

REDEFINING CAPTURE EFFICIENCY RATINGS VIA THROUGHPUT

The current measure of production scanner efficiency is rated speed. Quoted by every manufacturer, the industry has grudgingly accepted it as the only metric that allows equipment to be compared side-by-side. Eastman Kodak advocates adoption of a new metric, one that more accurately conveys how a scanner performs not in a test lab, but in a workplace environment: throughput.

The State of Capture Efficiency Ratings. It's the statistic that your eyes jump to first when sizing up a new production scanner: speed. Whether pages per minute (ppm) or inches per second, this measurement has become a de facto way to determine how one machine matches up against another. Some manufacturers take this concept even further, specifying price-to-performance ratios (list price divided by rated images per minute).

But are these measurements an accurate way to gauge increased efficiency of a new scanner purchase and installation?

While rated speed and the price-to-performance measure provide some indication of a scanner's performance, they don't take into account the myriad of variables that operators encounter during field use: document preparation, loading time, user interaction, document handling, maintenance, PC capacity—many of which have escalating significance as speed increases. The list goes on and on.

A more effective measurement is throughput. The American Production and Inventory Control Society (APICS) defines throughput as the total volume of production through a physical facility or machine.

When applied to document capture, the amount of scanned documents divided by total process time factors in the multiple "real world" situations overlooked by rated speed specifications. Only throughput provides an accurate, overall perspective on how a scanner will affect workplace productivity.

THE DEMAND FOR A NEW PRODUCTIVITY RATING

The figure that most customers want revealed is the number of documents that a scanner will actually capture during the course of a day or shift. This rings true for Tim Fehr, executive vice president of Berkheimer, Pennsylvania's largest independent local tax administrator.

"The manufacturer's rated speed is never equivalent to what we can actually put through in a production environment," said Fehr. "We typically take a rated speed and divide it in half when considering a new scanner. That at least provides some degree of approximation as to the actual production speed."

While the rated speed simply refers to the constant velocity of the rollers or belts, it doesn't reflect how the scanner interacts with its operators, associated equipment, or even the document handling. The only true efficiency measure, throughput, is the total time needed—from preparation to completed processing—to finish jobs composed of standard document batches. Customer feedback obtained by Kodak indicates that it can range from 30 percent to 90 percent of rated speed, depending on the manufacturer.

Obtaining a more accurate view of scanner efficiency also allows customers better control over total cost of ownership projections.

THE ELEMENTS OF THROUGHPUT

As mentioned earlier, throughput must take into account each and every step in the document capture process. Even minor time improvements in a handful of categories can lead to significant overall efficiency gains, especially if early stage bottlenecks can be remedied (therefore allowing the rest of the process to run closer to capacity). Likewise, poor performance in just one area can throttle down an otherwise highly efficient operation.

The following chart details process steps found in many customer sites, along with steps that Kodak has taken on its new i800 Series Scanners to improve throughput potential.

Preparation		Scanning		Output	
Operator Training	Kodak provides highly detailed manuals and hands-on multimedia training, eliminating potential slowdowns because of a lack of pre-use training.	Operator Interface	Software-driven buttons on the i800 Series provide for intuitive scanner operation.	Quality Assurance	Kodak SurePath and Perfect Page Scanning address potential QA problems during the during the capture process, expediting operator-assisted QA.
Sorting & Batching	Because of Kodak SurePath paper handling and simultaneous bitonal/color scanning features, less time needs to be spent sorting and batching documents.	Document Input and Handling (feeding and maintenance)	Kodak QuickSet elevator provides 1,000 sheet loading, rapid recycle times, and auto-reset. Ultrasonic, calibration-free multi-feed detection virtually eliminates the need for constant operator monitoring.	Post Processing	Automated image quality adjustment and electronic color dropout performed during the scanning process quicken the pace at which post processing (e.g., OCR and indexing) can occur. In many cases, throughput is limited by the robustness of the host card, system, and application software. Although Kodak cannot directly control these issues, it regularly works with systems and software vendors and customers to suggest potential performance enhancements.
Staple/Clip Removal & Damage Repair	Kodak SurePath paper handling and Perfect Page Scanning are more forgiving of damaged documents, requiring less repair time on the part of operators.	Image Capture	Kodak Tri-Color Plus CCD sensor enables simultaneous bitonal and color scanning, eliminating the need to scan a document twice. Electronic color dropout feature lets operators remove irrelevant background color without stopping to change lamps. Zone Processing allows user selection of a fixed subsection or zone from which to capture color or bitonal information.		
		Image Formation & Enhancement	Kodak Perfect Page Scanning provides automatic deskew, rotation, and adaptive threshold processing, improving OCR and human readability without operator intervention.	Export & Delivery	Kodak scanners deliver industry-standard CCITT Group III-1D, 2D, or IV (bitonal) and JPEG (color) formats suitable for direct use with multiple data platforms.

INDUSTRY ADOPTION

If throughput is the best method of determining a scanner's efficiency, why hasn't it been adopted wholeheartedly by the imaging industry?

One reason is the significant variance between throughput specifications on scanners rated at the same speed (e.g., 30 percent to 90 percent of rated speed, depending on manufacturer). Those manufacturers whose scanners have lower throughput ratings will be less apt to support a change, preferring to state the rated speed figure so as to seemingly put their equipment on par with more efficient devices.

A second reason has been the lack of a standard testing process, one that can be implemented not only in a manufacturer's test lab, but also by a customer in a production scanning environment.

CREATING INDIVIDUALIZED THROUGHPUT TESTS

What does a standard document set look like? Because no two organizations are alike, no two organizations will share a typical document set. This necessitates individualized throughput testing.

The most common mistake when determining individual throughput is measuring for rated speed. For instance, simply calculating how many pages of a single size can be fed through the machine in one minute results in this figure.

However, most production scanning environments process mixed document batches.

For example, a standard document set could consist of 100 pages of 20 lb. paper, broken out as follows:

- 25% - 2 1/2" x 6" (CHECKS)
- 25% - 4 1/2" x 5 1/2" (1/2 SHEET)
- 40% - 8 1/2" x 11"
- 10% - 11" x 14"

A set such as this could actually increase the rated speed of the scanner because smaller documents will feed faster. On the other hand, it could decrease the rated speed if the scanner's feeder didn't have the capability to reliably feed mixed-size documents without jamming.

Taking this into account, the simplest way to calculate an estimated throughput for an organization is to determine the equivalent number of 8 1/2" x 11" pages scanned for a common workload, as shown in the following table:

Inches per average document*	Effective 8 1/2" x 11" Conversion Factor	
	Landscape	Portrait
6.55	1.30	
8.61		1.27

* For instance, (2.75" x .25 composition) + (4.25" x 0.25 composition) + (8.5" x 0.40 composition) + (14" x 0.10 composition) = 6.55 average landscape inches per document.

† 8.5" x 11" standard document divided by inches per average document.

It can now be estimated that with the above distribution of mixed documents, a scanner rated at 160 ppm (landscape) for 8 1/2" x 11" paper should mathematically scan the mix at 208 ppm (160 ppm x 1.3). Again, this is a hypothetical example, assuming the scanner's feeder can accommodate mixed documents, and presuming that not a single document will cause a work stoppage because of a jam or need for exception scanning.

The takeaway? Real world scenarios must be taken into account to achieve a more probable rating. For instance, the feeder may encounter trouble accepting varied batch sizes.

Let's consider a couple of typical slow-downs, and determine how they affect the throughput rating:

- Encountering eight paper jams per shift, with each jam requiring approximately five minutes to clear and prepare the machine for the next document (40 minutes = 0.66 hours).
- Rescanning 10 documents per shift, each taking five minutes (50 minutes = 0.83 hours).

Taking these factors into account, the actual throughput is quite different from 208 ppm. An eight-hour shift, allowing for one hour of lunch/breaks and the 1.49 hours of downtime detailed above, only leaves 5.51 hours of effective scanning. As such, the actual utilization of the machine is 89.5 percent of the rated speed.

Manufacturer published rated speed (pages/minute landscape)	160
Manufacturer calculated throughput (pages/shift) – 8 1/2 x 11	76,800
Mixed documents speed/minute	208
Effective hours of run time	5.51
Effective throughput (pages/shift) with downtimes	68,765
Utilization against manufacturer calculated throughput	89.5%

If you continue with this example, rescans must also be included for document anomalies such as folded sheets, bent corners, etc. These significantly increase stoppages and increase throughput time.

There may be other reasons a scanner stops during operation, known as unscheduled maintenance time. This must also be entered into the throughput calculation to determine the true efficiency of any scanner in a production environment.

THE KODAK COMMITMENT

Many manufacturers will not or cannot provide throughput metrics for their scanners, primarily because all documents are not the same.

However, Kodak is committed to helping its customers understand that rated speed is not the only measure upon which to rely when considering new scanner purchases and deployment.

Throughput gives organizations a more accurate way to predict which scanners will best meet their productivity needs.

More information is available by calling Kodak's Document Imaging Division at 1-800-944-6171 (U.S. and Canada), by contacting an authorized representative of Kodak products, or by visiting <http://www.kodak.com/go/docimaging>.

TIPS FOR ACHIEVING HIGHER THROUGHPUT

Some basic lessons can be applied to increase overall throughput of a system:

- Uptime: Pull out all the stops needed to ensure maximum uptime of the scanner. Pay particular attention to the feeding mechanism, time required to clear jams (and the jamming frequency), reducing rescans because of poor image quality, and basic maintenance downtime (for consumables replacements, repairs, etc.).
- Operator Training: Taking the time to train scanner operators in both hardware and software components is a very effective way to increase system throughput. Dedicated, hands-on training in advance of operation will not only give your employees the tools to troubleshoot the occasional problem, but in many cases will prevent such problems from occurring.
- Workflow Optimization: At what stages in your workflow process do bottlenecks most frequently occur? Audit your current system to determine these points of pain, and seek immediate solutions. Most importantly, minimize setups by saving them to the host PC, and creating standard batches that can be easily recalled. Don't overlook human factors, such as the positioning of equipment in ways that cause your employees to spend significant amounts of time in moving from one station to another.
- Document Preparation: Do you remember the phrase "garbage in, garbage out"? While Kodak scanners can handle a wide variety of document types, even a minimal amount of preparation screening can help maximize scanner uptime while minimizing the need for operator oversight. Find a scanner that can handle mixed document sizes and weights to reduce presorting. Also, if the scanner can simultaneously capture bitonal and color images (e.g., *Kodak iNovation Series* scanners), exception scanning to capture color information can be eliminated, thus lessening document preparation time.
- Post-Image Processing: Eliminate a separate image enhancement workstation, which adds to operator training time and slows throughput, by finding a scanner that incorporates this function (via software or hardware) as part of the capture process.

REDUCING TOTAL COST OF OWNERSHIP

Many scanner purchasers make the mistake of equating the purchase price with total cost of ownership (TCO), the combined expenditures made during the life of the equipment.

For instance, costs associated with scanning, including the purchase and maintenance of a high-volume scanner itself, average only 10 to 15 percent of total document capture costs. The preparation stage, however, represents more than 40 percent of total document capture costs, while the post-scan processing stage incurs similar expenditures.

In essence, the more an organization can increase the throughput in all stages of document capture—including preparation and post-scan processing—the lower the total cost of ownership will be.

Throughput, while an important factor, is by all means not the only determinate of TCO. Other elements to which customers should pay close attention include:

Purchase price	Does the purchase price include just the equipment, or a suite of value-added services such as setup, training, and service that would otherwise have to be procured separately? Likewise, beware of growing costs as you procure additional services on an a la carte basis.
Personnel wages and benefits	A major contributor to TCO is wages and benefits provided to personnel—those employees needed to operate and maintain equipment. By increasing overall system throughput, fewer employees are needed to coordinate the capture process. In some cases, companies have been able to achieve reductions of 50 percent or more, redeploying those personnel to areas requiring higher levels of human interaction.
Reliability	How reliable are your scanners? The amount of uptime translates directly into the efficiency of your entire system. A scanner with a lengthier “mean time between failures” specification will more favorably contribute to lower TCO.
Service	If a scanner needs maintenance or repair service, what’s the frequency of occurrence and associated cost? Is service timely, or are lengthy wait times the norm, creating unnecessary downtime that decreases system throughput while elevating TCO?
Quality	A complete examination of document capture costs also should consider the thorny issues related to the cost of poor quality, often categorized by failure and appraisal costs. Internal failure costs are those associated with defects (errors, nonconformance, etc.) found in the process, including rescans, while external failure costs are associated with image defects found after the process has been completed. Appraisal costs are incurred in determining the degree to which a scanned document conforms to quality requirements.
Systems integration	Factor in the costs of integrating a new scanner platform with your existing systems. Does the scanner support a variety of industry-standard interfaces and infrastructures, or will it require you to replace your legacy systems in order to achieve compatibility?
Maintenance	How frequently will your scanner require maintenance, and at what level? Can your employees be trained in preventative maintenance, thereby maximizing uptime while lowering the costs associated with requiring manufacturer or reseller assistance?
Space	Don’t overlook potential cost savings caused by a lessened need for physical space when a few high-volume scanners replace multiple mid- and/or low-volume devices. Reclaimed territory can be used to accommodate growth in other departments, or disposed of to lower lease expenditure.
Consumables & Supplies	What are the costs of consumables and supplies for the particular scanner that you’re considering? Beyond obtaining single unit price, determine the lifespan of each consumable and usage rate of all supplies, as a higher quality but more expensive device may ultimately prove more effective for lowering TCO.
Upgradability	If your scanning needs change, will you be able to upgrade your current machine, thereby preserving the training and supply expenditures already made to date? Moreover, if an upgrade is possible, can it be performed in the field by the manufacturer or reseller, or will it require that your scanner be taken out of service, thereby drastically cutting your productivity for multiple days?