

# Increasing Production Efficiency

*Back to Basics: The Five Steps*

## **Preface**

Food and beverage producers are incessantly challenged to increase profitability and lower costs in an economy that is confronted with fierce competitive markets, complex supply chain infrastructure and increased energy burden. Today, facilities operate in environments regulated by programs aimed at maintaining high standards in food, worker and consumer safety. It is apparent that improved production efficiency has become a necessity to thrive and succeed in today's marketplace.

In a time when many food and beverage companies are forced to target growth strategies either by acquisition, renovation or constructing new factories, one thing is certain: business must be profitable. To reduce overhead, many downsize or eliminate internal groups within their respective organizations, losing core competencies along the way. Core competency is intrinsic knowledge within an organization that is essential to the goods produced, whether it is in operations, engineering, or other key positions. These skills and knowledge generally are rooted to the origination of the company, and are developed or acquired over time; an investment. These internal skill sets are not completely lost to the marketplace, but deferred to consultants, think tanks, and integrated firms that are outsourced by the food and beverage manufacturer.

All competing producers have one thing in common. They operate similar equipment within the confinement of varying structures. What happens within these structures can make the difference. Improvements to efficiency on the factory floor can lead to lower costs that are reflected in the bottom line. This paper summarizes the basics steps towards efficiency reform for those companies that may have lost some of the core values along the way or for those needing a common sense approach or road map to evaluating their production output on the factory floor.

## **Efficiency & Production**

The definition of efficiency can be referenced in books and periodicals ranging in subject matter that include energy, electrical, mechanical, thermodynamics, quantum mechanics and even economics. It can be argued that all of the above may find its origin in physics where the efficiency can be defined as useful work per quantity of energy.

Production is a flow concept that measures the rate of output per unit of time. Therefore, production efficiency can be described as the percentage of total energy content that is converted to saleable product at the least cost. Remaining energy is lost to the environment as heat and waste, when measured over time.

## **The Five Steps**

1. Maximize raw material utilization
2. Control packaging costs
3. Manage labor costs
4. Benchmark and manage Overall Equipment Effectiveness (OEE)
5. Implement Continuous Improvement Programs

### **Step 1: Maximize Raw Material Utilization**

Raw materials are the essence of the finished product. They are the ingredients and are usually the most expensive recurring cost. Due to this fact, raw materials receive special attention in terms of procurement, transportation, storing and manufacturing, all of which could be subject to its own white paper. No matter the product, each elemental step absorbs energy. It is crucial to increasing production efficiency that the raw materials are handled minimally in terms of occurrence, energy and waste. This philosophy will be consistent for all steps presented. Efficiency is measured by the number of quality units produced against the unabsorbed energy and waste emitted to the environment. Handling raw material waste can be associated with high disposal or handling costs, and expensive operational procedures and management.



### **Methods for maximizing raw material utilization include:**

- A. Data acquisition: This should include recording all energy inputs throughout the process and tracking of critical properties such as weight, volume or temperature of the raw materials as they are tracked throughout the manufacturing step. If it is not measured, it cannot be improved upon.
- B. Analyze process methods utilizing process flow diagrams and mass balance spreadsheets. Track material flow, energy inputs, product yields, energy consumption, waste and downtime that are critical to process points.
- C. Analyze and optimize process layout. Identify and prevent cross-flow or contamination.
  - Identify bottlenecks.
  - Minimize raw material handling or over-handling.
  - Evaluate applied technology in terms of energy and performance output.
  - Analyze and rationalize product mix and equipment to production schedule.

### **Step 2: Control Packaging Costs**

Primary and secondary packaging systems are often subject to great opportunity for improvement. Technology in these areas is advancing rapidly, to where upgrades and replacement equipment can provide tremendous benefits in efficiency by reducing waste while producing more finished product units per unit time. Packaging systems usually implement more consumables such as film, corrugate, containers, labels, tape, glue and printing media than anywhere else in the production process.

Due to new expensive packaging materials and technologies, marketing, higher consumer demand and quality expectations, this category is emphasized when focusing on efficiency improvement. Packaging is usually the last critical phase where food safety awareness is at its peak. This is usually where the finished product is sealed from the outside environment and shelf life countdown begins. Methods for maximizing for raw materials should be repeated for managing packaging costs with greater emphasis on automation.

### **Step 3: Manage Labor Costs**

Increases in labor rates, insurance and benefits have made overall costs associated with labor a major influencing factor when tasked with improving plant efficiency.

Automation should be investigated when appropriate. It can help reduce labor and allow for elimination or reallocation of employees to more productive areas. Mechanization increases reliability, consistency, quality and performance in many plant operational categories, which increases quality ratings.

Additional methods that should be considered when managing labor costs are:

- A. Third party analysis and feasibility studies.
- B. Industrial engineering studies: Evaluate potential automation candidates and identify ergonomic issues. Poor ergonomic environments promote decreased output due to injury and fatigue. Improving manual work zone ergonomics may decrease labor requirements and potentially defer automation, which usually carries a large capital investment.
- C. Process layout analysis and process work stream analysis.

### **Step 4: Benchmark and Manage Overall Equipment Effectiveness (OEE)**

Overall Equipment Effectiveness or OEE is another topic to which a paper could be dedicated. Simply put, OEE is a formula that utilizes three equally important factors. Each factor alone is useful as a metric when analyzing the overall efficiency of the manufacturing facility.



The factor components of OEE are:

- A. Availability: Operating Time / Planned Production Time (Includes Downtime Loss)
- B. Performance: Design Cycle Time / (Operating time / Total Pieces)
- C. Quality: Good Pieces or Measureable Unit / Total Pieces

OEE is then defined as Availability (X) Performance (X) Quality

OEE is measured against the theoretical clock and therefore it should not be expected to be 100 percent, although that would be the ultimate goal in the vacuum of space. OEE should be benchmarked when probing for production efficiency improvement. Daily spikes or drops in OEE may alert to drop-off in availability, performance and/or quality since daily conditions change from day to day.

Chronically poor OEE figures may lead to discovery of equipment deficiencies and will help with theoretical replacement. When looking for replacement equipment, consider machine life cycles and capital expenditure that should include all components of the project in lieu of the stand-alone machine. Capital improvement projects must produce an acceptable return on investment (ROI) to the organization. Depending on equipment life cycles, ROI requirements may be extended and purchase amortized in order to redeem the efficiency rewards immediately.

### **Step 5: Implement Continuous Improvement Programs**

Once steps one through four are implemented, it is most important that optimization is continued through improvement programs. Systems, raw material inputs, energy inputs, packaging materials, waste, performance, quality, OEE should be measured and observed. Programs and metrics can be customized to fit the individual factory or the corporation's culture. These measurements should be monitored for change. Change is the number one indicator that efficiency is declining or improving, especially when all complex factors are set in motion.

Programs essential to successful improvement and maintenance of efficiency levels are:

- A. Preventative Maintenance: Keep the machinery operating at Original Equipment Manufacturers (OEM) specifications. Programs should be aimed at moving toward predicted maintenance in which problems are avoided during programmed downtime and parts are replaced on planned intervals. Downtime shall decrease while OEE should increase.
- B. Automation: Manufacturing Execution Systems and Supervisory Control and Data Acquisition Systems can be implemented to provide invaluable real time data that could indicate malfunctions or concerns and sound alarms or generate reports that would be aimed at monitoring and improving production efficiency.
- C. Lean Manufacturing Principles
- D. Third Party Audits
- E. Benchmarking and annual report cards
- F. Management and personnel training

### **Conclusion:**

Food and beverage producers operate facilities of varying complexities globally. Due to the dynamic nature of the marketplace and growth, profitably flourishes and/or is hindered by a plethora of factors that cannot predict success. End-users and consumers are demanding more quality driven products, while increasing energy costs continue to cascade through all industries, driving the food and beverage producer to higher costs in a very competitive arena. Profit is no longer the only end game as customers are now concerned with sustainability and carbon footprints. Corporations will analyze and struggle with supply chains and logistics but remember, efficiency can be applied to all categories as stated earlier. There are more efficiency formulas than there are stars in the sky. The purpose of this paper is to simplify an enormously complex issue in the realm of common sense. The production floor can be measured; therefore it can be controlled and is a good place to start to improve efficiency.

*Taking Solutions Further:*



***Start improving your bottom line.***

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