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WHITE PAPER

THE INKJET TIPPING POINT

Profitable Printing for Digital Production Inkjet Presses

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PREPARED FOR:

Canon

CANON SOLUTIONS AMERICA





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Executive Summary

Due to the state of constant evolution of the printing industry, it is imperative for print service providers (PSPs) to make the right decisions regarding investments in new digital production printing presses. These decisions are critical in that these are major investments, and often are integral to a growth strategy. There are so many options and factors to consider that making the right decision is not simple or easy, and requires a major exploration of the options and in-depth analysis of the pros and cons of each technology. This paper provides some of the key factors to be considered in the decision-making process.

The adoption of high-speed digital color inkjet presses continues to grow. In the United States, unit shipments occurring between 2013-2017 grew at a 6.2% compound annual growth rate (CAGR), and Keypoint Intelligence – InfoTrends (InfoTrends) expects shipments to continue growing at a rate of 3.3% between 2017 and 2022.

Key Findings

- ♦ Running costs are lower than offset printing at varying run lengths ranging from 1,500 96-page magazines or catalogs, and up to 15,000 pieces for an 8.5" x 11" brochure or 6" x 11" direct mail postcard.
- ♦ The ability to produce jobs in shorter turnaround times than offset allows PSPs to stay competitive and serve projects with tight deadlines.
- ♦ Image quality improvements that are equal to offset and digital EP for most applications enable PSPs to compete for a wider range of work.

Recommendations

New high-volume digital inkjet presses typically require an investment of \$1.5 million to \$4 million. When making the decision about what type, size, and configuration of digital inkjet press to acquire, you should consider the following:

- ♦ Conduct an analysis of your print run-lengths, key applications produced, total volume, as well as running costs of your current digital and analog printing equipment.
- ♦ Determine any potential new applications and capabilities that would be possible on a new digital press.
- ♦ Have a detailed and confident understanding of running costs on the various printing devices, ultimately understanding what the budgeted hourly rate of these devices is and the ability to determine the most cost-effective press to produce a job on. This will ultimately allow you to narrow the field to decide what type of investment you can sustain based on how much print volume and which applications are most suitable on a new press.

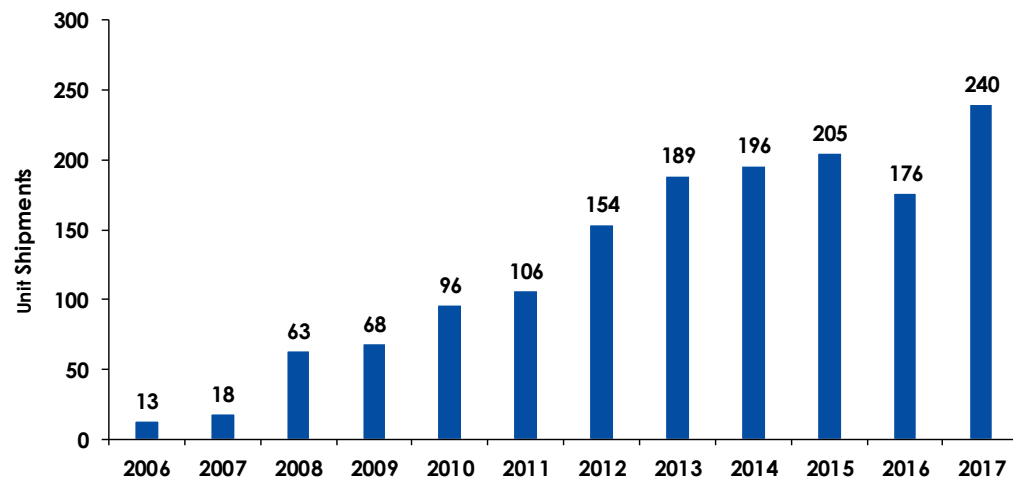


- ◆ Review the field of offerings and understand the value proposition of each brand. Identify strengths and weaknesses of each according to the acquisition cost, running costs, performance, image quality, substrate compatibility, footprint, press reliability, as well as vendor service and support offerings.
- ◆ Learn about current users' experiences with the technology directly through the vendor events, trade events, open houses, peer groups, associations, trade publications, or other forums where information is shared and discussed.

Trends in High Speed Digital Inkjet Printing

InfoTrends produces a market forecast that includes assumptions and estimates of the digital printing market that include unit shipments, installed-base, and page volumes. In general, the high-speed roll-fed inkjet printing market has been steadily growing since the technology adoption began accelerating in 2008 at a CAGR of 16.0%. From that point, the majority of adoption was within transaction, direct mail, and book printing environments.

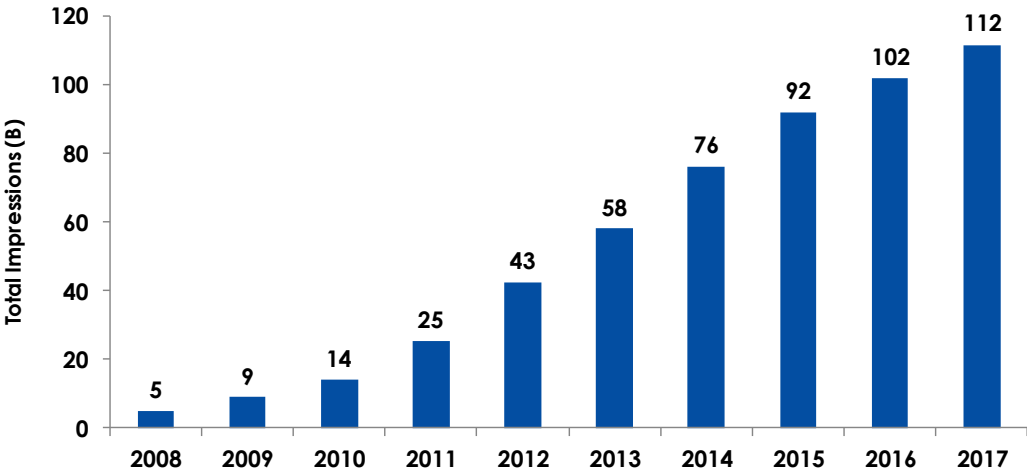
Figure 1: US High-speed Roll-fed Color Inkjet Unit Shipments: 2006 to 2017



The primary driver behind technology adoption is increasing page volumes. The initial driver behind the adoption of high-speed roll-fed color inkjet devices was the ability to produce transaction and direct mail applications more efficiently in a single pass versus the process of printing static document content on an offset web press and imprinting the variable content on a monochrome toner device. High-speed roll-fed color inkjet technology has also provided for cost effective and efficient short-run book printing. Transaction documents, direct mail, and books have been the primary applications driving page volume growth. Page volumes have grown from 5 billion impressions in 2008 to 133.6 billion impressions in 2017 at a CAGR of 45.8%.



Figure 2: US High-speed Roll-fed Color Inkjet Total Pages: 2008 to 2017



InfoTrends expects that the adoption of high-speed roll-fed color inkjet devices will continue into the near future. In our 2017-2022 *On Demand Printing and Copying Forecast*, we are predicting that unit shipments will grow from 231 in 2017 to 272 in 2022 (Figure 3), and page volumes will grow from 111.7 billion impressions in 2017 to 181.6 billion impressions in 2022 (Figure 4) at a CAGR of 10.2%.

While transaction, direct mail, and book printing will continue to drive some of the continued growth, new devices are entering the market that support a broader range of substrates—including standard coated commercial paper grades, thicker paper, as well as higher resolution output that rivals image quality of sheet-fed electrophotographic/toner-based systems and offset.

Figure 3: US High-speed Roll-fed Color Inkjet Placement Forecast: 2017-2022

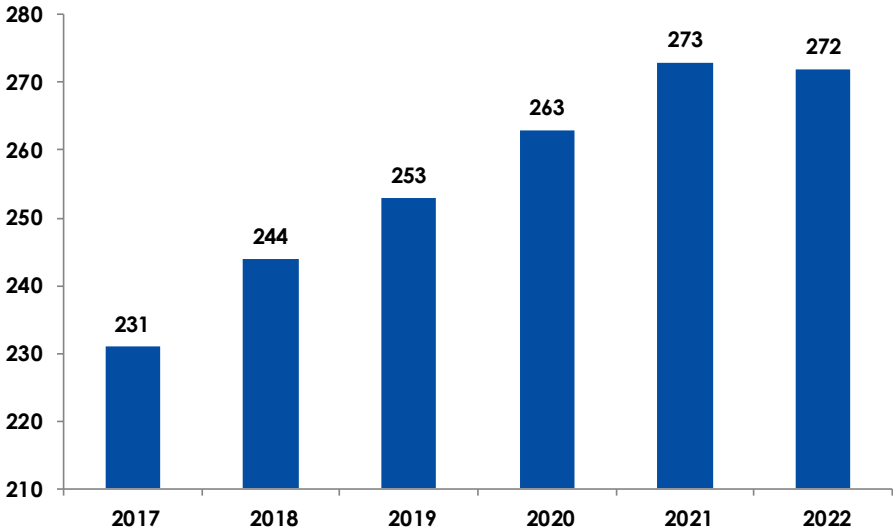
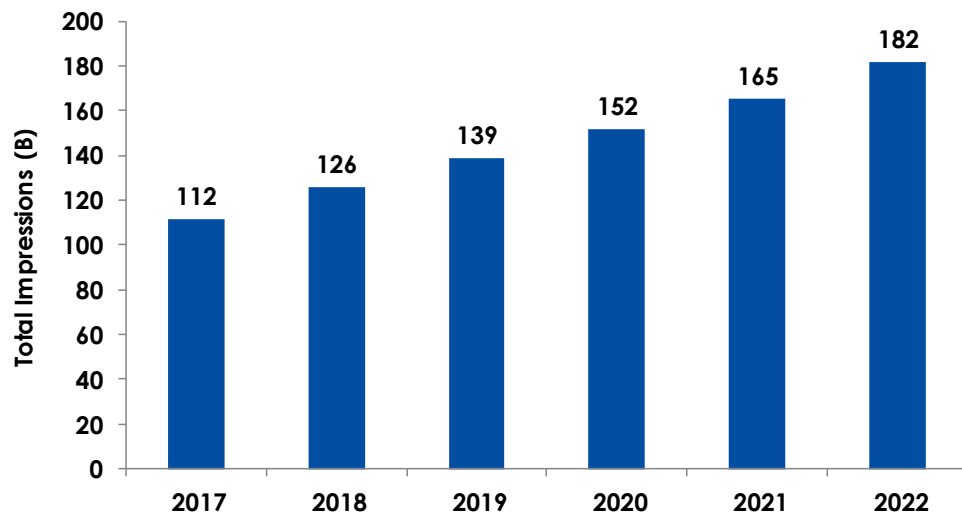




Figure 4: US High-speed Roll-fed Color Inkjet Page Volume Forecast: 2017-2022



It is encouraging to see the historic growth and optimistic outlook for high-speed roll-fed color inkjet presses. For those who are considering an investment in this technology, however, there are several factors to evaluate in the decision process. The next wave of adoption of these presses is increasingly relying on higher image quality and a wide range of compatible substrates to enable the printing of applications requiring these two elements. As we continue to analyze these factors, we will include examples of running costs, run-lengths, and other real-world implications of applying inkjet technology into a broader range of print

Analyzing the Digital/Offset Cross-over Point

Budgeted Hourly Rates and Print Volumes

The criteria in determining when it is cost-effective and more efficient to produce a job on a digital press instead of an offset press have typically revolved around the run-length of the job. Of course, this is only feasible on a press that can produce the level of quality on the type of paper that is required within a timeframe and cost that is acceptable to the customer.

In developing a deeper understanding of these considerations, we gathered input from a variety of end-users of offset B1 presses, offset web presses, and digital high-speed roll-fed color inkjet presses. We conducted phone interviews with these end users, asking a common set of questions that inquired about their usage of the presses and costs.



For the purposes of this paper, we will focus our discussion on a certain set of applications with specific characteristics, as depicted in Table 1.

Table 1: Job Basket of Print Application Examples

Job Type	Cut Size	Flat Size	Bleeds	(Ltr) Page Count	Finishing	Ink Coverage	Color/ B&W Pages	Paper
Catalog	17 x 11	8.5 x 11	Y	64	Perfect Bound	130-170%	64/0	70# Gloss Coated
Magazine	17 x 11	8.5 x 11	Y	96	Saddle-Stitch	90-120%	96/0	50# Gloss Coated
Book	12 x 9	6 x 9	N	300	Perfect Bound	50-80%	150/150	50# Uncoated
Brochure	8.5 x 11	3.67 x 8.5	Y	2	Tri-fold	130-170%	2/1	80# Gloss Coated
Direct Mail Postcards	6 x 11	6 x 11	Y	2	Trim	190-220%	2/1	9pt Gloss Coated

These applications represent some typical applications that are often printed on offset web presses in large quantities (e.g., 200,000 magazines or 1 million brochures). Because they have heavier ink coverage, higher resolution image quality, and/or coated paper requirements, they typically would not be printed on most high-speed roll-fed color inkjet presses. Nevertheless, as there are newer presses entering the market that are capable of printing high resolution and heavy ink coverage on coated paper, we are focusing our analysis here since these essentially are new addressable applications for high-speed inkjet.

Our analysis also considers the budgeted hourly rates (BHR) of running traditional offset web presses as well as high-speed roll-fed color inkjet presses. The BHR of a press can simply be defined as all the fixed costs that go into running a press:

Overhead/Facility/Utilities, labor, and equipment depreciation. Our research included gathering BHR examples from current users of offset and digital inkjet web presses. These can vary dramatically whereas labor rates, real estate values, utilities, and insurance can all vary by region and even by business to business.

Examples of budgeted hourly rates for offset heat-set and cold-set web presses are presented below in Table 2. In addition, we have also included some typical daily print volume ranges, percent of waste, and make-ready times—all factors that play into the decision criteria for moving print volume from offset web presses to digital web presses.



Table 2: Offset and Digital Inkjet Web Press Production Factors

Type of Offset Web Press	Typical Daily Volume	Budgeted Hourly Rate (BHR)	% of Productivity	% Waste	Make-ready Time (Min.)
Web - Full Cold-set	9.5 M	\$335	60%	5%	35
Web - Full Heat-set	6.5 M	\$450	85%	12%	30
Web - Half Cold-set	1.5 M	\$330	60%	8%	64
Web - Half Heat-set	3 M	\$600	85%	5%	45
Digital Inkjet Web	1.7 M	\$477	73%	1%	1.5

Again, these are examples of viable and actual figures provided to us by actual end users of these presses. We do not intend to present the best of class/best case scenarios, but to demonstrate some of the volumes as key performance indicators of offset web presses that are currently in use in some mid-sized print production environments.

In all categories, the digital inkjet web press is competitive in terms of typical daily volume (competitive with half-web cold set), BHR (while the inkjet is higher, it is lower than heat-set half web), and percent productivity (competitive with heat set and greater than cold set). Where digital demonstrates its greatest value is with the minimal waste and make-ready time.

Regarding our job basket of applications and those run on web offset presses, we discovered that the run lengths for these applications were within expected ranges. These are in Table 3 below.

Table 3: Job Basket of Applications Offset & Digital Inkjet Web Press Run-Length Examples

Type of Offset Press	Catalog			Magazine			Book			Brochure			Post Card		
	Typical	High	Low	Typical	High	Low	Typical	High	Low	Typical	High	Low	Typical	High	Low
Web - Half Heat-set										1,500,000	8,000,000	10,000	1,000,000	5,000,000	8,000
Web - Full Heat-set	12,000	250,000	1,000	12,000	250,000	1,000	8,000	100,000	1,000	2,000,000	9,000,000	15,000	1,500,000	6,500,000	10,000
Web - Half Cold-set							1,000	15,000	300						
Web - Full Cold-set	25,000	250,000	5,000				5,000	10,000	2,500						
Inkjet Web Press	700	2,000	25	700	2,000	25	700	10,000	25	75,000	3,000,000	5,000	75,000	3,000,000	5,000

Not all the PSPs interviewed with a certain press produced all the applications in scope with their press. Nevertheless, we were able to capture reasonable examples of each application for each press. One consistent theme is that, in all cases, the lowest run-length for offset is well within the range of a realistic run length for a digital inkjet web press.



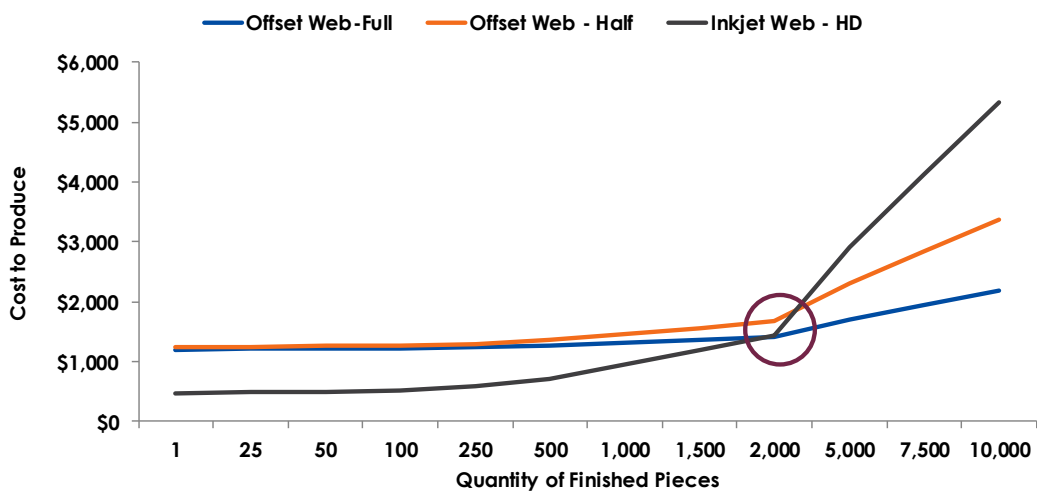
Establishing the Cross-over Point

Determining where the cross-over is between offset web presses and digital inkjet web presses will essentially establish at which run-length it is more cost effective to run the job on a given press. We will be discussing these comparisons of each of the jobs described in the job basket. Factors such as the budgeted hourly rate, labor, and ink costs are added into the calculations to determine the cross-over point. In all cases, we are comparing to a high-resolution inkjet web press that also has a wide range of substrates; therefore, we are assuming that paper costs are equal for digital and offset. In addition, we are also factoring equal time and costs for finishing, assuming that off-line bindery equipment will be used in the same/similar fashion for offset and digital. Finally, we are factoring in ink costs, assuming that the cost of digital ink is higher than offset.

Catalogs

Our first comparison is with catalogs. As mentioned earlier in the job basket description, we are using an example of a perfect bound 64-page catalog. Our calculations resulted in a cross-over point of around 2,000 finished pieces (or 128,000 pages) where the digital inkjet web press becomes more expensive to run the job versus both half-sized and full-sized offset web presses (see Figure 5). While catalogs can be produced in very high quantities (e.g., over 100,000 or even 1 million or more), shorter run jobs between 500 and 5,000 pieces can be common for smaller local and specialty companies with more targeted customer bases. Research participants with high-speed color roll-fed inkjet presses stated that a typical digital print run for catalogs was around 1,000 pieces.

Figure 5: Catalog Production Cost Comparison

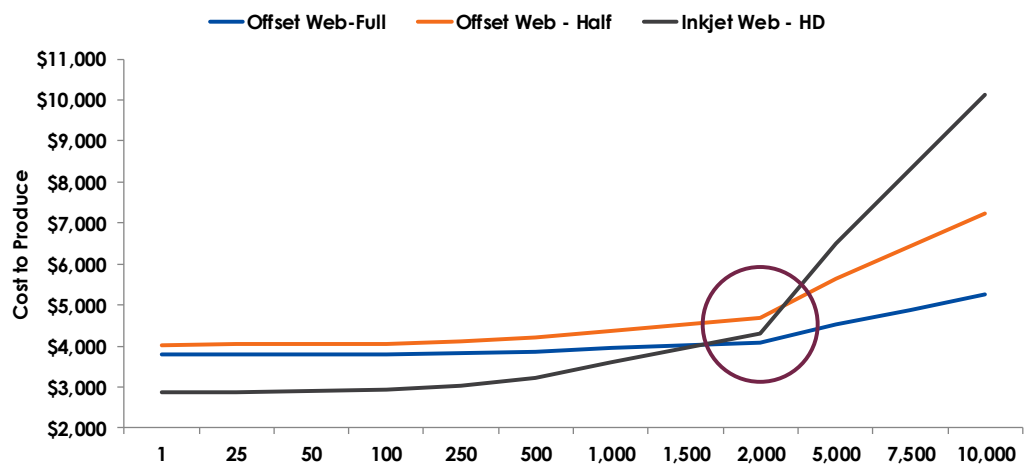




Magazines

Our next comparison is with magazines, which are very similar to catalogs in terms of paper type, print quality, use of full color images, and format. The key differentiators are page count, which is 96 pages versus the 64 we used for our catalog example, and saddle-stitching versus perfect binding. Our calculations resulted in a cross-over point between 1,500 and 2,000 finished pieces (or 144,000 to 192,000 pages), where the digital inkjet web press becomes more expensive to run the job versus half-sized and full-sized offset web presses (see Figure 6). Like catalogs, our research participants with digital inkjet stated a typical print run of around 1,000 pieces for magazines. Again, long runs of up to 1 million or more are typical for magazines, but it is not uncommon for smaller businesses with more targeted and/or niche audiences to print in shorter runs well within the cost-effective range for digital inkjet presses.

Figure 6: Magazine Production Cost Comparison





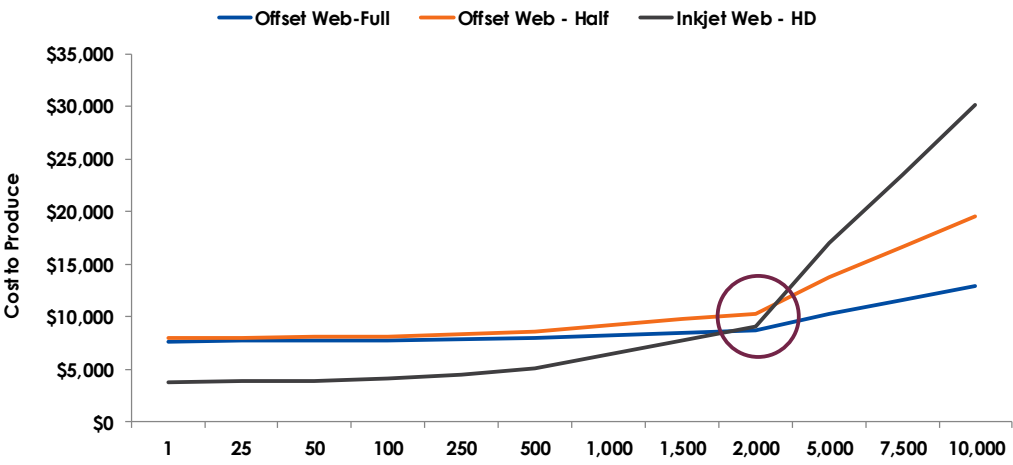
Books

Books are very diverse and can use a wide range of paper types, page sizes, binding, and amount of color imagery. The intent of a book—whether it is a text book, reference book, photo-book, or novel—has a significant impact on these factors. Our example assumes a 300-page book, with half of the pages in color and half in black & white, and perfect bound. For the purposes of this study, we are assuming the cover is printed in a separate run on 110# cover stock, but we are not including the cover in our analysis.

As we see in Figure 7 below, printing this type of book is cost effective on a digital color roll-fed inkjet press up to a quantity of 1,700 pieces (or 510,000 pages) versus a full-sized offset web press and around 3,000 pieces (or 900,000 pages) on a half-sized offset web press.

Printing short runs of books has been a practice in place for well over a decade as publishers have been moving to reduce costs and obsolescence by reducing excess inventory. Digital printing has enabled this practice with the ability to print on demand, helping to eliminate waste cost effectively. Custom publishing (e.g., printing a syndicated publication, but with some customized/localized components) is also an area where short runs are very common.

Figure 7: Book Production Cost Comparison

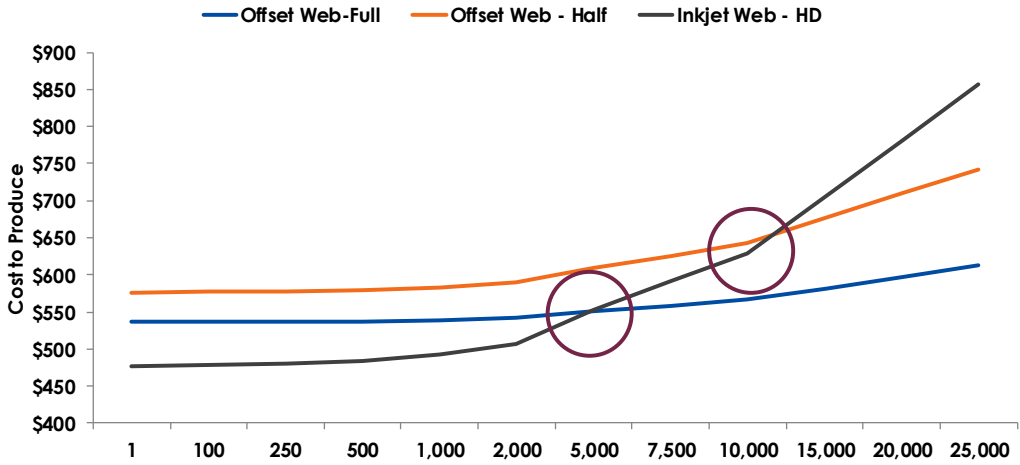




Brochures

Our example for a brochure is a very straightforward, single 8.5" x 11", 4/4, with a tri-fold. Our analysis revealed that digital high-speed color inkjet presses can produce up to 5,000 pieces cost effectively versus a full-sized offset web press and up to 10,000 pieces (or 20,000 pages) versus a half-sized offset web press. Run lengths for brochures have diminished significantly over the last 10 years with the ability to print very short runs (i.e., <500 pieces or 1,000 pages) cost effectively on sheet-fed digital toner presses. Nevertheless, when those run lengths exceed around 2,000 to 3,000 pieces, they are often no longer produced cost effectively on sheet-fed toner presses. Our assumption in all these cases is that the content is static and not variable, and variable data is often applied to brochures. Brochures with variable data can be produced in very large quantities on digital roll-fed color inkjet presses.

Figure 8: Brochure Production Cost Comparison

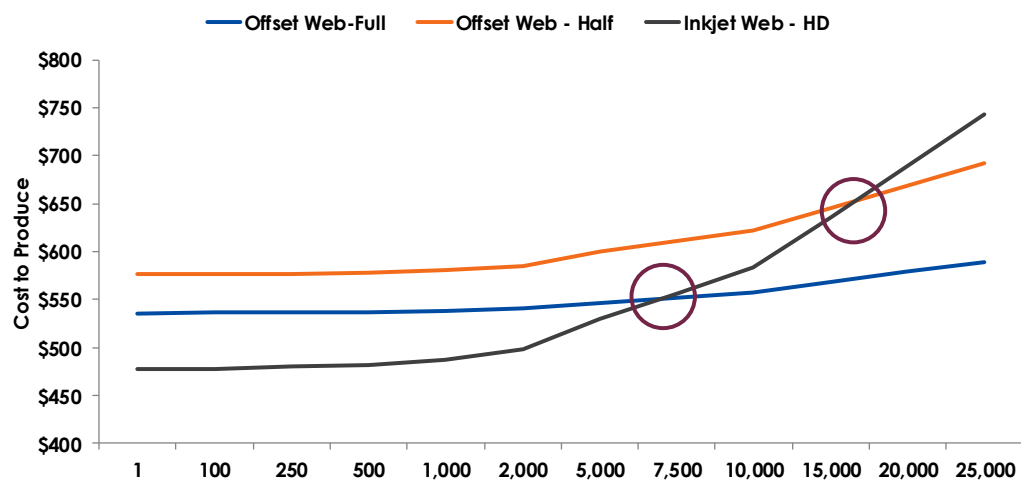




Direct Mail Postcards

Our postcard example is similar to brochures in that it is a single-sheet, printed 4/1, and is also common to include variable data. Again, for the purposes of this exercise, we are not assuming the content of the piece is static and not variable. As Figure 9 indicates, the postcard is cost effectively produced on the digital roll-fed color inkjet press up to 7,500 pieces versus the full-sized offset web press, and up to around 17,000 pieces versus the half-sized offset web press. It is highly common to include some level of variable content in direct mail pieces in the basic form of an address or more complex forms, such as variable imagery and verbiage related to customer/recipient data (e.g., purchase history or membership profile). We should also note that the newer generation of digital web presses on the market are now able to print on cover stock up to (and even exceeding) 9 pt. thickness.

Figure 9: Direct Mail Postcard Production Cost Comparison





Other Decision Factors

- ◆ **Quality:** Those with an older, 600 dpi resolution press still need to run jobs on offset if it requires higher quality (i.e., a line-screen of 133 or higher). For those with a newer press with higher image quality capability, however, these jobs are now possible to run on a more cost-effective press.
- ◆ **Turnaround time:** Many high-speed roll-fed color inkjet users state that the ability to turn jobs around quickly is a major differentiator and a necessity to address customer demand. Same-day turnaround is the growing norm in the industry today, and will continue moving forward. Once a new threshold has been reached, it becomes the standard expectation.
- ◆ **In-line finishing:** In-line bindery finishing on a high-speed roll-fed color inkjet press is a possibility due to auto-collation, whereas it is not an option on offset web presses. This further enables faster turnaround times and less dependency on labor in terms of head counts and physical space.
- ◆ **Variable data:** Jobs requiring variable data will need some type of digital printing to enable the variable imaging. Many of the current users of high-speed roll-fed color inkjet presses also have digital cut-sheet color toner presses that will be used for very short-run printing. Variable data printing opens a wide variety of possibilities and, ultimately, can be applied to most of the examples discussed in this paper—particularly with brochures and postcards. Regarding postcards, variable content is typically used for the recipient's name and address, but using variable personalized content in the messaging has been proven to improve the overall results of the campaign.



opinion

InfoTrends' Opinion

In March 2018, InfoTrends published a study entitled *High Speed Inkjet Printing in Commercial Print Markets*. This study surveyed 261 print service providers that are either current users of inkjet and/or planning on investing in inkjet in the next two years. One of the key findings of this study was that those who had invested in inkjet mentioned it was a primary driver of growth in their company. Many current users stated that inkjet meets the quality standards for a wide range of commercial printing applications due to improvements in substrate compatibility and image quality. As a result, and due to lower running costs than EP, these users reported moving significant volumes from EP devices to their high-speed inkjet devices—especially where multiple EP devices were in use. These same inkjet users also reported that the next horizon of opportunity rests in moving more volume currently produced on offset presses. About this, we have demonstrated where the cross-over points reside for certain applications that are commonly produced on offset web presses. These examples should serve at the very least as a point of further investigation, if not as evidence of the potential opportunities for high-speed roll-fed color inkjet presses.



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