Beat the Clock
Increasing Workforce Productivity in Process Industries
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EXECUTIVE SUMMARY

In today’s economic environment, companies are under intense pressure to reduce costs. Process-intensive industries such as power generation, power transmission and distribution, and oil and gas have significant opportunities to cut costs by increasing worker productivity. Ironically, many of these companies excel at keeping their physical assets at optimum productivity levels, but they fail to manage their human capital as effectively.

The potential savings can be substantial, especially in the current labor market, where a shortage of skilled workers has led to an increase in wages. An analysis of operations and maintenance divisions at process-intensive companies shows that productivity increases can result in cost savings of 5 to 10 percent of overall maintenance and operations expenditures.

So why do many plants fail to improve productivity? Is it that employee productivity is hard to measure? That thinking of workers as units of production is socially unacceptable? That employees and unions resist efforts to improve productivity? That non-repetitive work is difficult to quantify and make more efficient?

While all of these arguments have superficial merit, the most successful process-intensive companies manage to operate at high productivity levels, and in the past few years, a handful of lagging companies have proven that improvement is indeed possible.
In its simplest form, productivity measures the time that employees spend on value-added work (known as “wrench time” in most industries). For example, maintenance workers in the power industry have an average wrench time of about 25 to 35 percent, with a maximum of about 60 percent (see Exhibit 1). A mid-sized power generator with multiple plants that raises wrench time from 30 to 50 percent could save over $20 million a year.

It’s important to note that wrench time by itself does not measure the effectiveness of the work being done—that is, there’s no guarantee the time is being used productively. Some tasks may take longer than necessary (e.g., a pump could have been replaced in 30 percent less time) because of workers’ inexperience, a lack of appropriate tools, or poor planning. Worse, defective work needs to be redone. All of these problems undermine overall productivity.

The remainder of a worker’s time—everything outside of wrench time—includes things like safety meetings, training, and traveling to and from work sites, along with searching for tools or waiting (see Exhibit 2). This time can be reduced through improved planning, supervision, and communication, as well as through physical changes (rearranging a workspace, moving a lock-out/tag-out location, etc.).
KEY FACTORS

Operations and maintenance wrench time varies to a great degree, depending on factors that are both physical and cultural. Specifically:

- **Facilities/plant footprint.** Compact, well laid-out plants yield greater wrench time, whereas significant transportation time between work sites erodes productivity. This is particularly true for plant operations. For example, are plant controls set up in a way that requires two operators where one might suffice? Are there multiple control rooms, or are the controls consolidated to eliminate unnecessary walking? The level of automation and plant history are also key drivers. At a newer plant with few reliability issues, operators are much more willing to trust sensors and alarms. In older plants where sensors were recently installed, workers are less inclined to trust them and instead tend to check equipment manually.

- **Supervision.** Many supervisors get bogged down with administrative responsibilities like data entry. This isn’t the best use of their time, and it takes away from their more important role of overseeing front-line maintenance and operations workers.

- **Planning.** Productivity shortfalls frequently originate in the planning phase. Planning at many sites tends to be done manually (i.e., marking up a printed spreadsheet) and for the short term, often not more than a week ahead of current work. This handcuffs the workers and prohibits them from thinking long term to solve more systemic problems. At the same time, there’s a risk in relying too heavily on sophisticated planning software. The challenge is to assemble a plan that puts responsibility on each worker or technician to schedule tasks more efficiently, taking into account the longer-term planning horizon.
PRODUCTIVITY GAINS

Here are some examples of performance improvements that process-intensive companies have achieved using the framework outlined in this article.

Operations

A chemicals unit was responsible for desulfurizing the by-products in an industrial process and disposing of the materials. To improve productivity, the area supervisor—with the input of a set of operators—identified work tasks for each position and allocated time to each task. The company also eliminated a number of steps, including duplicate pH testing. Wireless controls were installed, freeing control-room operators to monitor and troubleshoot equipment. By selectively installing SO2 monitors, the company was able to eliminate a weekly manual monitoring round. Further, upgrades to mill controls, along with increased working capacity in slurry tanks, enabled the plant to scale back sludge-plant operation from daily to every other day. Overall productivity improved by 25 percent, and the company saved more than $1 million a year in unit operating costs.

Contract Services

The exploration and production operations of an oil company had invested in a number of improvement efforts. However, it realized that the contractors employed to service production sites were taking eight hours to complete tasks that could be done in half that time. When company representatives were on-site, activities usually took the estimated time, but the company didn’t have enough staff to monitor all the contract work. To fix the problem, it stopped paying the contractors by the hour and instead established a menu of standard tasks, with the preset time allotments and prices. Total contractor hours dropped by 15 to 20 percent.

Maintenance

A large, regulated utility faced significant maintenance budget overruns. Repeated staffing reductions to rein in costs did not solve the problem. Analysis revealed that the work management system—identifying, planning, and executing work and closing out the work orders—needed to be revamped. Through direct observation of maintenance work orders relative to existing and best practice processes, the organization focused on streamlining the process. Changes included clarifying lock-out/tag-out procedures, linking the work schedule to activity lists, and training the existing staff in work order management and materials planning practices. Improvements resulted in a productivity increase of 20 percent.

Supervisory

At a chemicals company, the workforce lacked sufficient training and guidance. The fundamental issue was that supervisors were being pulled away from their direct staff responsibility by administrative tasks. An assessment of each supervisor’s workday revealed large blocks of time spent attending meetings, completing paperwork, and doing data entry. (Union workers were considered “not qualified.”) To address this problem, much of the administrative and data entry work was offloaded to junior staffs. The approval process was automated, which freed up foremen and supervisors to spend more time with the workforce and ultimately improve plant operations and workforce effectiveness. Some 30 percent of weekly administration time was ultimately eliminated or reassigned.
Improving productivity starts with an in-depth analysis to determine where the true opportunities lie. The goal is to measure actual wrench time and identify how and where value gets destroyed during the workers’ time on the job (see Exhibit 3). The process takes a few weeks and involves both self-assessment by managers and direct, impartial observations of workers and technicians.

The first step in analyzing the overall productivity of a facility is to establish a baseline for how long specific tasks should take and then compare it with how long they actually take. This applies to all of the activities of maintenance employees, operators, contractors, and supervisors. Personnel data—including capabilities, years of experience, shift patterns, and time off—is factored in. To help determine a baseline, jobs should also be benchmarked against industry standards.

Workout sessions are conducted with line staff and supervisors to identify unnecessary steps or wasted time, along with possible solutions. It’s critical that the plant workforce participates in measurement and baselining, so that they understand the process and begin to see how it will

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**Exhibit 3**

*Productivity Losses in Operations and Maintenance Workflow*

<table>
<thead>
<tr>
<th>Operations</th>
<th>Planning / Scheduling</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Facility design/layout</td>
<td>• Limited pre-job scouting</td>
<td>• Inefficient warehouses layout</td>
</tr>
<tr>
<td>• Shift/personnel alignment to specific plant areas without cross-training</td>
<td>• Lack of standard bill-of-materials or execution processes</td>
<td>• Outdated system / process diagrams and management-of-change</td>
</tr>
<tr>
<td>• Staff sized to respond to high-impact low-probability (HILP) events</td>
<td>• Poorly coordinated Lockout/Tagout processes</td>
<td>• Lack of formal training in problem solving</td>
</tr>
<tr>
<td>• Delineations between Operations and Maintenance staffs</td>
<td>• Limited metrics for staff utilization or job completion rates</td>
<td>• Maintenance programs not aligned to equipment criticality</td>
</tr>
</tbody>
</table>

**Source:** Booz & Company
improve the efficiency of their facility. Plant personnel, particularly midlevel supervisors and above, typically believe they know all the issues and only need help to “fix the problem” or justify the million-dollar investment for new equipment. Clearly, the plant operations and maintenance staff are fighting fires every day and intimately know the symptoms that cause them to fall short of their performance aspirations. However, a rigorous baseline frequently uncovers unexpected root causes—the pain points that plants have lived with for years.

After baseline data for the amount of time required to do each task is compiled, activities should be classified into three categories: customer value-add, business value-add, or non-value-add. For example, meetings can be business value-add or non-value-add. Meetings for equipment certification or safety refresher training clearly add value to the business. But meetings to re-explain basic procedures to a poorly performing worker add no value. Even physical work may include non-value-add time if the actual time spent on a task is more than the planned amount (provided that the planned amount is based on industry standards or past history).

Key questions in this analysis include:

*Customer value-add*
- Does the task add form, feature, or function to the component or service?
- Does the task enable a competitive advantage (lower price, faster delivery)?

*Business value-add*
- Does the task reduce owner financial risk?
- Is this task required by law or regulation?

*Non-value-add*
- If you were the customer, would you be willing to pay for the task?
- Could the task be categorized as waste?

Finally, this kind of analysis must be applied to all facets of the plant—not just routine operations and maintenance but also outages and turnarounds (which can be complex, given the number of workers on-site and the need to get the facility back online quickly). In addition, on-site contractors involved in technical services—such as maintenance, environmental management, predictive measurements, and the like—should be evaluated as thoroughly as full-time staff. Many facilities hire contractors on time-and-materials agreements, which do not give contractors incentives for improving productivity.
At this step, a detailed list of problems, root causes, and potential solutions is compiled. Human nature drives people to focus only on the most obvious issue, which may not result in a sustainable fix. The investment of time required to analyze multiple problems from many angles, connect the dots, and develop a long-term solution will pay significant dividends.

A typical effort will generate more opportunities than the organization can support. Prioritizing on the bases of implementation time and expense will narrow the options to the most promising for a given facility. Only then can management choose specific targets and set aside funding.

Direct communication with the organization at all levels during this phase can help persuade the workforce to accept proposed changes. This includes mapping out the implementation schedule, developing project plans, and assigning accountability for delivering the expected benefits on time. Workplace cultures can be stubbornly resistant to change, especially those where a strong union may balk at productivity improvements that result in lost jobs. But coordinated efforts to explain the vision and emphasize the long-term goal of a more streamlined, efficient organization will help generate early-stage momentum. Frequent and transparent validations of activities and progress will help sustain this momentum as the improvements take effect.

In maintenance, most of the productivity gains can be found by focusing on non-value-add activities, such as travel, waiting, and searching for tools. Conversely, in operations, the gains typically come in one of four areas:

• **Work reduction.** Some tasks don’t need to be performed as frequently. (In rare cases, certain tasks don’t need to be performed at all.) Reduction can involve small steps like modifying operator rounds so that equipment is checked less frequently, or scaling back the frequency of preventive maintenance. More significant changes eliminate duplicate steps. All proposed changes should be monitored to gauge their real effectiveness.

• **Separation of shift activities.** Many facilities operate with the idea that certain work must be done on-shift, or off-shift, or by plant personnel. This can keep staffing levels unnecessarily high. The goal is to evaluate the priority and skill level required for each task, and then assign tasks

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as appropriate to fully utilize the workforce and use low-cost options wherever possible.

• **Technology and automation.**
  Advances in remote sensing and telemetry have brought down the cost of automation. While process automation has received significant attention, less emphasis has been placed on automating time-consuming or risky tasks. Increased control-room automation can unshackle operators from the desk and free them to roam the plant when necessary. Furthermore, installing cameras and sensors to eliminate the need to climb a tower or enter a hazardous area can provide significant payback in both time and safety.

• **Qualification levels.** Staff certification requirements may limit work load leveling. Evaluate restrictive work rules and staff training deficiencies to identify work that can be reassigned both within and across departments. Examples include tapping underutilized operator time for routine equipment maintenance, and certifying them for heavy equipment operations. Once standards are put into place, supervisors can monitor compliance.

## CONTINUOUS IMPROVEMENT

While successful implementation is absolutely critical, productivity gains will fade away without a continuous improvement program. Consequently, these steps should happen in parallel.

First, the implementation program needs to be formally launched, managed, and monitored. This takes place at a program office staffed by an overall program leader, an analyst to evaluate progress (especially results falling to the bottom line), and subject matter experts (SMEs) to assist in such areas as planning and work area layout in order to deliver the intended productivity improvements. These SMEs also serve as on-the-ground fixers whenever issues are encountered or progress bogs down.

Second, the company needs to implement its brand of continuous improvement along with changes to the facility’s culture. This may draw on TQM, Lean, or Six Sigma principles and will involve employee training, a clearly defined set of performance metrics, and participation in the overall improvement effort. In addition, executives need to be visibly involved. A Lean principle of executive leadership on the factory floor is highly valuable.
CONCLUSION

Improving productivity is a continuous journey. It’s not a binary before-and-after proposition, but rather an evolution of careful analysis and detailed implementation, followed by feedback and periodic adjustments. The most successful initiatives improve not only the efficiency of a workforce but the culture of an organization. Given the current economic downturn and the increase in skilled wages, improving productivity has become more important than ever, and it can pay compelling financial dividends.
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