CAPACITY PLANNING FOR CAPITAL PROJECTS: HOW TO REALIZE THE BEST ROI FOR EQUIPMENT UPGRADES

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INTRODUCTION

Many capital projects start their life as an observation of a problem. “This equipment seems always to be backed up,” a shift manager notices. “This belt is always stopping when I am trying to unload cases from the truck,” an associate confirms. The problem is reported to upper management as a request for an equipment upgrade.

A maintenance or operations manager is tasked to seek quotes for upgrades or replacements to the equipment. A vendor provides a proposal for a replacement unit that will run at twice the speed that the existing equipment currently runs. For the initial investment provided in the quote it appears that the new equipment will achieve twice the throughput as the old equipment, and the labor eliminated will payback within 2.5 years. Perfect, problem solved. The project is approved.

The new equipment is installed and started up. Even though the shift manager who initially noticed the problem receives fewer complaints about the line being backed up, he notices that associates who load the line are still often waiting for the equipment to free up space. He looks back at several weeks of production numbers since the new equipment was installed to find out if the improved productivity that was expected was actually achieved. As it turns out, equipment that runs at twice the speed of the old equipment does not necessarily result in twice the throughput.

There are a few common drawbacks to using the high-level rationale to define ROI on an equipment project:

- **Real-life operational inefficiencies are often overlooked**. There are natural cycle times to each process that could involve productive tasks necessary to the process but do not contribute directly to production units, such as the time it takes to change out a truck within the same door. Does the equipment handle the range of products the same? How do different weights and dimensions of cases influence the realized performance of the equipment?

- **The benefit may be based on unrealistic runtime or quality conditions**. Does the equipment need to go through safety checks every shift before it can be used? How often does preventive maintenance need to be performed, and for how long? What percentage of packages cannot satisfy Right the First Time and require human intervention before being processed again?
- **Equipment may be over-specified for the intended purpose, incurring unnecessary initial capital cost, or under-specified for the range of materials to be handled, resulting in add-on fees to fix the issue during start-up.** Is the goal of the project clearly defined? Has a diverse project team vetted the scope? Are the appropriate resources available to execute the work?

A **process flow chart** is one of the most beneficial tools to aid the team in understanding all the influential inputs and outputs that the equipment will need to accommodate. The expert knowledge of a project manager to plan a project, making sure all the initial costs are understood and taken into account, will result in fewer surprise costs during project implementation and start-up.

A **capacity study** will aid accuracy in ROI estimation to determine the true throughput that is expected from the proposed equipment once implemented. An equipment capacity analysis aims to minimize the necessary initial investment while maximizing the savings that can be realized. An Industrial Engineer's expertise here is critical. An engineering consultant can help if your business does not have the appropriate resources.

CALCULATING CAPACITY REQUIREMENT

The requirements for the equipment must be defined to understand the goal to be achieved when sourcing equipment options. First, determine the unit of measurement so that data from multiple sources can be standardized and understood. Verify as necessary by asking questions to the associates gathering data to check for understanding.

Use a process map to identify all sources of inputs and outputs. Where does this equipment fit into the overall flow of the operation? Is it a preceding process, bottleneck process, or successive process? Additional capacity should be planned into leading and finishing processes to absorb fluctuations in output from interruptions in the bottleneck process. The bottleneck process is commonly one of the middle processes, the most expensive process to operate. The preceding process must not starve the bottleneck, and the successive process must not block the bottleneck. An engineer or consultant can use statistical analysis to determine the deviation from the mean of bottleneck output and design an appropriate amount of additional capacity requirements for either end process.

INFLUENCES ON THROUGHPUT

A realistic throughput must be calculated to understand the annual benefit in terms of cost savings. Two variables of influence on the throughput that will be realized by the equipment are Overall Equipment Effectiveness (OEE) and Scheduled Time.

Overall Equipment Effectiveness is defined by **(Availability * Quality * Performance)** as a percentage of the Scheduled Time of the equipment. In broad terms, this means "how well did the equipment run when it was intended to run." Some factors that can affect Availability are breakdowns, lack of product (starve), change-over, or setup downtime. Quality can be affected by the volume of non Right-First-Time processes, such as scanning errors. Performance is affected by slow cycles such as running the equipment at less than top speed and manual labor components that are not performed at standards, such as meeting the labor standard for unloading cases per hour. These effects on OEE can be estimated through analysis of past production data and should be considered to influence a more realistic throughput estimation of the equipment in the ROI calculation.

Consider the scheduled time on the asset that is required for the necessary volume to process. Weigh the costs of adding more scheduled time, such as an additional shift, on existing assets (at additional labor cost) against the investment cost of installing new or upgraded equipment. Remember that savings will only be realized during the scheduled time of the equipment required to process the forecasted volume. Idle equipment generates no savings.

SELECTING THE RIGHT EQUIPMENT FOR THE JOB

One of the most important aspects of realizing a more significant ROI is specifying equipment that meets the requirements of the job. Using a standardized Request For Quotation (RFQ) will ensure that the requirements are well defined and that each prospective vendor provides a quote that addresses all of the requirements and that are comparable to each other.

After the RFQs are sent out to prospective vendors, hold a supplier conference so that vendors can ask questions and make clarifications on the requirements. It is beneficial to have all prospective suppliers present to hear the same questions and have an opportunity to reply to them. If any vendor cannot be present at the supplier conference, ensure that each prospective vendor gets a copy of the questions asked.

Once vendor questions are answered, and all updated quotes are received, iterative selection can be executed using a simple rating system. Rate each of the equipment choices against each of the requirements as how well does the equipment offerings satisfy the requirement. For example, 0= not at all, 1= meets requirements some of the time (has common conditional exclusions), 2= meets requirements most of the time (has few conditional exclusions), 3= meets requirements all of the time (or has automated systems that monitor compliance). Add the total "points" for each equipment option to make a selection.

Example:

Requirements	**Equip A**	**Equip B**	**Equip C**
Meets (company) and OSHA safety requirements	3	3	2
Max run speed of >500 feet per minute	0	2	2
Label scanning reject rate < 2%	2	2	1
Allows method for immediate associate intervention for rejected packages and reinsert to process (no out-of-flow jackpot)	0	2	0
Total	**5**	**9**	**5**

The preferred equipment selection in this example is Equipment B because it received the highest requirements compliance rating. It is common that a supplier quote will not satisfy 100% of the requirements specified, so some compromises will need to be made. This is best discussed with input from the operations team. Consider reputation, financial longevity, service level guarantees, and other "intangibles" of the proposed vendors in the selection process if your business does not intend to service the equipment in-house. Other factors such as purchase price and company politics may become a factor, but the simple rating system gives a precise baseline to demonstrate the choice that best satisfies the project requirements.

Check the specifications of the selected equipment against the project requirements once more with an inclusive project team to ensure that the end result of the project will satisfy the business goal. Pay particular attention to the range of products to be handled (dimensions, weights, materials). Use expert judgment to discover the most common problems faced with current equipment and ensure that the new equipment will eliminate or significantly reduce these issues. Operators know best!

Ensure that the equipment capabilities will solve the goal and not more. Overspecification can needlessly drive up the initial purchase price. If necessary, perform iterations on the expected objectives (goal) and get approval from management or project sponsor if the initial requirements change.

SUMMARY CONCLUSIONS & RESOURCES

This white paper focuses on the considerations to more accurately calculate the two elements of ROI; Initial Investment and Annual Return (savings). Calculating an accurate capacity requirement and understanding the true capability of equipment are necessary inputs for realistic savings figures. Specifying equipment properly to meet the stated business needs can reduce overall investment cost while ensuring the investment will yield effective results. Experienced project management and industrial engineering input are invaluable skill sets to utilize to reduce costs and improve productivity while executing projects.

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