Getting Higher Yield from your High-Speed Equipment: Creating a Culture of Objective Analysis

By Bill Hart, Chief Engineer, Lone Oak Technologies, LLC

Pressure to reduce production costs has driven growth in investment in high-speed inserting systems throughout the production mail industry. But too often the expected higher yield rates have not been achieved. Attempts to identify the root causes through limited and anecdotal analysis have met with disappointing success. Adopting quantitative analysis tools and techniques used in manufacturing environments to the production mail environment results in dramatic improvements productivity and overall cost savings from decreased overtime.

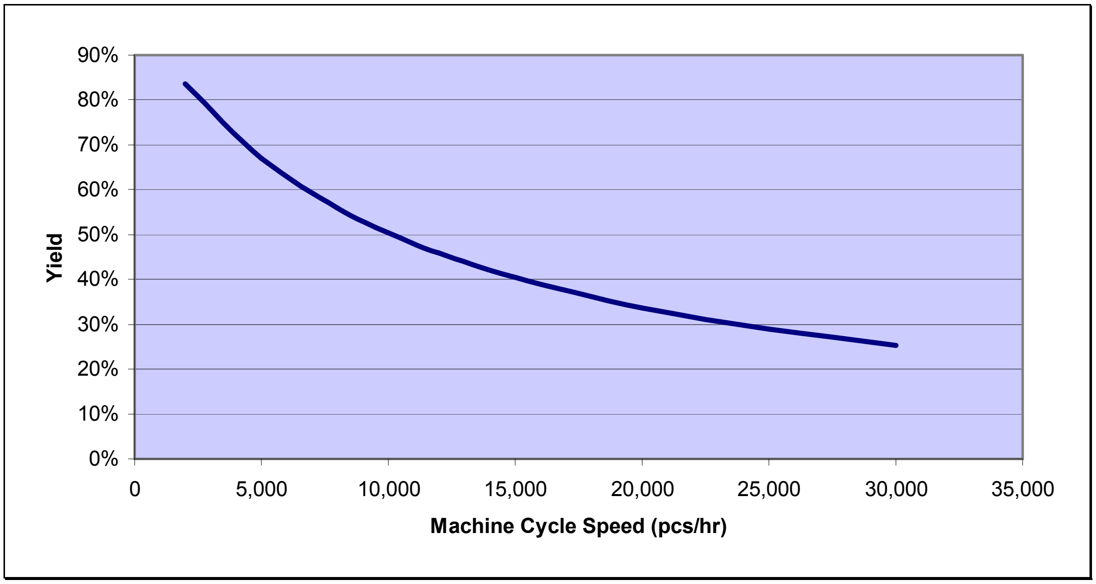
A Focus on High Speed Equipment

The past ten years have seen unprecedented growth of investment in high-speed inserting systems in the production mail industry. Driven by growth in job size, increasing demand to meet accelerated production schedules and ever growing pressure to reduce production costs, mail operations have sought productivity gains through the use of increasingly faster machines. In 1994 the industry regarded an inserter that could run at 10,000 pieces an hour as state of the art. In 2004 machines can theoretically run more than 20,000 pieces per hour. With a 100% rise in inserter speed it is not surprising that mail operations have sought to approach 100% increases in productivity through investment in high-speed inserter systems.

A Lack of Corresponding Productivity

However, corresponding increases in productivity have not been realized. As production mail supervisors and managers strive to achieve the performance numbers quoted in the product brochures, the *X*% faster = *X*% more productive equation has proven elusive. While state of the art inserters can theoretically operate at a cycle speed of more than 20K/hour, they do not consistently run at this speed due to stoppages caused by operator error, process inefficiencies, jams and malfunctions, job changes, unacceptable material quality and required maintenance which can collectively dilute productivity by as much as 50%.

This comes as no surprise; pure cycle speed with no jams, stoppages or unacceptable quality mail pieces has always been the ideal rather than the reality because machine downtime has always sapped productivity. But as inserter technology makes greater speed attainable, machine downtime remains constant or increases resulting in a paradox: The faster the machine, the poorer the productivity return, because as speed increases other factors gain significance in determining output and yield.



Graph 1.1 Effect of Machine Speed on Net Production

Graph 1.1 shows the leveling off of net production (pcs/hr) with the acceleration of machine speed due to downtime related to: paper jams, running out of inserts, loading jobs, operator breaks, machine breakdowns, data communication errors, etc. The graph shows the effect of increasing machine speed on net yield, assuming all other factors are unchanged (fault rate, service downtime, average job size, operator breaks).

If inserter technology has reached its high-yield threshold due to downtime's productivity theft then the answer to the question, "How can I grow my piece per hour ratio?" must be found in an analysis of the downtime itself. Productivity increases remain to be found here – and they are significant.

Current Methods for Evaluating Productivity

To evaluate and track productivity, production mail mangers typically rely on one of two separate measurement methods. The first, vendor provided data, is collected from the inserter itself and characteristically uses a binary classification: all downtime is identified as either machine error or operator error. Typically the first 30 seconds of any work stoppage are classified as machine error, with the following interval attributed to the operator. If for example, at 10:14:00 there is a stoppage, the vendor provided productivity tracking system will identify 30 seconds of machine error and then at 10:44:30 switch the remaining downtime to an operator error classification. Vendor provided productivity tracking systems provide useful information on the number and duration of downtime events but leave unanswered all the critical questions concerning the specific cause and location of the problem. Was it a jam due to material quality, or a problem with the feeder? Was the tray poorly loaded, or did it run out of inserts? And if it ran out of material, was the operator waiting for delivery, or was it a delay in loading? Furthermore, since the equipment isn't gathering production data when it is off, the information provided is incomplete and offers little insight into the "why" behind the downtime. Managers of large inserter sites tend to rely on anecdotal data regarding causes of downtime; this information is at least more specific as to cause. Information provided by the operators or in-house providers is richer in detail and may shed more light on why a machine is down, but still lacks objectivity.

A Productivity Tracking System Case Study

At one large Midwestern mailing site, managers knew that their inserters were not producing the number of pieces per hour required to meet their aggressive output goals. It seemed to supervisors at the site that the operators took an excessive amount of time responding to fault-stops. Presuming that the operators were poorly motivated, (union negotiations had just concluded, the issue of employee motivation was on their collective minds and it was easy to focus on this as the root cause of machine downtime) management took a variety of steps to improve employee motivation including morning motivational meetings. When productivity still did not increase, the site took a closer look at the root causes of their downtime using a productivity tracking system. The objective analysis revealed that the site did not have a high fault-stop rate – if anything it was slightly below average, but each individual fault-stop was running about 3 minutes; an unusually long interval. Closer examination showed that once the operator arrived at the machine, the problem was resolved within 30-45 seconds. The problem wasn't how long it took operators to resolve a fault-stop; the problem was how long it took operators to get to the machine in the first place.

With this data in hand, analysis turned to a study of what was causing the delayed response time, and quickly concluded that operators were spending a significant amount of time repairing damaged mail pieces. Before they could respond to a fault-stop, the operators first had to complete the pieces of damaged mail they were working on, put it in the correct pile and then move over to the machine. The mailer implemented an automated reprint system allowing the operator to simply throw away all damaged mail pieces. Eliminating this distraction freed up operators to focus on running the machines, and a corresponding drop in fault-stop time was immediate, increasing run time by 10-12 minutes per hour per machine.

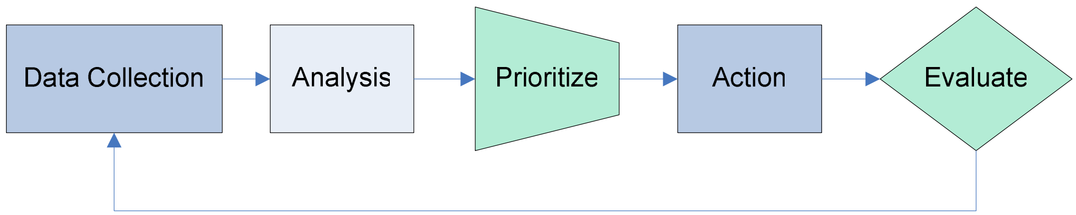
In the example above, while time and money was spent trying to improve employee motivation, the distractions and time loss associated with repairing damaged mail pieces remained largely unaddressed. The resulting downtime and attendant overtime costs continued with no plan in place to curb or control them.

Objective Analysis in a Manufacturing Environment

Running a large scale production mail site means managing complex, high-tech and high-potential equipment operated by real human beings. Inevitably there will be problems, errors and inefficiencies. To get the best out of your equipment you need to move beyond binary or anecdotal information and reach to the heart of what is really getting in the way of optimizing performance. What's required is to step away from subjective analysis and move toward the introduction of a disciplined process of root causes analysis which will yield solid and reliable data upon which to base production improvements.

Such disciplined processes, including TQM and the Six Sigma methodologies have been in place throughout manufacturing environments since the 1980s but have not been applied consistently or in large scale implementations in the production mail industry.

The application of objective analysis methodologies to production mail does not require overhauling or re-engineering a site, rather, production mail sites simply need to adopt the essence of any quality or data driven system: *Data Collection*, *Analysis*, *Prioritization*, *Action and Evaluation* based upon reliable objective data. Many of the technologies that work well in large scale manufacturing sites can be transferred to production mail environments which traditionally do not classify themselves as manufacturing operations.



Graph 1.2 Objective Analysis Process

Three Requirements for Objective Analysis Production Tracking in a Production Mail Environment

While Objective analysis in productivity tracking holds clear promise for increased efficiencies, there are three elements that must be in place before it can be successfully implemented.

1. **Production mail needs to view itself as a manufacturing environment.**

   Because, production mail functions traditionally grew out of back office support operations such as mail rooms, they tend not to regard themselves as manufacturing sites, when in fact this is exactly what they are. Productivity tools that have been proven to increase output on some of the largest manufacturing operations in the world are replicable in most large scale production mail facilities, with similar positive results.

2. **Blame must be replaced with a solution focus.**

   When problems, errors and inefficiencies show themselves in any system the natural human tendency is to affix blame. When emotions run high around performance issues - meaningful problem resolution becomes impossible. Empirical data defuses the emotional component while objective analysis techniques allow all parties to transcend personal agendas and focus on problem resolution.

3. **Operators and vendors must regard metrics as an ally, not an enemy.**

   In union and non-union environments alike it is difficult to implement an effective sustainable effort to improve and maintain individual productivity without the use of unbiased fact-driven data. It is common for occupational employees to dispute management challenges regarding individual performance, while management, lacking any verifiable data related to the unsatisfactory individual performance, is left with no recourse. A similar situation occurs when in-house vendors claim that their production mail systems will provide superior performance and site managers feel that service and equipment performance has been, in some cases, sub-par at best. Neither party agrees on how to proceed. Simple metrics which provide on-going real-time information on performance against daily or weekly goals minimize disputes regarding performance. In addition they offer valuable feedback to individual contributors and in-house vendors. This data not only forms the basis for individual performance review but can be highly motivating. Simply having access to real-time data on personal performance against goal tends to lead to immediate performance improvement as well as improvement over time.

An Illustration of Objective Analysis and Productivity Tracking In Action

When a large eastern financial institution merged with a slightly smaller regional bank the implications for their production mail operation were significant. Not only were the monthly statements re-engineered, but a production mail site that had been averaging 4.5 million pieces of mail per month was now expected to produce 9.25 million. This increased mail volume led to a significant investment in high-speed inserting equipment, but it soon became apparent to the Mailing Operation Manager that the site was not getting the yield they wanted from the new equipment. Machine stop time climbed and work hours skyrocketed 38% in the first quarter, with attendant overtime costs incurred by second shift operators.

Meetings intended to motivate operators to work faster along with frequent attempts to hold the vendor accountable for poor machine performance showed no appreciable increase in piece per hour output.

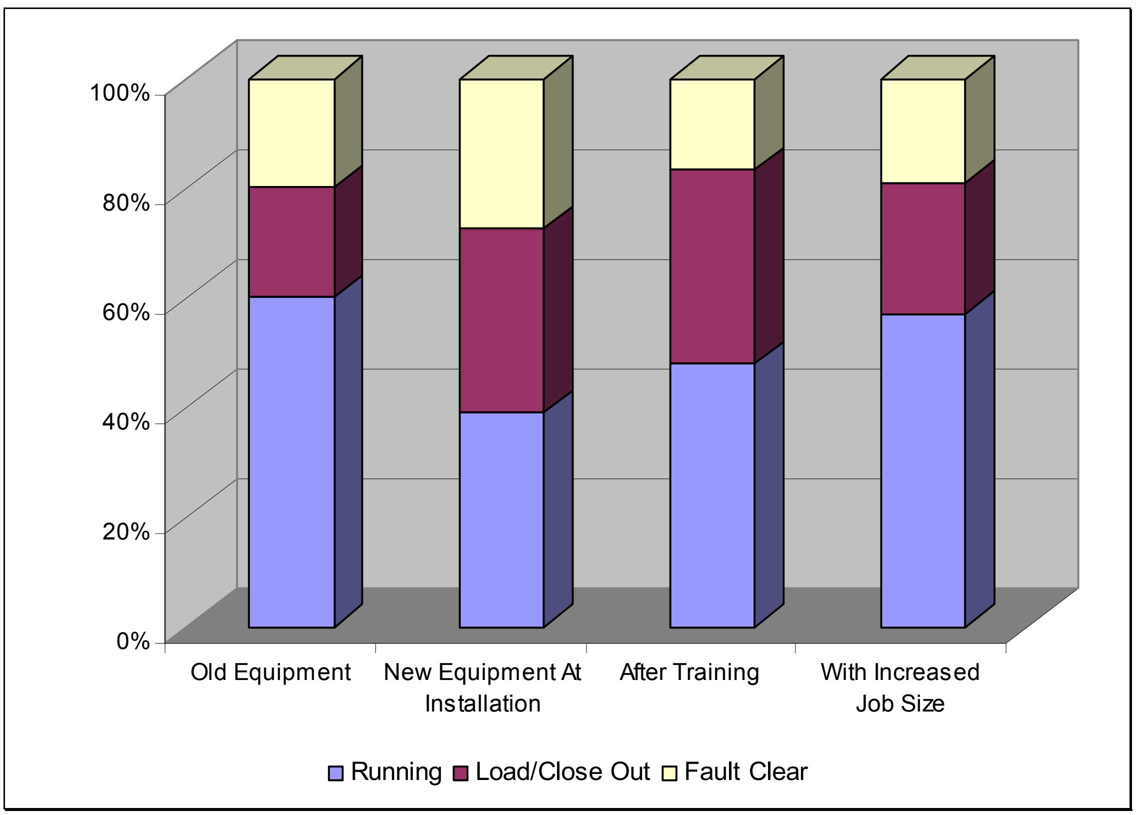
Although it was apparent that machine stop times had risen, the root cause of the problem was unclear. Making the assumption that jam clears were accounting for the problem, additional operator training on the topic was provided and some improvement was noted. The facility still had a 19% increase in work hours – down from 38%, but still not acceptable.

Finally, in the second quarter after installation of the new equipment, a productivity tracking system was brought in to the site. By implementing objective analysis techniques, it became apparent that job set up time was the primary contributor to the increase in stop time. The new machines were stopping for 16.1 minutes to close out jobs and set up new ones; only slightly longer than the 14.2 minutes with the old machines. However the higher speed of the new machines made this time a much larger fraction of the total production time. At the 7,000 pieces per hour speed of the old equipment, job setup and close out time was averaging 20% of the available machine time, then at the 16,000 pieces per hour speed of the new machines it averaged 35%. So while the fault stop rate was low, the scheduled stop rate was high with the inserters not running more than 50% of the time. There were simply far too many set-up stops.

Factor	Units	Old Equipment	New Equipment At Installation	After Training	With Increased Job Size
Machine Speed	cycles/hr	7,000	16,000	15,000	15,000
Cycles Between Faults	cycles	1,035	1,980	2,340	2,340
Time to Clear Fault	minutes	2.9	5.2	3.2	3.1
Job Load/Close	minutes	14.2	16.1	14.6	14.8
Ave Job Size	pieces	4,975	4,975	4,975	8,835
Ave Job Time	minutes	71	48	41	62
Net Productivity	pieces/hr	4,217	6,236	7,227	8,571
Relative Performance	%	100%	148%	171%	203%
Incremental Improvement	pieces/hr		2,019	991	1,344

Table 1.1 Production Factors During Equipment Upgrade.

The real problem was the job size; at less than 5000 pieces per run, job size was far too small to allow the client to realize the benefits of their high-speed equipment. Consolidating jobs and increasing the average job size to over 8000 pieces resulted in a dramatic decrease in set-up stop time.



Graph 1.3 Production Time Ratios During Improvement Process.

This company's use of a data driven productivity tracking system provided the analysis and the tools to identify the need to increase job size. Further use of productivity analysis led to further improvements by reductions in cycle speed. By the start of the third quarter, the work hour increase had dropped back to 0% and overtime costs were again under control

How to Evaluate and Select a Productivity Tracking System

Productivity Tracking Systems offer potentially dramatic cost savings, especially in reduction of overtime expenses. To maximize your investment, carefully evaluate options within the parameters of the following six questions:

1. Does the system provide solid indisputable data?

However the productivity tracking system is designed for data capture, you must have a high level of confidence that the data entered will be an accurate reflection of real world conditions and variables.

2. Is the system bias free?

Does data entry occur at only one point or from one point of view? Look for a system that has multiple data entry point from multiple perspectives.

3. Is the system hassle free?

The death knell for any productivity tracking system is excessive complexity and difficulty in administration. Look for a system that requires easy one or two-step data entry points. If it takes more than 10 seconds to enter data, or requires more than 2 separate actions, then the system is too complex.

4. Are you getting analysis tools and reports – or just raw data?

Objective data is great, but without the means to interpret and analyze the information you'll be left with a data dump. Most Productivity Tracking Systems offer some analysis; look at sample reports and tools to ensure you can work with the format.

5. Are you getting real-time information as well as long-term data?

Simple metrics which provide on-going real-time information on performance against daily or weekly goals offer valuable feedback to both individual contributors and in-house vendors alike, and having access to real time data on personal performance against goal is both a motivator and a performance monitor.

6. Is the system flexible and customizable?

As your needs and your facility grow and change, will your productivity tracking system change with you? Can it expand as you add equipment and staff? Is it capable of helping you to continuously refine and drill down into your data to get more and better improvements?

A successful productivity tracking system will provide objective analysis and a highly reliable method of determining how to fully leverage your investments in equipment and human resources.

Conclusion

The challenge of producing high quality and increasingly complex mail pieces in less time is expanding constantly. Data driven analysis of the operation will help realize the full potential of high-speed inserter investments and is the next great leap forward in overall operational efficiency and significant operational cost reduction.

Bill Hart, Chief Engineer, Lone Oak Technologies, LLC is a nationally recognized expert in production mail technology. He has over 30 years experience in the management, design and installation of engineered solutions in manufacturing environments. He was the author of Pitney Bowes' *Direct Connect Inserter Control System*[1] and has designed comprehensive mail facility solutions for some of the largest mailers in the telecommunications, insurance, retailing, and banking industries. He founded Lone Oak Technologies in 2003.

Lone Oak Technologies, LLC is a production mail focused software technology firm offering a suite of state-of-the-art products aimed at productivity management, mailing data automation, and production modeling and simulation.

[1] *Direct Connect Inserter Control System* is a trademark of Pitney Bowes, Inc.