

A New Diet for the Digital Printing Age

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With a distinguished history of craftsmanship spanning more than 500 years, it's not surprising that many printers tend to view their business in terms of process, rather than product. In fact, most printing shops and plants are physically organized along production lines, with sales and customer service out front, prepress workstations and imaging equipment in a nearby room, presses grouped together in another area, and all bindery, finishing and mailing equipment located near the loading dock. When a job comes in, it is processed by each department and then moved on to the next until the finished product is delivered to the client.

And while this approach has worked well for traditional offset production, proprietary research by Xerox indicates it is an impediment to success in all-digital print production. Digital printing requires a different approach that affects every aspect of operations, from the physical layout to personnel, and especially the way in which jobs are produced. The result of our research is a new consulting program called Lean Document Production (LDP) to help Xerox clients optimize their printing operations for all-digital production.

Of course, faster production systems are an essential part of the answer—and Xerox is constantly developing them. But, in the final analysis, even the fastest systems cannot overcome the inefficiencies inherent in the sequential, batch-and-queue workflows that dominate traditional offset printing plants. What is needed today is a whole new approach to the way in which digital print jobs are analyzed, scheduled, and produced.

Different Bytes

At Xerox, we did considerable research into how printers are using our digital printing equipment to determine the factors affecting productivity and profitability. What we learned is that, by itself, digital production does not significantly lower a printer's cost of operation. However, when integrated into an LDP framework and methodologies, digital printing can be very profitable—and even preferable to offset for all but very large jobs with no variable-data content.

Lean Document Production is an architecture for organizing a digital printing operation and it is a quantitative methodology for analyzing, scheduling and processing jobs with the highest quality in the most efficient and flexible manner possible.

Toward that end, printing plants are reorganized into multiple autonomous production “cells” with each containing all the equipment needed to completely process one or more types of work, and run by cross-trained employees. Jobs are routed to cells according to parameters such as job type, run length, and then prioritized within the cell according to additional guidelines, such as due date, client, number of processes, etc.

A key feature of this framework is that the cells operate concurrently. Not only does this minimize the impact of failure of any one cell, it also opens up considerable scheduling flexibility for new and ongoing work. For example, if preflighting is only performed by one employee on a single Mac and her system crashes, the entire plant must wait; if each cell does its own preflighting and one workstation crashes, only that cell is impacted while the others can continue processing that and other jobs.

To validate our research, we tested LDP in three different digital printing operations operated by Xerox—a print on-demand facility, a copy shop, and an in-plant transaction/billing site. Two are Xerox Document Centers and the other is a facilities management operation. All were organized by department and used traditional batch-and-queue workflows prior to implementing LDP. The results were astounding:

- Productivity more than doubled

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- Waste was reduced by a factor of three
- Turnaround time reduced by more than half

The pilot sites/studies also indicated that the potential gains are proportional to the number of operations/processes necessary to finish each job. In other words, the more elaborate the job, the greater the performance gains when using LDP.

A Nine-Week Diet

To help its clients achieve such gains, Xerox is launching a consulting service dedicated to implementing LDP. It's a nine-week program that consists of analysis of the current job mix and workflow, followed by a physical reorganization of equipment to maximize throughput of the job mix. This is supplemented by cross training for employees, empowering them to perform a wide variety of tasks in the new workflows. Based on our research, we believe that LDP is applicable to any printer with 10 or more employees that uses a departmental approach and plant layout. Though we are focused on customers using Xerox digital printing equipment, LDP will even work in a traditional offset printing environment.

Clearly, the analysis phase is critical because it establishes a performance benchmark from which to improve. Xerox LDP specialists spend one week gathering data about the types of work processed by the printer, perform a comprehensive equipment audit, measure the current throughput on different jobs, and interview management and key production employees about problems and bottlenecks. Particular attention is paid to job setup and makeready because these steps have so much impact on overall throughput and productivity.

Following a week of data collection, LDP consultants spend two weeks analyzing the data to determine the resources used—both human and equipment—to achieve the current rate of production. Using this benchmark as a starting point, the Xerox team then establishes realistic improvement targets for each of the types of products produced. As part of this, they design a new floor plan/layout with the equipment organized into production cells. A key part of this is designing versatile cells that can produce as many different types of products as possible.

The LDP environment operates using event-driven scheduling policies. Two examples of such policies are Conwip and Kanban. Conwip, which stands for constant work-in-progress, is a plant-wide job control policy that governs which cells get new work and when, based on jobs completed by the cells. At the cellular level, Kanban seeks to minimize work-in-progress between different operations by having downstream equipment/operator “pull” work (using kanbans, the Japanese word for job cards) only when ready.

Rules based on mathematical models are then created to implement various elements of the control policies. First is to determine the optimal batch size for a given project with the goal of minimizing setup/makeready time. That is, if the customer asks for 10,000 booklets, it may be more efficient to break them into five groups of 2,000 instead of four groups of 2,500. The rules also govern which parts of the job are routed to specific cells and, once there, assigned a priority within the queue based on factors such as delivery date, the number of operations needed for completion, and so on. Finally, the rules govern where and how human resources are deployed, so that the printer has the most flexibility to move employees where they are needed most at any given time.

Before implementing the layout and workflows throughout the shop, the LDP team spends one week conducting computer simulations and testing the new operational framework with different jobs produced by the printer to make sure the new workflows deliver the desired improvements.

While this is going on, the LDP team conducts cross-training sessions, so that all employees are capable of operating multiple types of equipment and performing a variety of tasks. For example, a digital press operator would be trained to operate a collator, hole puncher and wire binder.

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Once the new framework has proven its validity with pilot projects, it is rolled out across the entire shop/plant. After the new framework is up and running and employees have gained experience with print production cells, the LDP team spends the next three weeks monitoring performance and fine-tuning both the layout and the rules to further improve performance. At the end of the program, the printer receives customized database and spreadsheet programs to apply to and manage incoming jobs. The LDP team also delivers a report documenting the performance gains, as well as recommendations for ongoing improvements.

What's it cost? Of course, implementing LDP requires investment by the printer. There are expenses related to physically relocating equipment as well as employee training. In the pilots, these costs have ranged between \$10,000 and \$15,000.

Only the Bottom Line is Fatter

As stated earlier, we have proven the LDP concept in three pilot sites operated by Xerox (see sidebars). Not only are we confident that printers can double productivity within three months of implementing LDP, they will also see their unit labor costs decrease by more than half and their equipment utilization rates increase by a factor of two or more times. Perhaps most important, printers' customers will benefit from faster, more predictable and more reliable deliveries of their printing.

Given the pricing competition in the printing industry, one of the most effective ways printers can improve profitability is through internal measures. With variable costs—paper, toner, and part-time labor—adding little to the overall cost of operating a printing plant, increasing throughput directly impacts the bottom line. In the quick printing pilot, the site went from losing \$100,000 per quarter to making more than \$20,000! In the billing facility, revenues increased by 42.5% without any increase in staffing or equipment.

Still don't believe it? After finishing our research, we investigated performance-improvement initiatives in other industries and learned that Toyota and Pratt & Whitney, leaders in the automotive and aerospace industries, have also implemented manufacturing techniques using smaller teams working in parallel. Their results have also shown dramatic improvement. At Pratt & Whitney, for example, cycle time for one product decreased from 10 days to 75 minutes, and unit costs for a particular set of operations were reduced by 51 percent.

The bottom line is that LDP offers printers the greatest opportunity to streamline their operations and significantly improve productivity. In fact, we are convinced that it will revolutionize the way printing plants operate during the next five years. Those shops that adopt LDP techniques will clearly have the advantage over those that try to work harder using existing methods. Take your pick: Be in the vanguard and grab market share, or watch as competitors take business away. We think printers that implement Lead Document Production will be eating their competitors' lunches.

What's in it for Xerox? Many things. First, services such as LDP are a significant additional value we can bring to our clients—something that makes the word “partnership” more than a cliché. By making our clients more successful, they will use more Xerox consumables and stay with us for equipment upgrades and additions. Finally, it's a clear differentiator for Xerox as a supplier, one that enables us to go beyond “speeds and feeds” when competing against other vendors.

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Note: pilot sites would be presented as three table-style sidebars.

Pilot Site #1

Business Type:	Transaction/billing facility
Products produced:	invoices, checks, statements (401K)
Equipment:	3 Xerox 4180 MICR printers; 3 Xerox 4615 micro printers; 3 Pitney Bowes Inserters, 1 self-mailer, 2 shrink wrappers
Employees:	30 (24/6 operation)
Performance:	52% maximum utilization
Post LDF performance:	
Capacity utilization:	78% (50% improvement)
Turnaround time:	50% improvement
Revenue growth:	42.5 percent with no increase in staffing or equipment
Rework/waste:	Decreased to 0.5 % from 1.5% (industry average is 3%)

Pilot Site #2

Business Type:	Print On-Demand facility
Products produced:	booklets, brochures, perfect bound books, marketing materials,
Equipment:	3 Xerox 135 DocuTech 135s, 6 Xerox DocuTech 180s, 3 Xerox DocuColors, 2 automated punch systems, saddlestitch and perfect binding, guillotine cutter, shrink wrapper
Employees:	30
Performance benchmark:	20% to 40% capacity utilization rates
Post LDF Performance:	
Turnaround time:	45% improvement
Waste reduction:	From 5% to 1%

Pilot Site #3

Business Type:	Copy shop/quick printer
Products produced:	B/W & color copies, booklets, brochures, perfect bound books, marketing materials
Equipment:	3 DocuTech 135's, 2 DocuColor 40's, 1 Xerox 5100 copier, 1 Xerox 5319 copier and an array of finishing equipment.
Employees:	12
Performance benchmark:	Losing \$100,000 per quarter
Post LDF Performance:	
Revenues/ Profit Margins:	1 st quarter break even, 2 nd quarter profit of over \$20,000 Went from an operating loss to an operating profit
Turnaround time:	40% improvement
Labor costs:	decreased by more than 25% by eliminating temp workers