A Checklist for Productivity and Control

By James H. Reynolds

Common denominators in the formula for successful PCB production.

Systems and management tools for corporate control productivity vary according to company size, level of sophistication, and other characteristics. These tools change as the organization and the marketplace change. The checklist presented in this article evolved while I was preparing a project for the California Circuits Association. Intended as a catalyst for management, the list is based on experience in the PCB field as well as a wide variety of other industries. The purpose of the list is to help managers design and implement plans to strengthen their company's procedures, controls, and productivity.

Because PCB manufacturing consists of multiple operations, the list begins with the issues of backlogs, bottlenecks, and flexibility. I recommend that management use this as a starting point.

BACKLOGS

1) How are in-process backlogs expressed (for example, units, due dates, and hours)? Are they categorized by department or work center?

Are they visible to workers? If so, how are they displayed?

Backlogs should be expressed in terms of hours to completion. Employee hours are contributed to this effort, and the delivery schedule is also factored in terms of time. To facilitate the attitude of employees to the work, backlog hours should be categorized by work center.

Awareness of backlog hours gives employees targets for completion. Records of these hours should be visible to the workers so they can, under management supervision, access the work. They should also be encouraged to meet and surpass targets and seek ways to improve the efficiency of the operation. In the absence of such targets, the time to complete the work tends to equal the time available.

BOTTLENECKS

2) Are bottlenecks identified and managed continuously ? How is this accomplished?

Bottlenecks are those operations that limit the amount of work that can be moved out the door and converted to revenue. Typically easy to identify, they usually involve the most scarce resources, and the in-process backlogs accumulate in front of them. Bottlenecks have priority over other operations with respect to scheduling and management. They should involve judicious use of overtime, the shop's most proficient operators, quality and statistical process control, and the best maintenance efforts. Employees should work on overcoming these bottlenecks on a continuous basis.

Some simple techniques for achieving this goal include outsourcing, avoiding down time during employee lunch hours and break times, and ensuring that preparation and breakdown activities are performed by lesser-skilled employees so that critical operations and employees are used to a maximum. Bottlenecks will shift due to changes in product mix and other variables in the operation.

EMPLOYEE FLEXIBILITY

3) Are employees effectively Cross-trained? Are job skill levels and current employee skill levels known and defined? Do cross-training plans exist, and is this function linked to

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performance goals for supervisors and managers?

Cross-trained employees are key to effective use of personnel and equipment. Cross-use improves morale, encourages competition, results in process review and scrutinization and helps strengthen employees' vocabulary as well as improving corporate culture.

Skill levels should be linked with position descriptions. Awareness of skill definitions encourages employees to increase their knowledge and skill level, which, in turn, increases their value to the company,

Managers and supervisors should be responsible for periodically evaluating the skill and knowledge levels of their subordinates. They must focus on what their employees can do and how their skills might be improved. Skill flexibility should be considered at the employee level in each department and at the supervisory and managerial level across the organization. Managers should be encouraged to assess the ability of supervisors to substitute for one another in the event of vacations or illness, and to help deal with normal growth and attrition.

Effective ongoing cross-training requires an assessment of needs and dedication of resources (training materials and identification of skilled employees who can impart knowledge to trainees). Cross-training is easiest within departments, where employees have a skill and knowledge base regarding the particular technology and equipment.

The training should be scheduled for smooth implementation. Cross-training opportunities often come up spontaneously when a department experiences a lull in activity. Plans and objectives will facilitate the exploitation of such opportunities. Managers should link skill level assessments of their supervisors to continuously update cross-training objectives.

Cross-training should be linked to performance goals for supervisors and managers. The company's most valuable supervisors are those who are constantly training and establishing backups. Success in cross-training should be one of the parameters used to measure and reward management and supervisors.

ATTENDANCE

4) **What is the percentage of absenteeism in your company's work force? Are absenteeism rates categorized by department and employee? Does your company have written, formalized attendance rules? Are they enforced? How is good attendance rewarded?**

Absenteeism rates should be monitored and measured. Absenteeism is a cost of doing business, and it can be controlled. It highlights problems and trends, such as low Monday and Friday attendance. All absenteeism should be reviewed with respect to overtime; a common problem is that of the employee who is absent during regular hours but then works the premium overtime hours. Rates can be compared to industry and area rates. Absenteeism rates categorized by department and individual employees help to detect such problems and encourage supervisor follow-up.

The company should have written attendance rules that are circulated among employees. However, failure to enforce these rules implies that absenteeism and tardiness are acceptable. Enforcement is a statement of management's degree of seriousness regarding this issue.

Rewarding good attendance is effective. One method is to offer bonuses. A board testing facility reported an immediate improvement upon linking good attendance to qualification for quarterly bonuses.

OVERTIME

5) **Is overtime managed effectively in your organization? Does it determine average weekly overtime hours? What percentage of regular weekly hours are overtime hours?**

Overtime should be used judiciously to supplement regular hours, but it is frequently and easily abused. The efficiency with which overtime is managed is an indicator frequently used by consultants to determine the degree of control and effectiveness within an organization. Total lack of overtime may indicate overstaffing. Excessive shopwide or departmental overtime may indicate a lack of control or chronic understaffing.

Overtime hours should not be static; they should fluctuate relative to activity levels. In the PCB industry, this frequently occurs with the "end-of-the-month" phenomenon. An effectively cross-trained staff results in maximum utilization and minimal overtime.

The ratio of overtime hours to regular hours serves as an accurate barometer. Once a history and relationship have been established, this barometer will reflect any abnormal conditions or changes in the balance of the business.

WORK ORDERS

6) **Evaluate the adequacy of your firm's work orders and travelers. Do they contain sufficient information for operators, planned and actual times, and feedback for engineering?**

Work orders and travelers can be manual or automated, and many formats are available. The most important features are effectiveness in communicating instructions to operators, special instructions, and the ability to provide feedback for planning.

Self-checks help ensure operator verification of previous operations, Standard or target completion hours should be indicated, and space should be included for actual hours, if necessary. The work order should also serve as a record for costing and future planning.

SCHEDULING

7) **What are the weaknesses in your scheduling system?**

The more visible a scheduling system, the greater the chance it will be used. The most scarce resources—the ones that constrain the rest of the production process—should receive priority scheduling. The schedules of all other resources should be subordinate to those of the bottlenecks and the resources that feed them.

JOB TRACKING

8) How can you improve the visibility of your work in process?

The mechanism for tracking work in process can be manual or automated, Above all other concerns, it should be simple and easy to use. Customer inquiries, priority changes and other variables often require that accurate work in process status be determined quickly. For small- to medium-sized board shops, a manual system may function better for problem detection, quick decisions, and priority changes during the shift.

DOCUMENTATION SYSTEMS

9) Does your organization have written paper flows and documentation that are specifically defined?

Documentation, paper flows, and other management systems are tools that can either facilitate or impede smooth, efficient operation. Defined systems help employees do their job. The documentation systems and other management tools used to operate a company are not static, nor should they be.

While the organizations grow and products mix, the marketplace and other factors change, so should management tools. Because they become unwieldy and duplicative, documentation paper systems should be periodically analyzed, streamlined, and where practical automated. The updated systems definitions then serve as reference and training tools for supervisors and their subordinates.

QUALITY SYSTEMS

10) Are quality documentation procedures formally defined in writing? Does your company have an up-to-date quality manual?

Formal quality system definitions serve as training tools. By simply existing in an official, written format, they support overall quality. The basic quality instruments, such as inspection checklists, shipping and receiving inspection documents, defect reports, returned goods documents, and a corrective action program, are the most important factors.

Companies should establish sim-ple, regular quality reporting (the most common defects and cost of rework). Quality efforts should first be focused on the bottleneck operations, where they will have the greatest impact.

PROCESS SPECIFICATIONS

11) Are specifications with acceptance standards for key manufacturing operations thoroughly defined in writing?

In addition to their value in maintaining process control, process specifications with built-in acceptance criteria serve as employee training tools. The bottleneck operations should be addressed first.

STATISTICAL PROCESS CONTROL

12) Has SPC been implemented in your organization, or is such a program currently under way?

SPC documents are another management tool for improving process performance. Reducing process variability increases predictability and reliability and reduces yield loss. In conjunction with critical characteristics, controlled operations, and suitable process monitors, SPC documents can reduce or eliminate the need for end-of-line acceptance inspection and can reduce costs.

SPC is now required by a number of commercial and government contractors. In some cases the supplier is transmitting the data in real time to the customer for approval.

EMPLOYEE SELECTION AND DISMISSAL

13) Does your company have formal written procedures? Are these procedures followed?

The level of formality and degree of effort invested in these crucial management functions directly impacts work-force performance and attrition. A comprehensive personnel and

human relations function may seem like a luxury to many small operations, but the dividends are large.

Hiring is all too often conducted in a casual manner, without formal, comprehensive investigation. When searching for job candidates, consult local educational institutions, advertise, and check references thoroughly. Conduct panel interviews to obtain a consensus concerning qualifications, attitudes and compatibility.

Communication skills and literacy are critical but largely overlooked in the hiring process. Simple-to-assess tests should be administered to determine skill levels in these areas.

Employees who leave the company should be given exit interviews so their perceptions of the organization can be obtained.

EMPLOYEE EVALUATIONS

14) Are employee evaluations formally defined? Are reviews performed on time? Is there a two-way process of establishing goals and objectives that involves management and employees?

Procedures and formats must be documented to ensure their consistency and effectiveness. Punctual reviews are an indication of management's degree of seriousness concerning their employees, and they provide an opportunity for feedback, both positive and negative.

The practice of manager and subordinate defining specific objectives and the means for their achievement builds commitment.

TRAINING

15) How can training resources be strengthened in your organization?

Skill-development materials, tapes, manuals, mentorships, and various cross-training programs help management build quality, skill, and flexibility. Determine what is available by examining materials from different trade groups.

Recognition should be given to employees who have improved their job-related skills, particularly when they have done so on their own time.

PERFORMANCE MEASUREMENTS

16) How are productivity and qualit y measured ?

In the circuit board industry, measurements such as dollars of shipment per employee per month and boards shipped per month are popular. The former method has a basic connection to the bottom line. Productivity is best measured by comparing the standard production hours against total number of hours worked.

In a board shop with many variables, high productivity may not be equated with profitability. A measurement that relates to the bottom line, such as dollars of shipment, is probably the most accurate for this industry. The number and cost of customer returns are other accurate indicators.

GOALS AND OBJECTIVES

17) What methods are used to communicate this information?

Mission statements, training programs, employee meetings, and extra-curricular activities help to build a culture as well as a commitment to service and performance. But, perhaps most important is a visible example of management.

A business's ingredients are people, materials, equipment and systems, and tools for managing them. To the extent that such systems and tools are visible, consistent, and well adapted to the operation, they influence the success, comfort, and satisfaction of management and the work force. ■

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