result was mixed results on overall performance. For example, the quality department would report improvement in product "plug and play," giving management a sense that things were improving. The finance department, on the other hand, separately reported the excess costs (scrap, rework, inventory, etc.) expended to improve quality. As the vice president of manufacturing finance put it, "Trade-offs were hard to identify, let alone understand."

Recognizing the need to revamp its approach to performance management, Wang began searching for an alternative. The company soon found out that it was not alone. In a survey of 260 financial officers and 64 operating executives, sponsored by the National Association of Accountants and the Computer Aided Manufacturing-International (CAM-I), 60 percent said they were dissatisfied with their performance measurement system. In the electronics industry, the criticism was sharper: 80 percent thought their control system wasn't doing the job. The study went on to say that "this response clearly suggests the need to reevaluate and revamp longstanding performance measurement systems." Interviews with manufacturing management at Wang corroborated the need for a new approach to define and measure successful performance.

THE SMART APPROACH

The senior vice president of manufacturing called for an effort to define a framework for:

- Measuring departments and functions on how they are contributing separately and together in meeting manufacturing's strategic mission.
- Linking operations to strategic goals.

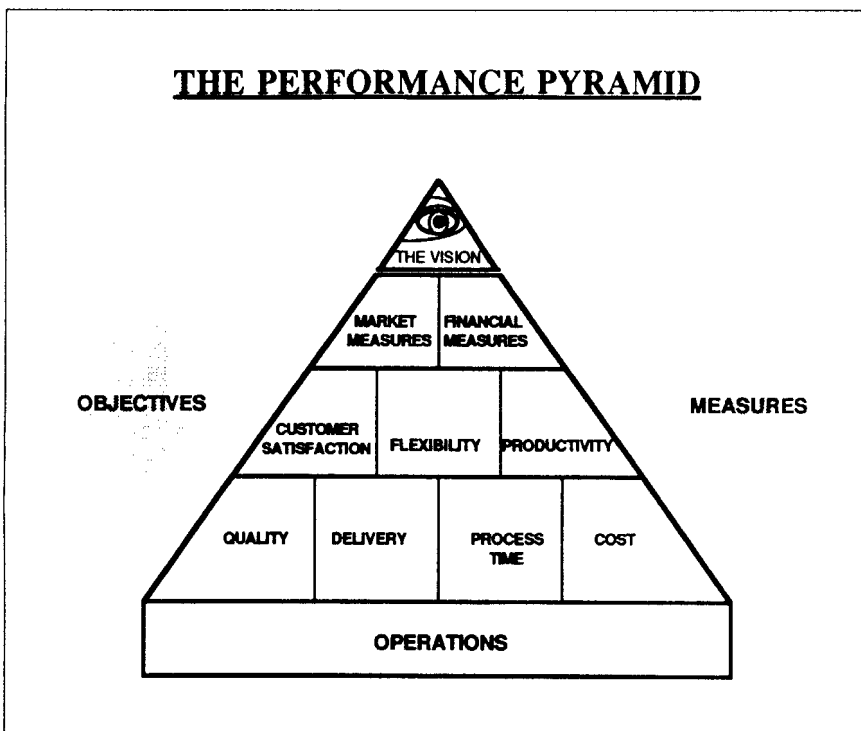
THE "SMART" WAY TO DEFINE AND SUSTAIN SUCCESS

- Integrating financial and non-financial information in a way that can be used by operating managers.
- Focusing all business activities on the future requirements of the business, as dictated by the customer.
- Changing performance, incentive, and rewards systems as necessary.

The result of this development effort was Strategic Measurement Analysis and Reporting Technique (SMART). In addition to meeting the objectives of the development effort, SMART provided the means to:

- Clarify measures of strategic importance.
- Build consensus horizontally across functional or department lines.
- Institute measurements at the operational level in each department that will enable department managers to prepare strategically relevant reports on the health of the business.

The Performance Pyramid (below) represents the structural framework for the new information network that's the basis for the SMART control system. A four-level pyramid of objectives and measures ensures an effective link between strategies and operations. This model translates



strategic objectives top down (based on customer priorities) and rolls measures bottom up.

At the top level, a vision for the business is articulated by corporate senior management. This vision forms the basis for corporate strategy. Management can then assign a corporate portfolio role to each business unit (cash flow, growth, innovation, etc.) and allocate resources to support.

At the second level, objectives for each business unit are defined in market and financial terms. Strategies to meet these objectives are then outlined. Most business units define success in terms of: (1) reaching the short-term goals of specified levels of positive cash flow and profitability and (2) achieving the long-term goals of growth and market penetration.

At the third level, for each Business Operating System (BOS) supporting the business strategy, more tangible operating objectives and priorities can be defined in terms of "customer satisfaction," "flexibility," and "productivity."

A BOS includes all internal functions, activities, policies and procedures, and supporting systems (for example, planning and control, information, rewards, and communication) required to implement a particular business strategy, involving the development, production, and provision of specific products or services to particular markets. Wang's production facility represents a Business Operating System for filling customers' orders. Wang's new product introduction process, change control, and sales administration are all examples of Business Operating Systems.

The BOS is the starting point for effective measurement and control at the department level. The link between each department's performance and the overall strategy and performance of the business, the BOS enables department measures to focus on the effectiveness of the entire operating system rather than on the efficiency of a single department. When addressing all the activities, processes, procedures, and systems required to execute a strategy, the BOS objectives can be defined in terms of customer satisfaction, flexibility, and productivity (see box on page 27). The principal relationships between the business operating system objectives and the top tier market and financial goals are illustrated by their position in the pyramid. For example, the market measures are supported by "customer satisfaction" and "flexibility."

At the BOS level, "customer satisfaction" means how customer expectations regarding quality and delivery are managed. At the heart of the middle tier—and critical to Wang's competitiveness—"flexibility" addresses the responsiveness of the operating system. Completing this tier, "productivity" refers to how resources, including time, are managed. For example, at Wang the EPIC project improved flexibility and productivity by focusing on reduced throughput time in the assembly operation. By converting from batch processing to a continuous flow operation, throughput time of twenty days was cut to three days. The ability to respond to new

BOS Performance in Perspective

Once the concept of the BOS is understood, it's imperative that the three major driving forces behind the BOS be clarified. They are: customer satisfaction, flexibility, and productivity. All three driving forces are involved in every BOS, but at different levels of intensity. The driving forces and their relative strength can be derived by the business strategy and the capability gap that exists between the strategic demand and the ability of the BOS to respond. The objectives for, and the relative importance of, each of these driving forces is determined by the business strategy. For a given operating system, each of these forces is important, but it's not unusual for one to be of primary influence. By understanding the driving force of the operating system, it becomes easier to identify priorities at the department level.

Customer satisfaction as a driving force: For many operating systems, especially those that support the external customer directly, customer satisfaction is of paramount importance. For the business as a whole, customer satisfaction can be defined in terms of quality, delivery, and price. Only quality and delivery can be translated into operational terms. Typically, price is more dictated by the market or the business strategy than it is by the business operating system. For instance, low cost across departments and functions will allow for lower pricing, and expedient delivery and higher reliability, for higher pricing.

An operating system driven by customer satisfaction will place strong emphasis on quality and delivery reliability measures. A customer satisfaction-driven operation also affects the measurement of work flow among departments. Such an operating system would tend to emphasize external measures of quality and delivery from department to department. For instance, the new product introduction group may be primarily concerned with process and product quality, which, in turn, will improve flexibility and productivity in volume production.

Flexibility as a driving force: Ulti-

mately, an operating system is said to be flexible if it can efficiently meet the changing demand of its customers. Flexibility has both internal and external components. The external component relates to meeting the demand of the customer. The internal component relates to doing that efficiently—faster, with no waste. For example, an operating system that delivers a product to a customer can meet the customer's requirement by having everything in inventory. To the customer, the operating system would appear flexible, but in reality it is not a truly flexible operating system. For example, in manufacturing, finished goods inventory may be used to meet customer satisfaction requirements. However, from internal management's perspective, the operating system is not flexible and the cost of that inflexibility is higher carrying costs.

Wang's production facility in Lowell is an example of an operating system driven by flexibility. Given the uncertainty of forecasts and expanded product offerings for strategic markets, the plant's goal is to be so fast that it can build to customer order.

Productivity as a driving force: Productivity relates to pricing. An operating system that delivers an upscale high-priced product may be driven by customer satisfaction. However, productivity is typically the driving force when firms compete on the basis of price in a commodity market.

Productivity is an internally driven force. It is not directly perceived by the customer; however, it often gets more attention than the two other driving forces. Productivity should be viewed in context of the most cost-effective and timely means of achieving customer satisfaction and flexibility objectives. Objectives can then be stated in terms of short cycles, asset management, and lowest total cost. Wang's professional computer production (actually a subsystem within the plant) is a good example of an operating system driven by productivity, where costs are lowered by reducing throughput time and eliminating waste.

demands in less time meant an increase in flexibility, and faster throughput boosted productivity: Work-in-process inventory was reduced by 85 percent and the new work cells required fewer people and less rework.

While these three objectives help in understanding the driving influences in the operating system, they must be translated further to provide a clear foundation for specific operational measures. At the department level, the objectives are converted into specific operational criteria: "quality," "delivery," "process time," and "cost" (specific measures within each of these areas need to be defined for each department). These four criteria for department measures can translate strategic direction into department action.

The objective of any function or department in the BOS is to increase quality and delivery, and to decrease process time and cost. High-quality products or services (based on customer-driven target values) and regular on-time delivery will ensure customer satisfaction. The combination of *externally* driven delivery (when the customer wants to take delivery) and *internally* driven process time (how can we reduce the time to make the product) defines flexibility. Productivity goals can be achieved by reducing both process time and cost. At the local department level, cost is viewed as the excess money (or waste) incurred to meet the other performance objectives.

As the foundation of the performance pyramid, the operational measures—quality, delivery, process time, and cost—are the keys to achieving higher-level results. Corrective action and continuous improvement at the department level will minimize unpleasant surprises at the top level and ensure successful implementation of the organization's business strategy.

Because the four operational pillars on which the SMART program is built are so critical to the organization's success, they warrant closer analysis.

Quality: It's no longer acceptable to think of quality as conformance to specifications. Quality has a far broader meaning in today's marketplace. Quality means translating the "voice of the customer" into appropriate company requirements at each stage from product/service concept to delivery. The Japanese call this Quality Function Deployment (QFD). For marketing and R&D this means innovative designs within price and reliability ranges expected by the customer. For production, quality is translated into reliability, durability, aesthetics, and perceived quality.

Delivery: Good delivery results when performance equals expectations. There are two aspects of delivery: quantity and timeliness. The objective of the SMART approach is to align performance with expectation. For instance, the customer and supplier may agree on a percentage to be

delivered to schedule and a percentage to be delivered on demand. There will inevitably be some give-and-take regarding both the customer's expectations and the supplier's agreement regarding performance.

Process (or Throughput) Time: Process time refers to the actual time it takes for a department to deliver the product or service from the time the work is requested of that department. Typically only five percent of the total cycle or process time is devoted to adding value. In many cases, the product is waiting to be worked on 95 percent of the time. The same is true for paper transactions as well! In focusing on process time, it's important to remember three points. Process time is entirely within department control; has a powerful influence on flexibility, which is rapidly becoming the most competitively oriented factor in industry; and has a major effect on productivity. In fact, a recent article in *Business Week* noted that the "new math of productivity points to time as a manufacturer's most precious resource."

For example, in production rapid process time will minimize work-in-process inventory and should eliminate or at least minimize the need for finished goods inventories. Carrying costs will be reduced and cash flow improved. Also, the cost of reworking WIP and finished goods to comply with an engineering change order for a specific customer requirement is eliminated. Productivity is enhanced by the rapid identification and correction of problems before too many defective subassemblies and/or finished products are built. Rapid process time means that emphasis is placed on building the product or delivering the service right the first time.

As the build cycle shrinks, it becomes more predictable and dependable. By reducing the distance (time) between consumer and producer, customer satisfaction improves. It's important to note that process time in behind-the-scenes functions (such as manufacturing and new product introduction) has traditionally received less attention than it has in service delivery operations—for example, restaurants, 24-hour photo labs, and dry cleaners—where the customer waits for delivery.

Cost (Waste): In the new productivity context, cost is viewed in terms of the excess money (or effort) spent in order to achieve the required quality, delivery, and process time. At the BOS level, the main objective is to improve productivity by reducing overall costs. At the department level, however, the cost objective is to eliminate waste.

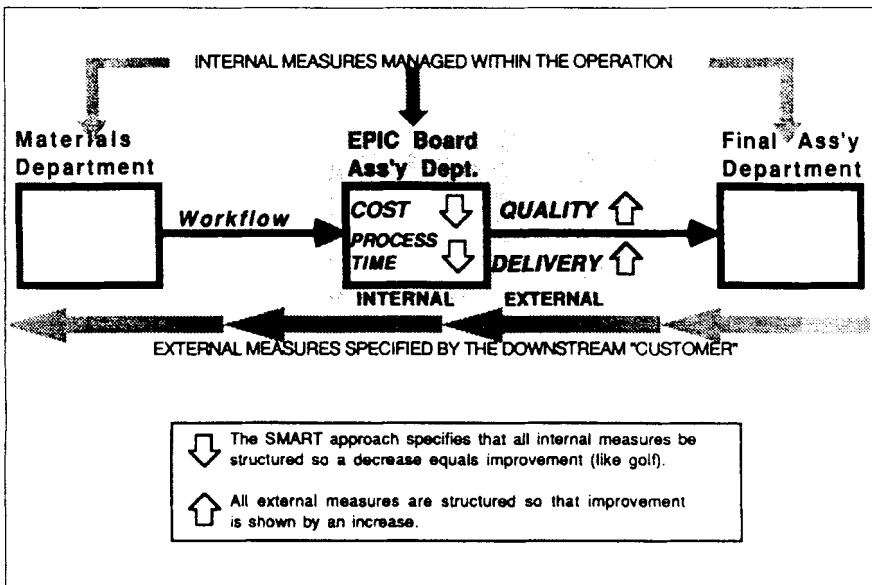
These four major performance criteria detailed above are seldom equally important at any point in time, and will probably change over time. For example, delivery may be critical for a time, but as competition heats up, quality or cost may become a decisive factor with customers. Thus, the control system must be sensitive to the business's and organization's future performance requirements.

APPLYING SMART

Once the conceptual framework was developed and supported by senior management, SMART was implemented in the printed circuit board assembly operation of Wang's Lowell plant. This operation was chosen for three reasons. First, it was close to the end customer (one department from distribution); second, it was the department where the EPIC project was initiated; third, and most important, its management was open to change and committed to making SMART work for them.

Teams were established with members from the department instituting the measures, the "downstream" or "customer department(s)," and the "upstream" or "supplying department(s)." The definition and methods of measurement were established by a joint venture. Through negotiation and compromise, the team members defined realistic, workable, and mutually acceptable performance indicators to optimize workflow throughout the entire operating system and, thus, better support the business.

The illustration below shows how the SMART model was applied in the board assembly operation. Quality and delivery performance measures were first developed for the department's output from the perspective of the customer (the final assembly department). Internal process time and cost goals were then established to best meet their external challenge. Next, the board assembly department worked out new quality and delivery measures with the supplier (materials department). In this way, new requirements and changing priorities are communicated as "quality and delivery expectations" from the downstream departments.



Three months after SMART had been implemented, management eliminated 20 percent of the measures used in their critical success factors, such as shop work order aging, productivity, machine utilization, and purchase price variance. A significant number of their measures needed refinement (for example, cost is now defined in terms of waste: inventory, rework, etc.). Working with its customer, the final assembly department, the board assembly department developed a new quality index. Also, new measures concerning timely delivery and the quality (completeness) of materials were established with the warehouse.

THE SMART DIFFERENCE

The SMART approach to performance measurement is fundamentally different from other popular programs designed to evaluate a department's performance. For example, an Internal Control System is essentially an accounting system designed to catch and correct the majority of bookkeeping errors. SMART is a strategically driven performance control system and, therefore, it serves a much broader business decision support system.

SMART provides a framework for a management control system, but with a new twist. Most management control systems are locked in time, monitoring past performance. SMART combines elements of a control system with elements of strategic planning. The framework for SMART allows the control system to continually self-adjust to the *future* needs of the business, as identified by the voice of the customer. Yet, SMART differs from department goal setting. When measures are related to fixed goals, the goal, once attained, is typically set higher. When the focus is on variances or shortfalls, feedback is often negative, killing motivation to improve. To be effective motivators, measurements should be defined in a way that encourages continuous improvement. In SMART, the focus on continuous improvement ensures consistent reinforcement.

Although it embraces key aspects of Quality Function Deployment (QFD), a system of translating customer requirements into appropriate company imperatives, SMART is more than a quality program. Like QFD, SMART recognizes that quality, delivery, and price are customer-driven, and internalizes these concepts as operational terms at each stage of the product/service creation process. But SMART also extends this viewpoint by adding internal operational performance criteria (process time and cost) and provides the mechanism to evaluate trade-offs among all four performance criteria.

Finally, SMART is not a new term for Management by Objectives (MBO). MBO is a process in which manager and subordinate sit down at the beginning of each performance period and agree upon individual job goals, which subsequently serve as a basis for personal performance assessment. Proponents of MBO say that it is a system for managing an

organization: holding managers accountable; encouraging all employees to contribute to department goals; coordinating goals within the organization; and measuring results. Although SMART and MBO share some common elements, such as planning and measuring performance, there are at least six fundamental differences between the two techniques:

- 1) SMART is not intended as a mechanism for assessing individual contributions at review time. Rather, SMART is aimed at group performance.
- 2) In SMART, it is assumed that management has already determined its business objectives in the course of its strategic planning process. SMART forces managers to focus on how to "satisfy the customer" rather than meeting internally set goals that may or may not be strategy-related.
- 3) While MBO centers on the manager-subordinate relationship within the department's vertical structure, SMART focuses on the horizontal work flow independent of organizational boundaries.
- 4) SMART is more concerned with the performance of the business as a whole operating system than with the performance of each individual part. SMART shifts the performance focus from departmental competition to operating system *teamwork*.
- 5) Once set, MBO objectives tend to become fixed throughout the organization. Adapting to changes in the external environment is often difficult. SMART, on the other hand, is a flexible system. It fosters change by establishing customers as key determinants of performance requirements and by establishing a process that facilitates change when appropriate.
- 6) MBO measures tend to be one-dimensional, often financially oriented. SMART measures—quality, delivery, process time, and cost—are multidimensional, relating to the performance of the business system and the execution of strategy.

In an award-winning article, "The Productivity Paradox," published in the July-August 1986 issue of the *Harvard Business Review*, Wickham Skinner challenged conventional wisdom concerning cost and productivity. "An obsession with cost reduction produces a narrowness of vision and an organizational backlash that work against its underlying purpose," he wrote. "To boost productivity in its fullest sense—that is, to unleash a powerful team of people supported by the right technology—we must first let go of old-fashioned productivity cost reduction as a primary goal." In SMART, the emphasis is on continuous improvement objectives for increasing quality and delivery while decreasing process time and cost.

OBSERVATIONS ON IMPLEMENTATION

The empirical data and observations from the Wang experience suggest that the SMART way to implement measures may take longer than other

approaches, but that the effort is worth it. When central groups, such as the finance department, develop measures, they usually aren't fully understood or accepted. When measures are instituted by edict, a great deal of effort is typically spent playing games with the numbers, fighting the results, or ignoring them until they go away. But when measures are developed, instituted, and updated at the operating level to match a particular strategy and work flow, the result is more likely to meet the needs of management at every organizational level. Managers at Wang's Lowell plant also noted short-term benefits from the implementation of SMART. Even before data on the newly established measures were collected and reported, service improved from one department to the next because of the clearer focus and improved dialogue between customer and supplier.

In essence, SMART measures departments and functions on how they are contributing separately and together in meeting their strategic mission. The overall impact will be powerful. SMART is already changing Wang's internal reporting, which is used in the business decision-making process. But SMART will *not* change either inventory valuation or Wang's external reporting practices. Management anticipates that when SMART is fully implemented in Wang manufacturing, it will have at least four broad effects on Wang:

- Mindset will be changed from focusing on stand-alone functions (vertical hierarchy) to integrated supplier-customer networks (horizontal workflow).
- New organizational alignments and priorities may emerge.
- Needs/priorities of management information systems will change to match the new information needs.
- The basis for investment justification will change from primarily a return on investment (ROI) calculation to include a more qualitative statement on how the project affects operational requirements for quality, delivery, and process time.

The SMART approach is not limited to manufacturing. The greatest opportunity for further improvements in corporate performance will come when two different functions—such as marketing and R&D, R&D and manufacturing, or manufacturing and sales—meet.

Everyone wins with SMART—the customer gets better, more consistent satisfaction; senior executives are more secure that their strategy is on track; and operating managers are focusing consistently on key result areas. This all adds up to better corporate performance for the stockholder and a satisfying work environment.