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2025 | Annual Technology Outlook Issue

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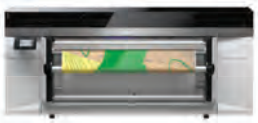

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WELCOME TO OUR SIXTH ANNUAL TECHNOLOGY OUTLOOK!

Can you believe it's been six years since we launched our Annual Technology Outlook? The original outlook was born out of necessity during the COVID pandemic lockdown of 2020, when all industry events were on indefinite hold. To help manufacturers get the word out about new equipment, and inform the industry about overarching trends—technological and otherwise—WhatTheyThink had launched its series of Technology Outlook webinars in May 2020 that aimed to fill in the gap left by the absence of trade events. Over the ensuing years, the online sessions were complemented by corresponding written articles, often written by the same webinar presenters. Now, even though trade events are decidedly back, the Technology Outlook has remained a WhatTheyThink tradition, and this year's printed "Annual" is accompanied by a weeklong series of webinars that ran in September, with presenters including Kelly Lawrence (Production Print), David Zwang (Labels & Packaging), Pat McGrew and Ryan McAbee (Software & Workflow), Richard Romano and Cary Sherburne (Sign & Display and Textiles & Apparel), and Patrick Henry (Finishing). To access the full archive of those sessions—slides and audio—please visit ***whattheythink.com/webinars***.

Designed to help bring print businesses up to speed on the latest technology trends, and arm them with things to look for and questions to ask at the fall trade events.

Our Technology Outlook breaks the industry down into eight sectors (there is overlap between and among them of course):

- **Toner/EP-based Digital**—David Zwang provides an update on the electrophotography/toner side of digital printing, while
- **Production Inkjet/Industrial Print**—Kelly Lawrence looks at all the facets of inkjet in the commercial print and related segments, while Mary Schilling digs into the inkjet side of industrial printing, which is where a lot of the cutting-edge applications are taking place.
- **Offset**—Patrick Henry looks at offset and digital "mashup" workflows and how they help print businesses get the best of both worlds.
- **Labels & Packaging**—David Zwang does double duty this issue, and looks at the latest developments in labels and packaging application technologies.
- **Software & Workflow**—Pat McGrew and Ryan McAbee look at automation, specifically how shops can design scalable automation ecosystems tailored to their specific goals, budget, and evolving team.
- **Display Graphics & Signage**—Richard Romano looks at the latest trends, products, and other announcements in the world of wide-format printing and signage.
- **Textiles & Apparel**—Cary Sherburne looks at some of the latest trends in textiles, especially with regard to ongoing sustainability efforts.
- **Binding & Finishing**—Patrick Henry looks at how digitally controlled postpress systems are coming into their own as linchpins of automated print manufacturing, while Taktiful's Kevin Abergel provides some of the highlights of this year's Taktiful/WhatTheyThink Digital Embellishment Study.

The Technology Outlook articles are designed to help bring print businesses up to speed on the latest technology trends, and arm them with things to look for and questions to ask at the fall trade events, particularly PRINTING United.

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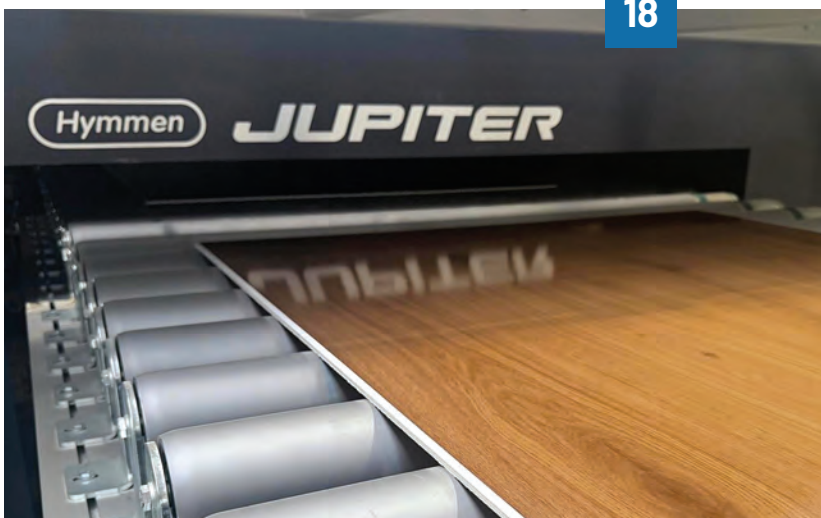

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TRENDS AND TECHNOLOGIES IN EP (TONER) DIGITAL PRINTING: 2025

BY DAVID ZWANG

Production inkjet has reached the offset quality barrier, and digitalized analog printing is targeting shorter run, so some believe that it is the death knell for electrophotography (EP), aka "toner." Although, as Mark Twain said, "The reports of my death are greatly exaggerated" and based on trends and recent developments in EP technology, I believe that is the case here as well.

BACKGROUND

Electrophotography (EP) was invented by Chester Carlson in 1938. After a variety of business transactions, Xerox introduced the first EP dry plain paper coper in 1959. The introduction of the Xerox DocuTech in 1990, followed by the introduction of the Indigo Eprint and Xeikon continuous-feed in 1993, fostered the growth of production EP printing, and led the migration to digital printing from analog offset, flexo, and gravure over the last three decades. Over time, the EP technology evolution seemed to slow as inkjet and even digitalized offset and flexo developed a beachhead against EP growth. But there is still plenty of growth and innovation so EP will probably be with us for a long while. Especially since digital print in general (EP and inkjet) tend to offer higher margins per volume than the analog print technologies.

GROWTH

There has been continued investment and innovation in EP for decades. In fact, the continued growth of EP in light of inkjet and digitalized analog competition can be attributed to a number of factors. First of all, it is a well-established technology and, as a result, issues with media, finishing, etc., have been resolved over time. Second and probably more importantly, the initial CAPEX of the machine is lower than most of the other technologies, making it less of a barrier to entry. On the limiting side, speed and sheet width are limitations, depending on your application and volume requirements, although some of those limitations are being mitigated by longer sheet length support and newer imaging engine performance.

Going forward, EP is expected to grow at a compound annual growth rate (CAGR) of 1.9% between 2025 and 2035, resulting in the market expanding by roughly 21% over the decade. While this indicates relatively slow, mature market growth, the global EP market is still projected to reach about $11.24 billion by 2034. The effects of inkjet adoption on EP growth varies dependent on application, with the higher volume applications like direct mail and transaction taking a bigger share from EP.

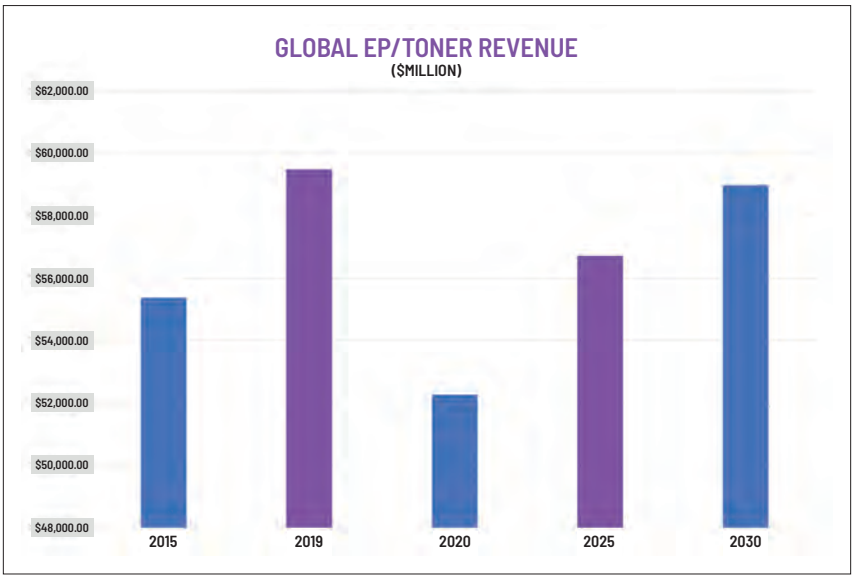
Today, EP printing is primarily driven by the following industry sectors:

- Corporate and Office Printing, including transactional documents, business communication, manuals, and reports in sectors such

Production Printing Market Share (2025, Estimated by Revenue)		
Segment	**Estimated 2025 Market Size**	**Share of Production Market**
Inkjet (Production)	$7.5–$7.8 billion	~80%
Toner (Production)	$3.6–$5.1 billion	~38%

Source: IT Strategies

Source: IT Strategies



as corporate offices, banking, insurance, and government remain dominated by EP due to its turnaround speed, reliability, and cost-effectiveness for monochrome and color documents.

- Commercial Printing & Professional Print Shops, where EP is heavily used for brochures, catalogs, bookmarks, banners, business manuals, and other high-quality print jobs where sharpness and durability are crucial.
- Packaging & Labels, where EP is increasingly used in product packaging applications, including labels, cartons, and folding boxes, especially where regulatory compliance, durability, and quick turnaround are priorities..
- Education and Medical, for cost-effective printing for textbooks, forms, legal and medical records.

TECHNOLOGY AND INNOVATION

All EP presses are not alike. In fact, while there are incremental differences in most of the presses in the market. At a high level, there are really two types of EP presses, not including dye sublimation. Liquid toner, which can be seen primarily in HP Indigo, and dry toner, which can be seen in most of the rest of the manufacturers in the market. The other big differentiator is sheetfed vs. webfed, with webfed producing a higher level of productivity, but with somewhat reduced application flexibility.

As we look at EP presses today, they really come down to HP Indigo and the "others." That is not to downplay those "others," however, but considering the application scope and global penetration of the HP Indigo presses, they really are in a class of their own.

The Indigo presses have been part of the production print landscape since Benny Landa unveiled them in 1993, then passing the mantle to HP in 2001. According to IDC, there have been over 10,300 Indigo presses installed in the over 20 years since the initial introduction, of which approximately 2,000 are label and packaging presses. The current installed base includes about 7,500 presses at 4,500 customers, spanning 120 countries. This includes the B2 format presses: the sheetfed HP Indigo 10000 Digital Press designed for commercial print, and the HP Indigo 20000 continuous web, and the sheetfed HP Indigo 30000 Digital Presses designed for packaging. Combined, more than 300 units of these B2 presses have been installed. According to IDC (2024), HP Indigo accounts for 51% of the digital press market, with an installed base of over 4,500 presses. This can be attributed to the wide range of commercial print and packaging applications that their EP presses support. For example, in labels, there is an installed base of over 2,500 presses that amount to a 50% market share, anchored by the 6K series and the trailblazing V12. Today in flexible packaging, HP is really the only field-proven solution, driven by over 400 installations.

SPEED

While most of the EP press manufacturers have production inkjet offerings as well, they have all worked to increase productivity of the EP devices through speed increases as well as new integrated

HP Indigo v12 Digital Press

Ricoh Pro C9500

operating system intelligence. This is driven by obvious need for EP presses as an integral part of the mix of print technologies.

Recently we saw some introductions which included bigger leaps in EP performance, proving that EP presses will maintain viability for a long time to come. These include 30% speed increases in the HP Indigo Series 5 vs. Series 4 presses. The new Series 6 inline vs. legacy common impression print architecture which is currently seen in their V12 label press is rated at 120 m/min. with up to 12 ink stations, in comparison to 150 m/min. for a production inkjet machine, and 300 m/min. on a Koenig & Bauer RotaJET—which shows that EP can present a compelling alternative.

The Xeikon SX3000 webfed press offers a 30% performance increase over previous Xeikon presses, as a result of a platform redesign. The new SIRIUS platform, which includes hardware changes and design improvements in substrate conditioning, print towers, fusing, and cooling enable higher running speeds, up to 30 m/min. or the equivalent of 404 A4 pages/min. For webfed label printing, the Konica Minolta AccurioLabel 400 is their fastest EP-based digital label press, with a maximum print speed of up to 40 m/min.

Not too long ago, the maximum press speed for most of the full-color sheetfed EP machines maxed out at somewhere between 80 ipm to 100 ipm. The ipm (impressions per minute) designation refers to simplex print. For machines that can duplex, usually that cuts the ipm by half. Today, we are seeing significantly higher performance. For example, the Canon varioPRINT 1350 can print up to 135 ipm, while the Canon varioPRINT 6000 (Titan) monochrome prints up to 320 ipm. The Konica Minolta AccurioPress C14000(e) series, prints at 140 ipm. This device is 40% faster than any other EP model from Konica Minolta. The Ricoh Pro C9500, also sold as the Heidelberg Versafire EP can print up to 135 ipm. The fastest sheetfed Xerox EP press currently available is the Iridesse, which achieves print speeds up to 120 ipm. Xerox also still supports the aging, but respected IGEN 5/150 which can run at speeds up to 150 ipm.

BEYOND SPEED

Overall performance or OEE (Overall Equipment Effectiveness) can be attributed to more than press speeds. Speed is only good if you don't have to deal with time-consuming setups, or to stop for color and registration adjustments while continuously feeding the media for both simplex and duplex printing. While there are many unique developments in these presses, there are a few key areas that highlight the design advantages.

Whether you are feeding a lightweight bond stock or heavy packaging media, envelopes or magnets, each with its own characteristics, the feeding and imaging can be affected. If you are duplexing, it compounds potential issues, especially on long sheets now 24 in. and longer, which are increasingly supported on the higher-end sheetfed EP presses.

The new Canon POD DECK F1 was designed to ensure reliable and stable feeding of a wide range of media. Full-air paper feeding enables stable transportation as a result of its high separation performance. Unlike many other feed systems, only one sheet is separated from the deck by air, picked up by the suction belt, aligned, and then fed into the press. To ensure continuous operation with this new system, even if a double feed occurs, the problem media is ejected to a purge tray, and printing continues automatically without reprint instructions by the operator. The Konica Minolta AccurioPress C14000 uses their IQ-501 Intelligent Quality Optimizer, which automatically performs front-to-back registration adjustment before printing. This ensures that printed images are accurately


Konica Minolta AccurioPress C14000

aligned on both sides of the sheet, minimizing misregistration and manual intervention. Ricoh also features a new paper transfer unit designed specifically to improve front-to-back registration, further enhancing alignment accuracy.

Providing accurate and repeatable color throughout a press run is an imperative. Today, color accuracy is achieved on most of the EP presses with the use of an inline spectrophotometer. Most of the flagship presses from all of the manufacturers and even many of the mid-range presses have these built in to the system. The Ricoh C9500 has an Auto Color Diagnosis Unit, which automates quality, registration, and color fluctuation inspections and can execute automatic reprinting and purging if deviations are found. The Ricoh C9500 is equipped with automated inline sensors and an Auto Color Diagnosis Unit. These systems constantly monitor printed output, scan images during printing, and automatically adjust color values if they deviate from the target, with minimal manual intervention.

The Canon imagePRESS does this through a number of automated technologies. The imagePRESS V1000 automatically measures 20 color patches (20%, 40%, 60%, 80, & 100% densities of each primary) every minute (or 102 pages) with built in densitometers, while the imagePRESS V1350 performs this measurement between every image. If it reads outside of tolerance, the press will automatically adjust in real time. It can also perform media calibration, create custom media profiles, calibrate to the G7 standard, and even run a verification check to many color standards.

The Ricoh Image Quality Monitor (IQM) has seven available detection levels, automatically comparing RIP-processed data with scanned printed sheets to identify and correct issues. You can also adjust gloss levels for media and artwork preferences, as well as execute fully automatic color registration to maintain alignment and sharpness. The Konica Minolta AccurioPress C14000 IQ-501 system also allows for automatic engine setup, meaning the press calibrates itself, further reducing downtime and improving accuracy. It also automates color control by continuously measuring and correcting print color during production. This results in color consistency and stability, even over long print runs. It features automated density correction and can be configured to detect issues such as color shifts and streaks throughout print jobs.

Canon imagePRESS V1350

EXTENDED COLORS

Today, print has found its role as the true value-added communication method, and embellishment is finding its way into the mainstream with new digital tools. As a result, the EP press manufacturers are building these capabilities into the press design. The Xerox Iridesse six-color press was the first EP press to include the standard CMYK EA-Eco Toner with VCSEL (Vertical Cavity Surface Emitting Laser) imaging process colors and two additional stations that are used for enhancements. Manufactured by Fujifilm, and now also available as the Fujifilm Revoria Press PC1120, the dry inks (toners) in the color stations can be swapped for both color and order of color. The two extra stations can be used for a variety of specialty toners, and those available include Clear, Pink, Gold, Silver, and White, as well as High Flop Index Gold and Silver metallic dry inks or Clear dry ink as underlays or overlays with Clear generally going in the last station. The metallics and clear ink can be run in multiple passes to achieve dimensional effects. Fujifilm also supports extra colors in their four new entry-level to mid-range color production presses in the Revoria Press series, including the Revoria Press EC2100, EC2100S, SC285, and the SC285S. These presses use the same CMYK EA-Eco Toner with VCSEL imaging achieving 2400 dpi resolution as the PC1120. We can expect to see some additional EP machines supporting extra colors from other EP press manufacturers in the near future.

SUMMARY

Print technology is not standing still. Offset press digitization and automation are making it more competitive with digital printing technologies. Production inkjet technology is continuing to improve in both quality and productivity, with many new introductions on the horizon. However, through all of this, EP press technology is also going through a new technological growth period, and as a result will be very viable for a long time to come.

DIGITAL PRODUCTION INKJET 2025: TECHNOLOGY, TRENDS, AND VERTICAL MARKET SHIFTS TO WATCH AT PRINTING UNITED

BY KELLY LAWRENCE

INTRODUCTION

Digital production inkjet has moved from a disruptive newcomer to a core production technology across commercial print, packaging, textiles, signage, and beyond. In just over a decade, inkjet has transitioned from niche adoption in high-volume transactional and book printing to a widely deployed, multi-sector platform driving growth and innovation.

This year's Technology Outlook comes at a pivotal moment. Sustainability commitments from global brands, tightening environmental regulations, supply chain volatility, and accelerated automation are reshaping how print providers evaluate investments. At PRINTING United 2025, attendees will see not just new presses and inks, but entire connected ecosystems including hardware, software, workflow, and finishing designed to meet both production demands and market expectations.

DEFINITION AND SCOPE

Digital production inkjet is defined as high-speed inkjet printing systems designed for industrial and commercial applications, distinct from desktop or departmental devices. A decade ago, the term referred specifically to single-pass, high-throughput presses built for large print volumes in demanding environments such as direct mail, transactional documents, and book manufacturing.

Modern production inkjet systems use fixed printhead arrays with media moving rapidly underneath, producing precise, high-resolution output often on par with offset lithography and handling a wide range of substrates from coated commercial papers to corrugated board, textiles, and flexible packaging films. These presses have evolved from specialized tools to central production platforms, driving application expansion into packaging, textiles, signage, and industrial decoration.

Key characteristics include:

- **Speed & Throughput:** Single-pass printing capable of thousands of impressions per hour.

- **Image Quality:** Advanced drop size control, multiple color channels, and high-resolution imaging.
- **Substrate Versatility:** Compatibility with coated and uncoated stocks, synthetics, textiles, packaging materials, and specialty substrates.
- **Automation & Workflow Integration:** Integration with DFEs for color management, defect detection, and end-to-end job handling. AI-enabled analytics and automation.
- **On-Demand Customization:** Variable data, short runs, and personalization without analog setup time.

RESEARCH METHODOLOGY FOR THIS OUTLOOK

This 2025 outlook draws on an in-depth review of the major manufacturers and brands shaping innovation and investment in each production inkjet submarket: commercial print, labels and packaging, sign and display, textiles and apparel, software and workflow, and finishing. We examined investor relations statements, annual and sustainability reports, industry news, OEM product announcements, trade show releases, and more. By cross-referencing financial strategy, R&D focus, and recent innovations, we identified the trends most likely to influence technology development, regulatory compliance, and market adoption in the year ahead.

OVERARCHING TRENDS SHAPING PRODUCTION INKJET IN 2025

Several forces cut across all submarkets:

Sustainability as Compliance—Sustainability is embedded in contracts from global brands like Nestlé, Unilever, and Procter & Gamble. Requirements for recyclable, compostable, and food-safe packaging with verifiable metrics are driving ink chemistry and substrate innovation.

Regulation Meets Brand Pressure—Extended Producer Responsibility laws, chemical safety regulations, and packaging waste directives converge with CPG brand sustainability goals, shaping both investment priorities and go-to-market timelines for new presses and inks. It's not only about sustainability. Sustainability initiatives still have to be justified with a business case that makes sense.

Automation and AI Integration—OEMs are embedding AI into Design for Environment (DFEs) and workflow platforms for predictive maintenance, closed-loop color control, and real-time defect detection. API-based, modular cloud workflows from vendors like EFI and Agfa are helping print shops bridge legacy equipment with new inkjet lines, a critical capability for those modernizing in stages.

Market Diversification—OEMs and Print Service Providers (PSPs) are expanding into adjacent sectors, such as packaging printers adding signage, commercial printers adding packaging, and textile printers adding décor to spread risk and capture growth.

Localized, Agile Production—Supply chain volatility is driving nearshoring and microfactory adoption, particularly in textiles, fast fashion, and specialty packaging.

VERTICAL MARKET TRENDS AND STATE OF THE TECHNOLOGY

Commercial Print: Speed, Quality, and Automation

Commercial print remains the largest installed base for production inkjet, with applications spanning direct mail, transactional print, books, and marketing collateral.

Trends:

- **High-Speed Evolution:** Presses like the Kodak PROSPER ULTRA 520 deliver offset-comparable quality at continuous-feed speeds, with enhanced handling of coated stocks.
- **Automation-First Workflows:** AI-driven DFEs from Kyocera and Memjet automate quality control, freeing operators for higher-value tasks.
- **Sustainability Commitments:** Carbon-neutral production goals from major print buyers influence ink and press selection.

BY THE NUMBERS: INKJET IN 2025

- 5–6% projected CAGR for cut-sheet production inkjet presses (2022 to 2030)
- Under 48 hours turnaround now expected for retail signage campaigns
- 100% recyclability targets from major CPGs including Unilever and Nestlé
- One press serving two markets through hybrid rigid and flexible capability

INKJET ROI REALITY CHECK

Ink Cost vs. Total Value

While per-liter ink costs are higher than analog, ROI improves through:

- Reduced setup time
- Lower waste
- On-demand production that minimizes inventory
- Short-run profitability for high-mix work

- **Cost vs. Value:** While ink costs are higher than in analog printing, OEMs stress ROI advantages from reduced setup time, lower waste, and minimized inventory, which is crucial for short-run, high-mix work.

PRINTING United Questions:

- Can your press handle premium coated papers without pretreatment?
- ow integrated is your workflow from prepress to finishing?

Labels & Packaging: Sustainability, Compliance, and Flexibility

Labels and packaging are the fastest-growing production inkjet segments, with adoption now well established in corrugated, folding cartons, and labels, and growing in flexible packaging.

Trends:

- **Food-Safe Inks:** OEMs like EFI (Nozomi 12000 MP, 14000 AQ) and ink manufacturers including Siegwerk and Sun Chemical focus on regulatory-compliant aqueous inks. Food-safe status, however, always requires end-user validation, as compliance depends on the specific ink, substrate, print process, and the product's final use.
- **Smart Packaging Integration:** QR codes, NFC-enabled labels, and augmented reality (AR) features are becoming standard for traceability, consumer engagement, and brand authentication.
- **Shapes and Surfaces:** AMICA Systems' cylindrical printing platforms open opportunities in beverage and cosmetics packaging.

Smart packaging close-up featuring a recyclable carton with a printed QR code and embedded Near Field Communication (NFC) chip. While QR codes have been used for years, the innovation lies in integrating multiple authentication and engagement tools—such as NFC and augmented reality—directly into digitally printed packaging, enabling real-time traceability, anti-counterfeiting, and dynamic consumer experiences without slowing production.

FOOD-SAFE PRINTING 101

- Food-safe status always requires end-user validation
- Compliance depends on the combination of ink, substrate, print process, and final application
- Verify against regional regulations such as FDA or EU standards
- Best practice is to request full compliance documentation from vendors

TRENDS IN SMART PACKAGING

- QR codes for consumer engagement and traceability
- NFC chips for authentication and supply chain visibility
- Augmented reality features for brand storytelling
- Integration with digital inkjet for rapid campaign deployment

KEY CPG DRIVERS

Brands shaping 2025 production inkjet requirements:

- **Unilever:** recyclable and biodegradable materials
- **P&G:** sustainable packaging innovations
- Nestlé: food-safe and regulatory compliant packaging
- **Patagonia:** apparel microfactories and recycled packaging

PRINTING United Questions:

- How do your ink and substrate choices align with recyclability certifications?
- Can your system integrate smart packaging or authentication features inline?

Sign & Display: Green Chemistry Meets Hybrid Production

Signage OEMs are pushing eco-friendly chemistries alongside faster hybrid platforms for rigid and flexible substrates.

Trends:

- **Sustainable Inks:** Fujifilm's AQUAFUZE combines water-based and UV-curable properties, offering odorless, safe, and vibrant output.
- **Soft Signage Growth:** Fabric-based retail displays reduce shipping and improve reuse potential.
- **Hybrid Presses:** Agfa's Anapurna Ciervo H3200 serves both rigid and flexible markets in one device.

PRINTING United Questions:

- Which high-volume jobs could transition to more eco-friendly substrates?
- How quickly can you switch between rigid and flexible jobs?

Textiles & Apparel: Microfactories, Customization, and Sustainable Fashion

Digital textile printing is evolving rapidly under pressure from fast fashion timelines, sustainability goals, and e-commerce fulfillment needs.

Trends:

- **Localized Production:** Brands like Patagonia and ASOS are driving microfactory adoption.
- **Eco-Friendly Chemistry:** Kyocera's water-efficient printheads and pigment-based inks reduce environmental impact.
- **Color & Durability:** Mimaki's direct-to-fabric solutions improve vibrancy and wash performance.
- **Mass Customization & Sampling:** Digital inkjet enables rapid prototyping, localized mass customization, and quick-turn sampling for apparel and home décor, creating new revenue streams for PSPs.

PRINTING United Questions:

- How fast can you move from design to finished garment?
- Do your inks meet restricted substance list (RSL) requirements?

Software & Workflow: The Digital Backbone

Automation and data connectivity are now competitive differentiators.

Example of an eco-friendly soft fabric banner displayed in a retail store, produced on a hybrid inkjet system for rapid campaign turnaround. The innovation goes beyond vibrant graphics—new recyclable textile substrates and water-based ink technologies meet sustainability goals while maintaining durability, enabling brands to refresh in-store visuals more frequently without adding to landfill waste.

Trends:

- **Sustainability Dashboards:** OEMs integrate tools to track emissions and resource use, meeting brand reporting needs.
- **End-to-End Connectivity:** Cloud-based DFEs link print, finishing, and supply chain data.
- **AI in Production:** Predictive maintenance and automated make-ready optimize uptime.

PRINTING United Questions:

- Can your workflow generate brand-ready ESG reporting data?
- How integrated is your production from intake to shipping?

Finishing: Inline Value-Add and Automation

Finishing is where speed, customization, and sustainability converge.

Trends:

- **Inline Embellishment:** Scodix and MGI expand recyclable foiling and embossing capabilities.

DIGITAL PRODUCTION INKJET 2025—KEY TRENDS BY VERTICAL			
Vertical	**Top Trends**	**Example Innovations**	**PRINTING United Questions**
Commercial Print	High-speed, offset-comparable quality; AI-driven automation; ROI from reduced waste and setup time	Kodak PROSPER ULTRA 520; Kyocera TASKalfa Pro; Memjet DuraCore	Can your press handle premium coated papers without pretreatment? How integrated is workflow?
Labels & Packaging	Food-safe, recyclable inks (with end-user validation); smart packaging (QR/NFC); cylindrical printing	EFI Nozomi 12000 MP/14000 AQ; Siegwerk aqueous inks; AMICA cylindrical	Do your inks meet recyclability certifications? Can you integrate smart packaging inline?
Sign & Display	Eco-friendly inks; soft signage growth; hybrid devices for rigid/flexible substrates	Fujifilm AQUAFUZE; Agfa Anapurna Ciervo H3200	Which jobs could move to greener substrates? How fast can you switch between formats?
Textiles & Apparel	Microfactories; eco-friendly pigments; mass customization and sampling for décor and apparel	Kyocera pigment inks; Mimaki direct-to-fabric systems	How fast can you go from design to garment? Do inks meet restricted substance lists (RSLs)?
Software & Workflow	Sustainability dashboards; API-based integration; AI-enabled QC and predictive maintenance	EFI Fiery with ESG tracking; Agfa cloud-based workflow tools	Can your workflow produce ESG data? How integrated is intake to shipping?
Finishing	Inline embellishment; recyclable foils; automation for labor gaps	Scodix recyclable foiling; MBO modular automation	Could inline embellishment win more premium work? Are finishing materials recyclable?

- **Automation for Labor Gaps:** Modular systems from MBO reduce touchpoints and errors.
- **Premiumization:** Tactile finishes help brands differentiate in crowded markets.

PRINTING United Questions:

- Could inline embellishment win more premium projects?
- Are your finishing materials recyclable?

CHALLENGES AND BARRIERS TO WATCH

- **Substrate Pretreatment:** Still a constraint for certain high-quality coated stocks and films.
- **Ink Costs & ROI:** Higher per-liter ink pricing can be offset by reduced setup, waste, and inventory compared to analog, but buyers must run the numbers based on their job mix.
- **Workflow Complexity:** Multi-device integration can create bottlenecks if systems are mismatched; API-based modular workflows are easing the transition.
- **Regulatory Uncertainty:** Varying regional standards for food safety, recyclability, and VOC emissions add compliance complexity.

OPPORTUNITIES & FUTURE DIRECTIONS

- **Functional Printing:** Growth in printed electronics, smart labels, anti-counterfeiting, and consumer engagement features.
- **Hybrid Analog-Digital Lines:** Blending inkjet customization with flexo or offset long runs.
- **Localized, On-Demand Packaging:** Small-batch production close to the point of sale.
- **Closed-Loop Sustainability:** Ink recapture, energy recovery, and cradle-to-cradle material strategies.

RESOURCES

OEMs: Kyocera, Kodak, Memjet, AMICA Systems, EFI, Fujifilm, Agfa, Mimaki, Konica Minolta, MBO, Scodix, MGI
Ink Manufacturers: DIC/Sun Chemical, Flint Group, Sakata INX, Siegwerk, Toyo Ink Group, hubergroup, INX International
CPG Brands: Unilever, Procter & Gamble, Nestlé, PepsiCo, Hormel Foods, Patagonia, Calvin Klein (PVH), ASOS, Allbirds
Publications & Events: WhatTheyThink, Ink World, Smithers, PRINT United, FESPA, Digital Textile News, Packaging World
Press Releases & Investor Relations: 2024–2025 OEM and ink manufacturer announcements, annual and sustainability reports

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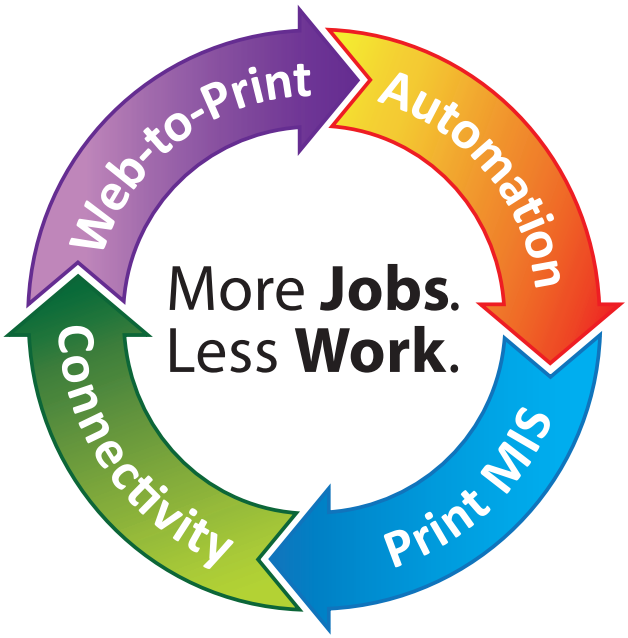

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DROP BY DROP: HOW INKJET PRINTING QUIETLY TOOK OVER THE WORLD

BY MARY SCHILLING

From dashboards to diapers, inkjet printing has gone way beyond the label. Here's how a once-humble tech is reshaping how we design, manufacture, and interact with the world around us.

INKJET GROWS UP

Not so long ago, inkjet printing lived quietly in the corner of your office, churning out spreadsheets and PTA flyers. Fast forward to today, and it's powering some of the most exciting innovations in automotive design, wearable tech, home goods, flexible electronics, and, yes, even baby diapers.

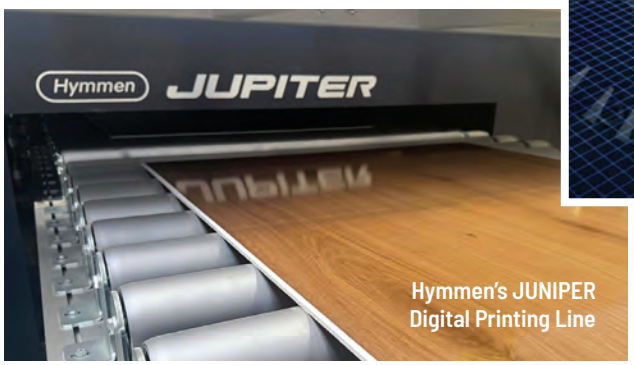
The secret sauce? A unique ability to place ultra-precise droplets of functional, decorative, and even conductive material on a dizzying array of surfaces. That means inkjet isn't just for graphics anymore. It's for texture, electronics, interactivity—and magic.

Let's explore how this quiet revolution is unfolding across industries, drop by drop.

CUSTOM LUXURY AUTOMOTIVE

If car interiors used to come in "beige," "less beige," or "dealer's choice," inkjet printing has put that era in the rear-view mirror. Today's dashboards, door panels, and console trims are often digitally printed with photorealistic textures: woodgrain, carbon fiber, and brushed metal, all with tactile finish options called haptic.

Haptic printing adds a sense of touch to traditional inkjet printed materials, allowing brands to create more engaging products. This technology transforms two-dimensional prints into textured, three-dimensional surfaces, which can increase consumer interaction and perceived product quality. This is becoming particularly essential as brands look to differentiate themselves in a saturated market where traditional print may not hold consumers' attention as effectively as new digital mediums.



Hymmen's JUNIPER Digital Printing Line

Companies like Kao Collins with their Tesla and Flexar LED-curable inks, designed for thermoformed plastics and curved surfaces and Hymmen's JUNIPER Inkjet Printing Line have pushed the envelope on decorative surface printing; creating seamless and ultra-durable patterns. Specially designed UV-curable inkjet technology, these parts hold up under high wear, UV exposure, and extreme temperature swings.

Manufacturers can now offer bespoke options without the cost or rigidity of traditional mold tooling. It's personalization meets lean production for just-in-time luxury.

WEARABLES TEXTILES: SLIP INTO SOMETHING FUNCTIONAL

Inkjet has rocked fashion but the real buzz is in functional textiles.

Conductive inks, printed sensors, and piezoelectric patterns are now embedded into clothing using modified inkjet heads. Companies like DuPont and NovaCentrix are leading the charge with silver nanoparticle inks. Even the University of Tokyo has developed a flexible substrates turning fabric into interfaces which remain functional even when stretched 3X its length.


Image from NovaCentrix

Leading the way for electronic apparel such as sportswear and underwear. Oh yes, underwear...incorporating sensing devices for measuring a range of biological indicators.

Functional textiles can also be artistic and fun. The singer Katy Perry once wore a gown lit up with assorted colors and patterns. Embedded with LEDs, this dress created a stunning wearable art piece.

It's now possible to create a child's jacket which plays audio stories, changes colors, or provides different scents when different zones are pressed. And for the hunter in the family, digital camouflage now can be printed in fine layers which are in disguise, then easily activated when sneaking up on that deer or turkey.

MORE GRAIN, LESS TREE

The furniture world is embracing digitally printed laminates in a big way.

Inkjet is used to print photo-quality woodgrain, stone, or abstract textures onto rollfed films or direct to board and finished with haptic effects such as embossing, then sealed under wear-resistant coatings. The results are indistinguishable from the real thing but being more durable and sustainable.

Companies such as Yotta and Apache DTF, specializes in vivid, embossed wood grain flatbed inkjet printing using eco-friendly UV inks and LED curing.

Inkjet printing is transforming how decorative surfaces are designed and manufactured by bringing high-resolution woodgrain effects, custom patterns, and even tactile textures directly onto engineered wood panels.

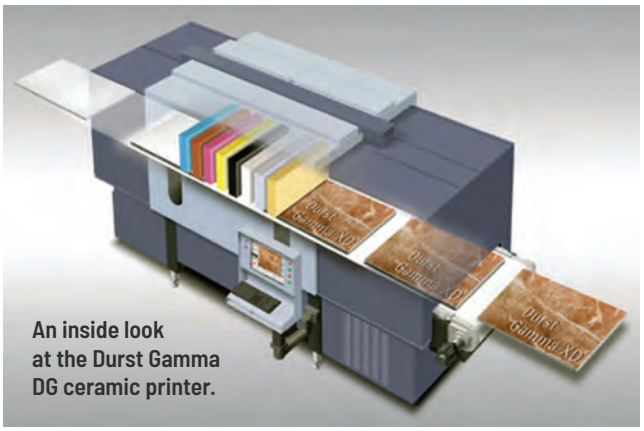
Edge treatments and 3D profiles? Inkjet can manage those, too. Some machines even print around curves, making everything from tabletops to dresser edges photorealistic.

FLOORING TOO PRETTY TO WALK ON

Imagine walking across your living room floor…and feeling like you're strolling through a marble palace, a tropical jungle, or a pop-art comic strip. Inkjet-printed flooring where MDF and tile meets—OMG.

Companies like Durst and Barberán have turned today's inkjet flooring into a Photoshop playground, allowing users to create woodgrain that looks like you would get splinters, or printed flowers on ceramic or porcelain tiles you swear you can smell.

With UV-curable inks, single-pass inkjet printers print anything you can image with embossed textures that



An inside look at the Durst Gamma DG ceramic printer.

Deep Blue haptic effect flooring printed on Jetmaster by Barberán.

synchronize perfectly with the print, adding beauty, durability, and personality in one pass.

FREE SNIFFS

Specialty products and packaging are where inkjet's adaptability really shines. Packaging is a space where speed, customization, and shelf impact collide.

Inkjet packaging systems come in many sizes. High-speed systems such as HP and Koenig & Bauer digital web series are industry leaders here, pushing beyond CMYK with specialty direct marketing. Fujifilm and HP indigo expand common process inkjet into varnish effects, raised textures, and even printed holograms.

Creative brands are using inkjet for:

- Short-run seasonal packaging with variable imagery
- Direct-to-consumer target marketing
- Region-specific promotions
- Scannable printed codes that link to digital experiences
- Thermochromic inks that reveal when products are cold, warm, or touched
- All of this without retooling

The best marketing teams are taking smart packaging a step further with pressure-sensitive triggers, scratch-and-sniff panels, and mood-reactive inks that change color with light or pH changing with the environment.

Although made for conventional printing, companies like Scentisphere develop printable scent inks and coatings, offering microencapsulated fragrance technologies for offset, flexographic, gravure, and screen printing. They provide a wide range of scents, from cookies to fragrances and will even custom blend for your cannabis product.

Cannabis "Scratch n Sniff" Packaging. *(Image courtesy Packaging News)*

Such microencapsulated slurries though can be adapted for inkjet-compatible coating depending on substrate and curing method used in the print process.

DON'T LIKE YOUR HOUSE? PRINT IT!

One of my most favorite applications is the wonderfully wacky world of inkjet-printed siding and garage doors,

where your front-facing panels go from drab to fab.

Instead of slapping on some paint and calling it a day, imagine using high-tech inkjet printing to conjure photo-perfect woodgrains, cobblestone, and marble illusions, or even your favorite pet or sports team on your house.

Maibec Architectural is one such company out of Québec has coined themselves as the "Façade Creator"—a true bespoke solution customizing any color or texture to your home or building's aluminum siding using high-definition UV CMYK inks with high-resolution inkjet printing and protective coatings.

(Above) Printed aluminum siding by Maibec Architectural. (Right) Library of digital patterns and textures by Maibec Architectural.

Their inkjet siding offers the same warranty for color fade, finish wear, gloss, and adhesion as traditionally painted aluminum siding. Adding an additional benefit, inkjet-printed siding will not chalk—chalking is when surface paint binder deteriorates, and pigment particles create powdery, dusty, and faded residue overtime from UV and weather exposure. No one likes a dusty house!

EXPRESSION COMES FROM THE OUTSIDE

Traditionally, garage doors came in a limited palette of colors and textures, with woodgrain laminates or painted finishes dominating the market. These options, while functional, lacked flexibility and often required large inventories of pre-finished panels. Enter digital inkjet printing, a game-changer that allows manufacturers to print directly onto standard white panels using UV-curable inks.

Custom inkjet-printed garage door by Axpanel.

This approach eliminates the need for foils or pre-painted stock, reducing waste and streamlining production. With inkjet, designs can be applied post-manufacture, enabling on-demand customization without compromising durability.

Need a garage door to match your custom printed siding, no prob… companies like Axpanel digital inkjet system prints photo quality almost any type of design, vector, bitmap photograph, 3D effect or custom design for individual doors using 4-color CMYK UV inks and coatings. Axpanel uses Z-axis rotation to print around panel edges, eliminating white gaps at joints even when the door is in motion.

DIAPERS? NOTHING IS OFF LIMITS

Inkjet has quietly found a foothold in one of the most unexpected places: baby and adult diapers.

As nonwoven materials become more print-friendly, inkjet systems are being used to decorate diapers with vibrant, character-driven designs. Some diaper liners are printed with pressure-activated ink that reveal a rhyme or animation when flexed, entertaining the baby (and the parents) mid-change.

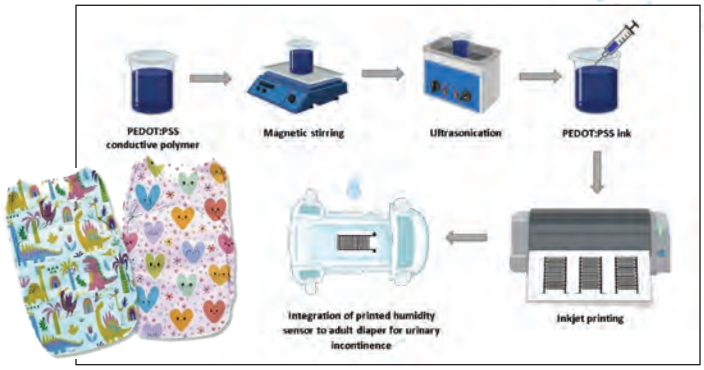
But it doesn't stop at aesthetics. Functional inks that respond to moisture or temperature are being trialed for real-time wetness indicators.

Companies like W+D and Drylock Technologies are exploring how to make these advances both scalable and compostable. Printing directly on diapers is tricky though. Due to their absorbent layers and textured surfaces, custom designs are applied to the outer film layer when using inkjet systems with special UV or water-based pigment inks. Companies like Kao Collins and INX develop Inks which are specially formulated to be compatible with flexible substrates like polyethylene or polypropylene, while meeting high safety and regulatory standards for low migration for absorbent hygiene products following non-toxic, safe skin regulations.

PLAY GETS PRINTED

The toy industry is rapidly integrating inkjet's versatility in both packaging and play itself, developing printed stuffed animals and toys which respond to touch with sound or lights, playsets printed to look like real wood, metal, or stone, as well as interactive books printed with AR markers trigger animations collectible cards with rare variable image or data or custom printed puzzles.

There is no shortage of offered UV flatbed machines making printing full-color, direct-to-object printing a simple task. Flatbed manufacturers such as Besjet, Canon, and InkCups offer variously sized systems from a single printing to full manufacturing covering up to a whopping 10 x 8-ft. bed size with part heights up to 30-in., offering primer, white, and protective varnish applications.



Schematic view of inkjet-printed humidity sensor fabrication, and integration into an adult diaper.

Looking for a world war zombie or custom character head for your Lego character? Seek no further as Bricktactical and Eclipsegrafx offers a series of custom inkjet-printed Lego parts to entertain even the most eccentric Lego enthusiast.

EVEN QUENCHING YOUR THIRST IS CHANGING

Direct-to-shape (DTS) inkjet printing allows full-color images, text, and even variable data (like barcodes or batch numbers) to be printed directly onto curved or cylindrical surfaces such as beer cans, wine bottles, mugs, and cups.

JunoDTS, hinterkopf, and Helix® inkjet printer line offer DTS solutions that can print on glass, aluminum, stainless steel, and plastic. Some systems even include attachments for cylindrical printing, making it easy to decorate tumblers, candles, and bottles with precision.

Craft breweries, wineries and distilleries and specialty beverage brands are embracing DTS to stand out on crowded shelves with high resolution imagery and robust colors with added embellishments like digital foiling or raised textures. With no label waste, misalignment, or peeling, leaving the design as part of the container. Making limited editions, regional designs, or even personalized messages quicker to market with simple art changes without plates or dies.

Hey, looking for custom products for your next wedding or party? JunoDTS makes it easy to upload your artwork to Juno Studio for an arrange of sizes of cups and cans with low order requirements for folks like you and me.

(Below) Custom printed puzzle and skateboard by InkCups. (Right) Custom Lego heads inkjet printed by Bricktactical.

THE FUTURE IS DROPLET-DRIVEN

Inkjet printing has quietly become the hero of modern manufacturing. Its precision, scalability, and material flexibility have unlocked design freedom that spans industries.

Whether it is coating your cabinet, decorating your kid's hoodie, or whispering lullabies from a printed plush toy, inkjet doesn't just look good, it enables new functions, new stories, and new business models.

UV custom inkjet-printed cans produced by JunoDTS.

Inkjet printing had evolved from a humble graphics tool into a backbone of modern manufacturing. This technology now shapes how people dress, drive, play, and live.

What once required carving, molding, stamping, or stitching could now be rendered in milliseconds through droplets of ink.

Everything now can be created with a level of personalization that would have seemed like magic just decades prior.

RESOURCES

Apache DTF: www.apachedtf.com/wood-mdf-board-printing
Axpanel: www.axpanel.com/
Barberán: https://jetmasterseries.com/deco-2/
Besjet: https://besjet.com/
Bricktactical: https://bricktactical.com/collections
Canon: www.usa.canon.com/
Drylock Technologies: https://drylocktechnologies.com/
DuPont: www.dupont.com/products/interra.html
Durst: www.durst-group.com/en/segments/ceramics
Eclipsegrafx: www.eclipsegrafx.com/
Fujifilm: www.fujifilm.com/us/en
Helix: www.inkcups.com/cylindrical-inkjet-printers/
hinterkopf: www.hinterkopf.de/en/solutions/machines.html
HP: www.hp.com/us-en/commercial-industrial-printing/pagewide-corrugated/t1195i-presses.html
HP indigo: www.hp.com/us-en/industrial-printers/indigo-digital-presses.html
Hymmen: www.hymmen.com/en/technologies/digital-printing-lines/
InkCups: www.inkcups.com/printing-applications/toys/
INX: www.inxinternational.com/
JunoDTS: https://junodts.com/
Kao Collins: www.kaocollins.com/
Koenig & Bauer: www.koenig-bauer.com/en/products/packaging-printing
Maibec Architectural: https://archi.maibec.com/
NovaCentrix: www.novacentrix.com/
Scentisphere: www.scentisphere.com/
University of Tokyo: www.t.u-tokyo.ac.jp/en/press/foee/press/setnws_e8c60028f0bb_20150625005_eng.html
W+D: www.w-d.de/en/
Yotta: www.yottaprinter.com/

OFFSET AND DIGITAL MASHUPS PUT PRINTING IN A NEW GROOVE

With a hybridized approach, two printing processes can be better than one printing process—even if the processes are fundamentally different from each other.

BY PATRICK HENRY

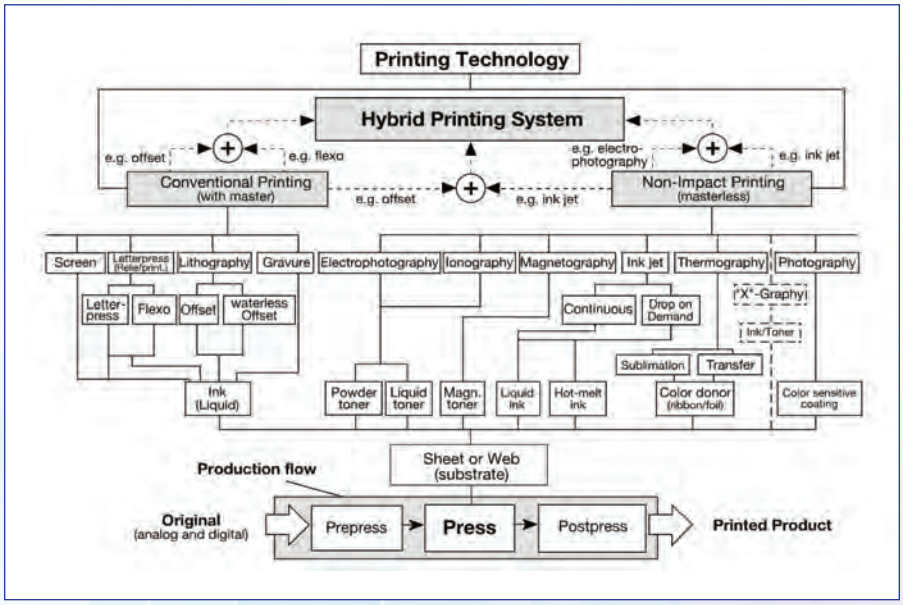
In 2001, Walter d'Heureuse and Helmut Kipphan of Heidelberger Druckmaschinen AG published a visionary paper in which they surveyed what had been accomplished up to then by combining conventional and non-impact (i.e., digital) production technologies in hybridized printing systems.

The hybrid approach, they wrote, "can create efficient and powerful production possibilities and systems such as in-line imprinting, personalization and coating (print finishing)."

Heidelberg had demonstrated the offset/digital concept at drupa 2000 on a single-color Quickmaster offset press. d'Heureuse and Kipphan described an expanded application that equipped a Heidelberg QM DI 46-4—a four-color offset press using direct imaging technology—with a piezo inkjet imprinting unit from Spectra.

What they said this hybrid machine's output would be impresses even by today's standards: 10,000 fixed-image A3 sheets per hour imprinted with variable data at full press speed at a resolution of 600 dpi. A UV dryer cured both the offset and the inkjet inks.

Hybrid printing systems, the authors concluded, "can create powerful means of production, making special production methods and strategies possible. It is to be expected that an increasing number of combination systems will be employed for the in-line production of printed matter, especially with ink jet technology for variable imprinting and segmentations."



Combination of various printing technologies to set up hybrid printing systems. *(Image courtesy "Print Technologies and Design Concepts for Hybrid Printing Systems," Walter d'Heureuse and Helmut Kipphan.)*

WHOLE GREATER THAN SUM

Their forecast has held up well in the years since then. Today, hybridization stands out as an opportunity to combine analog impact printing with digital non-impact printing in a whole that is greater than the sum of the parts.

Although "hybrid printing" can denote any combination of processes in a single platform or in an integrated production line (see below), the term has most commonly come to mean flexographic and offset presses fitted with digitally controlled inkjet modules that imprint variable content over static images. The advantages are well recognized:

- Thanks to the economies of scale built into its conventional process, a hybrid printing system achieves the lowest cost per piece of any digital print solution. Hybrid printing uses the less expensive offset or flexo printing for content that does not change, reserving digital inkjet for variable data only where it is needed on the printing form.

- Adding inkjet modules to an existing conventional press enables the business to compete and win jobs without the expense and floor space requirement that installing a stand-alone digital press would entail.
- Because hybrid printing takes place in one pass on a single machine, this form of production combines process steps, saves time, minimizes waste and errors, and speeds job throughput.
- A hybrid print run can use specialty inks and coatings that are not available in digital printing.
- With hybrid production, a conventional shop can use its existing postpress equipment to finish jobs containing matter that was digitally printed.
- A conventional press hybridized for digital printing gets a new lease on life for producing applications that require variable data. Examples include personalization, security, transpromotional messaging, and versioning for marketing purposes.

OMET Varyflex V4 Offset

Flexographic presses have been more extensively hybridized with inkjet than offset equipment has, thanks to strong demand for narrow-web applications such as labels and flexible packaging. But there are significant opportunities to hybridize offset printing in its own right.

PREPROCESSING PLATFORM

Perhaps no platform better illustrates the possibilities than the VariJET 106, a joint development by Koenig & Bauer and Durst.

Designed for folding carton production, the VariJET 106 essentially is a seven-color inkjet engine on the chassis of an offset press. Durst supplies the inkjet components, while mechanical systems such as sheet transport, feeding, and delivery come from Koenig & Bauer's well established Rapida family of sheetfed presses.

The result is a B1-format carton press that can print water-based inks on heavy stocks at up to 5,500 sph with what the manufacturers call "offset substitutable" print quality. At drupa 2024, Koenig & Bauer promoted the VariJET 106 as a modular press that can be configured either as a pure inkjet system or as a hybrid press with optional flexo, offset, and coating units.

Hybridized printing systems were to be found elsewhere at drupa. OMET, for example, demonstrated its specialty in integrating multiple printing and finishing processes into all-in-one production lines for specific production requirements.

OMET's equipment base consists of 2,200 machine installations worldwide. Its press platforms can incorporate flexo, rotogravure, rotary screen, sleeve offset, and digital inkjet in the same chassis, along with virtually every type of inline asset for finishing, converting, drying, and curing. OMET's record is 23 such units in one machine.

WEB IS THE WAY

The most widely used method of hybridizing offset with inkjet is adding inkjet modules to existing offset equipment. Advances in technology have made inkjet modules more reliable to print with, easier to operate and maintain, and more flexible for melding with other kinds of production machinery.

Hybridizing offset with digital inkjet almost always means that the platform will be a continuous-feed web press, which offers the sheet stability and frame mounting options that printing with a non-contact inkjet module requires. For web offset shops, adding modules is a cost-saving alternative to installing a dedicated inkjet press where a simpler implementation of the process can give them the capability they want.

Add-on technologies for this kind of hybridization are numerous. One

such solution, the FS-600c family of print modules from Document Data Solutions (DDS), prints variable data in widths from 4.25 in. to 17 in. wide at a print speed up to 600 fpm.

The Freedom Series 600 dpi CMYK++ Printbar, featuring up to two additional spot color printheads, enables printing with dye- and pigment-based inks, UV curable inks, and MICR. DDS says users can fine-tune print quality and reduce operating costs by selecting print resolution, ink density, and ICC profiles for specific applications.

Hybrid inkjet towers from Graphic Systems Services (GSS) can be installed on offset web presses in 20-, 26-, and 28-in. widths. They are typically installed after the last print unit and prior to any finishing stations. Operating at up to 2,000 fpm, they can be placed above the press on a mezzanine or at right angles to the press. Alternatively, the press can be modified to incorporate the inkjet tower inline.

Features include servo-driven web tension control and automatic color-to-color registration control. DDS also can supply drying units and camera verification systems.

BIG-NAME BIDS

Leading vendors of digital print systems have committed to offset/digital hybridization as a way of broadening the market for their inkjet technologies.

At drupa 2024, Kodak debuted a wide-width version of the KODAK PROSPER imprinting system based on its continuous inkjet (CIJ) Stream Inkjet Technology. Kodak says that PROSPER can be integrated into offset, flexo and gravure presses as well as postpress and converting systems for highly flexible, high-quality digital imprinting of custom packaging, security, and commercial print applications.

HP's solutions for hybridization are its C800 and M800 Print Module Systems. These are said to be easily integrable with offset equipment for adding digital content inline. Process color printing on the C800 (the M800 is monochrome) can be up to 800 fpm at a resolution of 600 x 600 dpi. Printheads can be automatically serviced and are operator-replaceable.

Enhancing offset print with digitally printed variable data raises the bar for quality inspection and control. Axode addresses the requirement with systems that automatically maintain color alignment, colorimetry, and print quality in a real-time, closed-loop workflow.

Axode PrintControl is a stand-alone unit installed at the output of a continuous paper printing line. It checks all printed documents in real time, records all non-conformities, and stops production if necessary.

Axode says PrintControl is compatible with all printing processes in continuous paper, laser, inkjet, white or preprinted in monochrome or color. Axode SheetControl performs similar

functions for printed sheets using Axode's Axode 180neo2 and Axode 1080neo2 quality management software.

DOESN'T HAVE TO BE DIGITAL

It's worth repeating that the definition of "hybrid printing" isn't limited to the integration of a conventional process with a digital one.

Many combinations of non-digital technologies are also possible for specialty applications and flexible production opportunities. Ingredients for non-digital hybridization may include waterless offset, letterpress, flexography, rotogravure, intaglio, rotary screen, inline hot and cold foiling, and embossing.

One such demonstration seen at drupa was the exhibit by DG Press, which promoted its solutions for hybrid web offset in security printing, pharmaceutical inserts, flexible packaging, and labels. Its presses are modular platforms that can include processes in addition to offset for fast, flexible operation with quick job changeovers and low setup costs.

DG-Auxo is designed for short- to medium jobs on film, foil, paper, and board-based packaging in web widths of 520mm (20.5-in.), 900mm (35.4-in.), and 1,085mm (42.7-in.). With quick-change variable offset sleeves, repeat lengths can be from 16 to 30 in.

Because the printing units can accept flexo inserts, the job can be printed with both processes in the same run. Rotogravure can also be added. The drying/curing options are UV, hot air, EB, and LED UV.

Aimed at complex applications like security documents, DG-Vision is a servo-driven, 520mm (20.5-in.) web offset press with options for rotary screen printing, flexo, rotogravure, letterpress, hot and cold foil stamping, laminating, and numbering.

HOW RIGHT THEY WERE

"With the help of different digital printing technologies it is possible to meet the most diverse, job-specific customer requirements," wrote d'Heureuse and Kipphan in 2001. "The use of production systems based on various printing technologies and hybrid printing systems is being increasingly taken for granted." The variety of hybrid printing systems and their continuing pace of adoption stand as proof that the authors were not guilty of overstatement.

RESOURCES

Axode: www.axode.com/?lang=en
DG Press: https://dgpress.nl/hybrid/
Document Data Solutions (DDS): https://dds-usa.com/
Graphic Systems Services (GSS): https://gsspress.com/
HP C800 and M800 Print Module Systems: https://h20195.www2.hp.com/v2/getpdf.aspx/4AA4-0237ENW.pdf
Kodak Prosper: www.kodak.com/en/print/product/digital/prosper-print-bar/
Koenig & Bauer Durst: www.koenig-bauer-durst.com/
OMET: https://printing.omet.com/en/
Walter d'Heureuse and Helmut Kipphan: www.imaging.org/common/uploaded files/pdfs/Papers/2001/DPP-0-252/4682.pdf

WhatTheyThink

TECHNOLOGY OUTLOOK

Our Sixth Annual Technology Outlook webinar series is designed for you to quickly learn about new innovations from industry analysts and thought leaders. The Technology Outlook 2025 series ran live September 8–12, 2025, and all five sessions are available for playback at https://whattheythink.com/webinars.

PRODUCTION PRINT TECHNOLOGY OUTLOOK

Monday, September 8

WhatTheyThink contributor Kelly Lawrence highlights the latest technology and product announcements from manufacturers of production inkjet digital printing equipment.

What you'll learn:

- Market leading features of the newest press technology.
- The impact of inkjet technology on market segments and print businesses.
- Trends driving volume and profitability for printers.
- Strategies for differentiating and streamlining your inkjet operation.
- Questions to ask vendors at upcoming events like LabelExpo & PRINTING United.

LABELS & PACKAGING TECHNOLOGY OUTLOOK

Tuesday, September 9

WhatTheyThink contributor David Zwang highlights the latest technology and product announcements from manufacturers of label and packaging solutions.

What you'll learn:

- New label and packaging technology developments and trends.
- New label and packaging products from major industry vendors.
- New features, capabilities, and applications.

SOFTWARE & WORKFLOW TECHNOLOGY OUTLOOK

Wednesday, September 10

WhatTheyThink contributor Pat McGrew and Pixel Dot Consulting's Ryan McAbee look at the latest trends in software and workflow—which are not the same things. Software is the collection of tools to support your workflow processes. Software, when used well, allows the business to succeed by improving efficiency, exceeding key performance metrics, and enhancing the customer experience. The path is to disrupt the flow of endless phone calls, emails and texts asking questions, chasing information, and looking for approval by creating solutions where customers can self-serve for most of their needs.

What you'll learn:

- Current trends in software and workflow.
- How is AI being integrated into print workflow software and what the practical benefits are.
- What automation options are there and how can printers take advantage of them.

DISPLAY GRAPHICS & SIGNAGE AND TEXTILES & APPAREL TECHNOLOGY OUTLOOK

Thursday, September 11

Richard Romano and Cary Sherburne highlight the latest trends and technologies in display graphics, signage, and textiles and apparel. Display graphics (aka "wide-format printing") is a maturing market, but new application areas are gaining traction and seeing tremendous growth. Meanwhile, digital textile printing is a hot new area—and in fact display graphics printers are starting to add textile printing. What are the top trends in both these areas, and how do they complement each other?

What you'll learn:

- New developments and trends in wide-format printing, signage, and textiles and apparel.
- New products from major industry vendors
- New features, application areas, and marketing opportunities
- How the two sectors can complement each other

BINDING & FINISHING TECHNOLOGY OUTLOOK

Friday, September 12

Patrick Henry highlights the latest trends and technology and product announcements from manufacturers of binding, finishing, and embellishment equipment. This session will give you the lowdown on new features, capabilities, and applications that can give your business a competitive edge.

What you'll learn:

- New developments and trends in binding and finishing.
- The latest in digital embellishment technologies.
- New products from major industry vendors.
- New trends, features, capabilities, and applications.

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TRENDS IN LABELS AND PACKAGING: 2025

BY DAVID ZWANG

Generally, print and especially packaging will continue to grow as long as there is economic growth. However, all labels and all packaging are not equal, and as a result the opportunities, trends, and technologies can differ, affecting margin and volume growth. While digital package printing provide many opportunities for higher margins and growth and ease of operation, it still faces lower productivity, higher costs for traditional runs, and some substrate limitations as it competes with digitalized flexo and offset.

BACKGROUND

Let's start with the most important fact: all labels and all packaging are not equal, and as a result the opportunities, trends, and technologies can and will differ. That having been said, packaging in general is essential to both good and bad market conditions and it will continue to play a major role regardless of economic disruptions or regional conflicts. The use of more individual packaging in place of bulk is growing and online purchasing of goods has driven the demand for new packaging and repackaging options. This is driven to a great extent by the increasingly bifurcated retail market with the online channel growing at the expense of the brick and mortar, creating a need for packaging targeted at each of those channels.

Regardless of the market, this demands a focus on protective materials and appealing design choices that reflect an industry-wide commitment to ensuring products arrive intact, meet consumer demands, regulatory requirements, and align with broader corporate responsibility goals.

OPPORTUNITIES ARE THERE

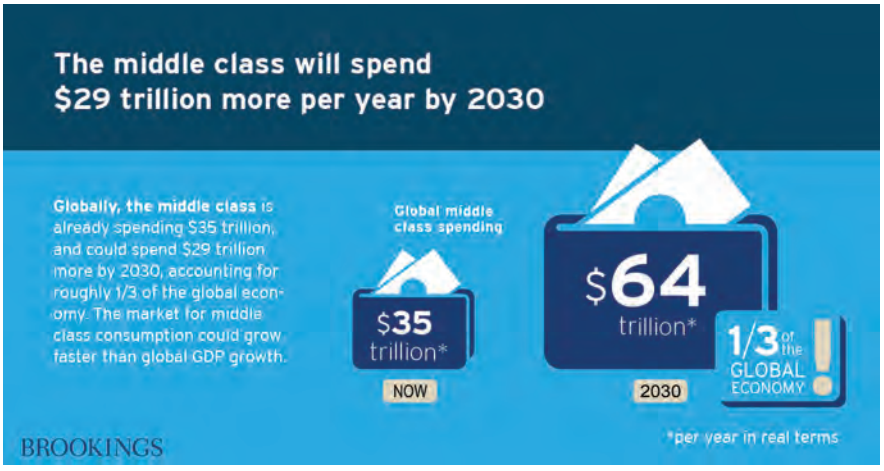
Generally, print and especially packaging will continue to grow as long as there is economic growth. The last decade has seen a record expansion of consumerism, with current spending at annual growth rate of about $35 trillion per year, and projected to reach about $64 trillion per year by 2030 according to Brookings. That growth, is primarily driven by the growth of the global middle class and translates to about 1/3 of the global economy. Overall it is anticipated that the global label and packaging sector will grow at a rate of about 13% CAGR from 2024 through 2029, although at different rates depending on

the packaging and market types. One of the biggest drivers of this growth is the continued rise of e-commerce and its varied requirements over in-store packaging. In 2023, global e-commerce sales reached $5.8 trillion, and are projected to grow to over $8 trillion by 2027. This is a 39% increase from 2023. In the US, in Q3 2024, US e-commerce sales grew 7.5% year over year, accounting for 54.2% of total retail growth.

According to Grandview Research, "the global cloud computing market size was valued at US$483.98 billion in 2022 and is expected to grow at a compound annual growth rate (CAGR) of 14.1% from 2023 to 2030." This will continue to foster online shopping, which has been growing. It is projected that it will drive 24% of all retail in 2025 and be affected by 85% of global consumers. If you add the increased SKU proliferation, a result of the segmentation of the larger consumer base and onshoring, this challenges the existing methods of packaging production and the supply chain. All of this drives the need to streamline and automate production and business systems to meet the new market requirements, and will continue to bode well for packaging but digital packaging in particular. This projected growth will vary based on the print and packaging applications. Along with that growth we are seeing purchasing habits change, and things will continue to change, creating opportunities and headwinds.

KEY TRENDS

So opportunities exist, but what are the key trends in labels and packaging that will affect the potential for growth? At a high level, they include sustainability, smart technologies, personalization, innovation in design, and regulatory compliance. These trends reflect the shifting consumer expectations, regulatory changes, and advances in both materials and digital technologies.



Source: Brookings Institute

Ultimately, the purpose of packaging is to capture the consumers' attention and protect the product, so product safety with aesthetic and functional design are the top priorities to meet consumer expectations for quality and functionality in both packaging and label designs. However, that is only at a high level. Once you start to look at the shifting manufacturer, producer, consumer and government requirements, you really start to dig into the other trends that are driving market shifts.

- **Sustainability**

Eco-friendly packaging solutions dominate industry priorities, with most brands using or moving to recyclable, compostable, or biodegradable packaging. Plastics are still the dominant material in the packaging labels market, capturing a substantial 46.1% share. This dominance can be attributed to plastic's versatility, durability, and cost-effectiveness, which make it a popular choice for a wide range of packaging applications. Plastics such as polyethylene, polypropylene, and PVC offer strong performance in both aesthetic appeal and functionality, providing resistance to environmental factors like moisture and temperature, which is crucial for products in industries such as food and beverage, cosmetics, and pharmaceuticals.

Even with that, the plastic vs. paper battles still exist, since recycling is still fragmented across the globe and there is currently a move to fiber and/or mono material solutions to ensure better compliance with both regulatory and consumer requirements. There's also an increased focus on carbon footprint transparency and recyclability design to meet consumer demand for sustainability and to support corporate social responsibility goals, while still protecting the product.

(Above) Packaging producers face an increased focus on carbon footprint transparency and recyclability design to meet consumer demand for sustainability. (Left) Adoption of QR codes, NFC tags, and RFID transform labels and packaging into interactive platforms. *©PACKMOJO*

- **Design Aesthetics**

This is all about the FMOT (First Moment of Truth), and it is where packaging needs to focus its efforts on developing or reinforcing a perception and converting potential customers into actual customers. The main challenge is that a retail grocery has an average of 45,000 SKUs (stock keeping units) in the store, while Walmart has about 140,000. Even if a shopper does pre-shopping online with search and social media, with an average of 5–7 highlight elements on a package and considering most shoppers can only process three elements on a package at once, how do you capture a shopper's attention? Tactile and visual enhancements, like embossing, textured laminations, and metallic effects are increasingly popular for premium products to capture the FMOT, and are even migrating downmarket. This is now possible with an increased use of new digital and hybrid embellishment technologies being integrated into design and package converting in both analog and digital packaging print production.

- **Smart Technology Integration**

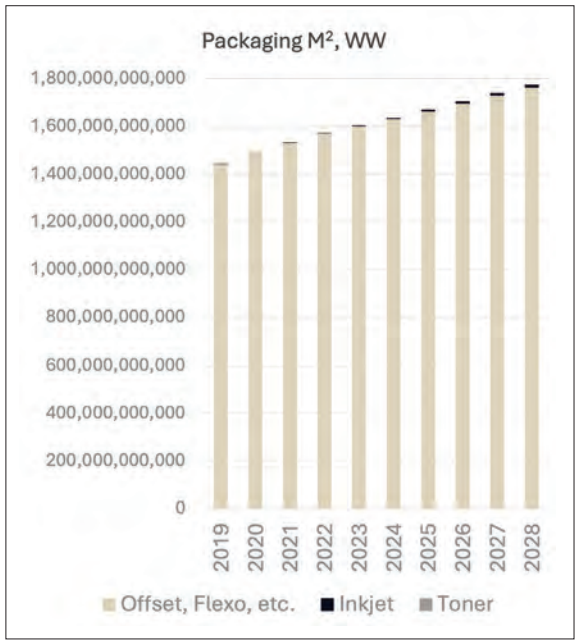
Adoption of QR codes, NFC tags, and RFID is rapidly expanding. These technologies transform labels and packaging into interactive platforms that enable authentication, real-time data access, supply chain transparency, and even augmented reality or interactive experiences for end consumers. Today, this shift is prominent in food, pharma, and electronics sectors driven by safety and security. However, as major retailers like Walmart, government bodies like the EU, and other tracking and recycling efforts begin to require the use of these technologies, it will become more mainstream. The added benefit is that it offers additional marketing support as tracking and targeting consumers becomes more accepted. Advancements in creation and adaptation of them into the supply chain will support growth and new benefits.

- **Regulatory Compliance**

EU's new Packaging and Packaging Waste Regulation seeks to reduce packaging waste, increase recycling, and foster harmonization of EU-wide rules on labeling, empty space, and mandatory recycled content. Governments are also pushing for more detailed and accessible product information. For example, new front-of-package (FOP) nutrition labeling mandates are likely to become standard, with simpler "Low-Med-High" indicators for key health metrics. Allergen information, sourcing transparency, and clearer recycling instruction regulations are also on the rise. Data-driven product label and packaging information and the use of smart technology integrations will help achieve those goals.

- **Automation and Faster Turnaround**

There is an increased demand for fast, cost-effective packaging solutions. Faster and wider digitalized flexo and offset presses are emerging as cost effective solutions for some smaller as well as mid to long runs. Automation and hybrid technologies in press and converting are developing to address those needs as well. These solutions can be seen driving automated and quicker makeready for printing, die cutting, folder gluers, pouch making, hybrid embellishment solutions, etc.



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While digitally printed packaging offers a value-add with increased margins for those who can justify the cost, the reality is that, lux packaging aside, digital currently offers little appetite for high-volume needs. In fact, while overall digital print for packaging applications are growing with total market values increasing from $16.3 billion in 2021 to $17.2 billion in 2024, and offer projected compound annual growth rates (CAGR) ranging from 3% to 18% through 2029, they only account for about 1% of the total volume compared with analog printing technologies like flexo and offset.

Digital label presses were introduced to the market in 1993. However, as of December 31, 2024, the installed base and market penetration of digital label presses show fewer than 2,500 HP Indigo label presses, which holds the lion's share, and about 1,500 inkjet label presses installed worldwide. Approximately 2,500 label converters, out of ~6,000 in US and Europe, own digital presses. This represents about 10% of self-adhesive labels but accounting for 20% of brand label expenditures, albeit at higher margins. However, in the case of labels, considering the length of time digital label presses have been in the market, we have seen an almost a 3X growth of output value ($) over the last 10 years. Although, putting that in perspective, in digital label output volume (physical amount of production) by 2027, while the value will be higher it still will only translate into about 12% of the total volume of label production across all of the printing technologies, although digital print for packaging adoption is increasing and it is growing. Going forward, it is projected that digital label production will show a 4% unit CAGR from 2024 to 2029 and a 12% CAGR in square meters printed, according to IT Strategies, Inc. Newer digital solutions like the HP V12 and faster and wider inkjet solutions will help support some of that growth.

EP/toner-based digital print had the earliest foothold in the digital print for packaging space primarily for labels. However, we are seeing increased development and deployment of inkjet solutions across the entire digital print for packaging market. As speeds increase to 100 m/min. and higher, newer inkjet print solutions offering both water-based and UV ink are suited to a wider base of applications. These support—and will continue to support—other areas of digital packaging production going forward as well.

Digital corrugated printing, which includes both single-pass inkjet and post-print serial technologies are projected to see a 25–36% CAGR in square meters and 15–23% vendor revenue growth forecasted through 2029. The output from these include custom boxes, POP, displays, endcaps, etc. Digital flexible package printing is projected to show an 8% unit CAGR and 27% square meter CAGR with 15% revenue growth, but still showing some ink/media challenges, especially for food and beverage which has the largest potential for growth. Digital folding carton printing, including toner and inkjet, seems to offer the largest opportunity for growth due to ink/media and equipment advantages. It is projected to show a 5% unit CAGR and 12% CAGR in both square meters and vendor revenue forecasted from 2024 to 2029, according to IT Strategies.

IN SUMMARY

Packaging converting continues to offer a wide variety of growth opportunities. However, you need to be sure to understand and align your customer requirements to the right press and converting technologies to achieve good margins and higher growth. While digital package printing provides many opportunities for higher margins and growth and ease of operation, it still faces low productivity, higher costs for traditional runs, and some substrate limitations compared with flexo and offset. On the other hand, digitalized analog print technologies including flexo, offset, and hybrid solutions have evolved to counter some of those digital print advantages.

As business transactions continue to move to digital data exchange, be prepared to work with supplier partners and customers to integrate your systems across the supply chain. Additionally, focus efforts on helping them understand and track the trends and ever changing market shifts.

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SUSTAINABILITY IN PACKAGING: LATEST TRENDS

BY CARY SHERBURNE

A new McKinsey report highlights consumer attitudes towards packaging, including their feelings about sustainability. It doesn't quite reflect what you might think! Meanwhile regulatory agencies march on with efforts to diminish packaging waste, and brands and retailers must decide not only how they can comply, but what, if any, marketing messages around sustainability with resonate with consumers.

I recently came across an interesting study by McKinsey: *Sustainability in Packaging 2025: Inside the Minds of Global Consumers.* McKinsey has been conducting this research globally since 2020, and the most recent round encompasses survey responses from more than 11,000 respondents from 11 countries. It addresses consumer preferences across product categories, packaging substrates, and sales channels. It follows surveys in 2020 and 2023, so it also revealed trends over time.

They identified five key findings, and especially if you represent a brand or packaging converter, you should read the entire report to get the full details, but we will summarize them here. Two relate to the factors most important to consumers overall when making purchases and when considering packaging, and the remaining three provide detail on consumer attitudes toward sustainability.

It's not really a surprise that price and product quality were the most important characteristics influencing consumer purchasing decisions. But it surprised me that environmental concerns ranked significantly lower than in the past across product categories – even as climate change is clearly heating up.

Of course, food safety and shelf life were also important considerations. And while overall, sustainability fell low on the list, recyclability was viewed as the most critical sustainability trait—around the globe. This includes whether the packaging is recyclable, made of recycled content, and/or reusable. Whether the packaging is bio-based was also an important consideration, a global thumbs down for plastics on the part of consumers, or so it would seem.

But respondents didn't really agree on which packaging materials are the most sustainable. Glass and paper, of course, rank high. But there is disparity in perceptions about things like PET bottles—like those water bottles and single-use plastic containers we all seem to like so much. These are more acceptable in geographies with "robust collection systems such as deposit return schemes." The study states, "Respondents in the countries with the highest PET collection rates—Germany, Sweden, and Japan have collection rates of more than 80%, for example—all ranked PET in the top three, while the countries with the lowest collection rates (such as the United States, with a rate of 33%) rank PET the lowest." Some respondents also noted they were willing to pay more for sustainable packaging, although as consumers, we don't usually think much about what the added cost of packaging—primary and secondary—is as a percentage of the overall product cost. Perhaps we should.

(Above) Secondary packaging can have an adverse environmental impact. (Right) Amazon has pioneered the concept of "right-sized"packaging.

Interestingly, McKinsey research showed that "sustainability was a top concern across the whole packaging value chain" before the COVID-19 pandemic. That drove efforts on the part of regulatory agencies—and brands—to address the issue. These days, not so much. But that being said, especially in Europe and some U.S. states, there are regulations in place to address packaging waste and hold producers responsible for reducing it.

One issue that was pointed out by Jeff Bezzo, executive director of plastic and packaging sustainability at SC Johnson during the recent Packaging Recycling Summit is the disparity in regulations from state to state in the U.S. He said, "We could have common definitions for producer, for covered materials, the timelines to implement, and even reporting timelines as well as what gets reported. If we could get some of these definitional pieces aligned at the federal level, it would help." While that, of course, would be quite helpful, it does not excuse brands from compliance with existing state regulations. And that's true whether or not they have a physical presence in a given state—say, California. They are bound by regulations if their packaging and/or products are sold in the state. The Summit article referenced above also includes a number of other great suggestions for reducing packaging waste, ensuring regulatory compliance, and more. One interesting proposal for the pharmaceutical industry is a take-back program whereby consumers would drop off empty packaging where they pick up their prescriptions (which are often recurring), and packaging would be collected by healthcare distribution agencies for processing.

In the recent London Packaging Week Innovation Awards, sustainability stood out, especially in terms of compostability (which we're not addressing here) and end-of-life considerations. While laudable, innovations shown there and elsewhere will take time to get to scale and have true impact on the future of the planet.

WHAT ABOUT SECONDARY PACKAGING?

Most of the effort has seemed to have gone into primary packaging, but secondary packaging is also important in terms of its environmental impact. Remember all the

hoo-hah around the unboxing experience? And if you had beautiful secondary packaging with minimal plastic, it enhanced the unboxing experience and your loyalty to the brand. You don't hear about that so much anymore. Although brands and influencers still use those unboxing videos as a marketing technique.

So primary packaging is important for shelf appeal—I'm sure I'm not alone in admiring some of the gorgeous primary packaging you see, especially in personal care products for example! And that presumably drives in-store purchases. But I'm not sure how much that impacts ecommerce sales, which according to Fit Small Business and other sources, accounts for 15.2% of total retail sales in the U.S. (accounting for as much as $1.5 trillion in total sales). That's a lot of secondary packaging!

As the cost of shipping packages continues to rise, and now that those costs are based on both weight and volume, the days of the large Amazon box stuffed with more paper than product are numbered. Plus, if the unboxing experience is still important to consumers, this is not a good look.

RIGHT-SIZED PACKAGING — THE FUTURE FOR ECOMMERCE?

Our readers will recall, perhaps, that at drupa 2024, EFI and Packsize unveiled an interesting solution for right-sized secondary—or even primary—packaging. The Packsize EFI X5 Nozomi Erected Box Printing System (yikes, that's a mouthful!) is the world's first full-color, on-demand, right-sized box system. It prints, cuts, creases, glues, and erects customized boxes with high-resolution graphics in a single solution that delivers a right-size, fully erected box every 6.5 seconds. You can see the video at https://videos.efi.com/watch/rn4v7sW91kZ5BirkYaKfhn. As you will see, each box can be different—size and printing. And because the boxes are sized to fit as closely as possible the targeted contents, void fill is eliminated, or at least minimized.

Another example is DS Smith's Made2fit technology that delivers right-sized packaging. They state, "This innovation has been developed to specifically tackle the e-commerce challenge of void space, as shipping air is a waste of resources. Creating the right-sized pack lowers costs for etailers by reducing both operational and shipping costs: saving storage space, cutting labor costs and order administration, and significantly cutting assembly and packing times. It also significantly reduces product movement, helping to reduce damage."

I also notice, since I live on an island and use a lot of Amazon, that their packaging is mostly—but not always—more "right-sized" than in the past. And since I'm not the only Amazon customer in the world, this adds up to a substantial environmental benefit, both from the perspective of waste as well as reduced transportation impacts on the environment—smaller boxes, fewer trucks, etc.

THE BOTTOM LINE

While consumer concern about sustainable packaging has taken a hit since the pandemic, it doesn't change the regulations that are out there, or the responsibility of brands, retailers, etailers, and packaging converters to reduce packaging waste, use more recycled content, make sure packaging is recyclable or reusable, etc. That means more paper and less plastic, right-sized primary and secondary packaging, and the other considerations raised by this article and the McKinsey study.

We'll continue to follow this issue as more data becomes available.

RESOURCES

Fit Small Business: https://fitsmallbusiness.com/ecommerce-vs-brick-and-mortar-statistics/
McKinsey's Sustainability in Packaging 2025: www.mckinsey.com/industries/packaging-and-paper/our-insights/sustainability-in-packaging-2025-inside-the-minds-of-global-consumers
Packaging Recycling Summit: www.packworld.com/sustainable-packaging/recycling/article/22944477/live-at-prs-day-3

AI IN PACKAGING TODAY

BY PAT MCGREW AND RYAN MCABEE

(This article is excerpted from the WhatTheyThink Quarterly Journal.)

The integration of artificial intelligence (AI) tools is a game-changer. It offers opportunities to enhance creativity, efficiency, and precision in the execution of packaging projects, reshaping the landscape. AI is so pervasive that it can be hard not to become overwhelmed. It seems that every product boasts AI capabilities. And then there are the tools you can download and play with. Where should you start? Here are some ideas.

AI IN GRAPHIC DESIGN

AI tools have turned graphic design on its head by automating repetitive tasks, allowing designers to focus on creativity and innovation. AI-driven software can automatically adjust color schemes, optimize layouts, and even suggest design elements based on brand guidelines. This not only speeds up the design process but also ensures consistency across different packaging formats. It isn't perfect, though, so you must check your results.

AI FOR DESIGN OPTIMIZATION

AI's predictive analytics capabilities can uncover potential design issues before they occur. By analyzing historical data and current trends, AI can predict how a design will perform in the market, allowing for adjustments that enhance consumer appeal and functionality. This proactive approach reduces the risk of costly redesigns and accelerates time-to-market.

ENHANCING PERSONALIZATION

AI tools enable hyper-personalization in packaging, allowing brands to tailor designs to specific consumer segments. By analyzing consumer data, AI can generate packaging designs that resonate with target audiences, enhancing brand loyalty and engagement. This level of personalization was previously unattainable with traditional design methods.

STRUCTURAL DESIGN AND AI

In structural design, AI tools can simulate packaging scenarios, optimizing material usage and structural integrity. AI algorithms can suggest the most efficient designs for specific products, considering factors like weight distribution and material strength. This leads to more sustainable packaging solutions that minimize waste and reduce costs.

WORKFLOW AUTOMATION AND AI

AI enhances workflow automation by streamlining processes from design to production. Intelligent systems can manage project timelines, allocate resources efficiently, and ensure that all team members are aligned with project goals. AI-driven automation reduces human error, increases productivity, and ensures that your production lines can meet their deadlines.

AI FOR QUALITY CONTROL

Visions systems with optical sensors are expanding their capability to find, identify, diagnose, and suggest corrective action using AI. The combination of visual inspection solutions and AI is improving quality from plate production to printed output.

The integration of AI in packaging projects is not just a trend—it's a strategic imperative for staying competitive in a rapidly changing market. By leveraging AI tools, packaging professionals can enhance creativity, optimize efficiency, and deliver superior products that meet the demands of today's discerning consumers. As AI technology continues to advance, its role in packaging design will only grow, offering even more innovative solutions for the industry.

Visit the WhatTheyThink Q2 Quarterly Journal for more in-depth coverage of packaging and the use of AI in packaging workflows: https://whattheythink.com/quarterly/2025-total-package.

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BUILDING YOUR AUTOMATION UNIVERSE: A PRACTICAL GUIDE FOR PRINTERS READY TO SCALE SMARTER

BY PAT MCGREW AND RYAN MCABEE

Automation is no longer optional for printers—it's foundational. From commercial print to packaging, thriving businesses are building Automation Universes that align people, processes, and technology to reduce friction and drive value. Here is what you need to know about how to design scalable automation ecosystems tailored to your goals, budget, and evolving team. Whether you're buying big or building lean, the path forward starts with strategy, not just software.

The print and print automation landscapes have shifted again. Automation on its own is now table stakes in the competitive print world, no longer the pure competitive advantage it once was. As an essential pillar of success in commercial print, direct mail, transactional communications, book production, and packaging, the demand for faster turnaround times, reduced error rates, and higher margins is the new space race. But how does an in-plant printer or a print service provider build an Automation

Universe that aligns with current and future needs, skillsets, and ambitions? The answer lies not just in buying tools or adopting software, but in building a cohesive ecosystem that spans people, process, and technology.

PRINT IS STILL A CRAFT

The industries of print—from commercial offset to flexo to digital printing with toner and ink—all share a common history rooted in craftsmanship. Estimators, color experts, prepress technicians, and shop floor managers are among the professionals who take pride in producing output that meets their customers' specifications and their internal quality standards. But despite the print industry's solid foundation in craftsmanship, it now finds itself at the intersection of technologies that power small-batch manufacturing.

The printers who thrive in this environment recognize that automation isn't just about replacing manual steps. While that is crucial, it is not the goal. Automation is about liberating your workforce to focus on the tasks that add quantifiable value to your business. A robust Automation Universe includes intelligent job onboarding, streamlined production planning, automated color management, finishing and fulfillment intelligence, and a business intelligence layer that provides the insights needed to make smarter decisions. But building this kind of infrastructure takes more than just buying licenses or signing service contracts.

WHAT'S MISSING FROM MOST SHOPS

Even shops that have invested in automation often miss these critical elements:

- **Centralized Error Reporting:** Automate alerts and error tracking across devices — use AI to classify recurring issues.
- **Customer-Facing Portals:** Let customers track job status, upload files, and approve proofs in a self-service way. It reduces email overload and speeds turnaround.
- **Closed-Loop Analytics:** Dashboards should not just report performance — they should inform improvements and trigger workflow adjustments automatically.

THE PEOPLE IN THE PROCESS

To begin with, consider the people who will inhabit this universe. The traditional roles of estimator, prepress operator, scheduler, and press technician are not disappearing, but they are evolving. The successful print operation today needs team members who are not just *task executors* but *system thinkers*. These are employees who can understand workflows, logic chains, and data flow. Hiring for these skills can be challenging, which is why training existing staff and creating a process that continually trains the next generation is a critical first step. Teaching the team to think in terms of processes rather than individual tasks is essential to ensuring two things: there is no single person who is so critical to a task that their unavailability stops production, and there are visible career paths for new people hired into the business. Helping them become fluent in the jargon of job ticketing logic, file metadata, and the basics of scripting languages or low-code platforms will grow them into your automation champions.

> Your Automation Universe should touch every part of your operation — from job onboarding and prepress through production, finishing, fulfillment, and customer communication. But equally important are the people who will use these tools.

An Automation Universe is most effective when it reflects the specific needs of *your* business and not the business down the street. For instance, if your shop handles a high volume of small-batch jobs, automation in job onboarding and imposition may yield the most immediate returns. If you manage large transactional mail runs, investments in finishing automation and postal optimization may deliver the most significant value.

The point is that *one size does not fit all*. Your journey begins with identifying each task and determining who is responsible for it. Then, identifying the bottlenecks and low-value tasks that consume disproportionate resources, especially those that go in loops through the shop. From there, define what success looks like. Is it a 20% reduction in makeready time or greatly reducing errors that lead to reprints? Waste reduction? Reducing the time from job acceptance to delivery? A 15% increase in on-time delivery? Set clear goals to guide your technology investments.

Tip: Think about those goals as you think about who to hire next. Do you need Automation technologies, data analysts, software Integration specialists, or a combination of these roles? Consider what balance of print industry knowledge and core technology expertise is the right fit.

SKILLS THAT POWER AUTOMATION

You probably don't need a staff of data scientists, but you do need curious problem-solvers who understand the power of automation. Here are the core skills your team should either bring or be encouraged to develop:

- **Workflow Logic Thinking:** People who understand process design and can build or optimize workflows using conditional logic tools like Enfocus Switch, Fiery JobFlow, or Kodak Prinergy Rules-Based Automation.
- **Data Fluency:** Employees should be comfortable with basic data structures like CSV, XML, and JDF, and understand how data flows between systems like your MIS, DFE, web-to-print storefronts, and customer portals.
- **API Literacy:** While not every team member needs to write code, knowing what APIs are and how they enable connectivity is essential in an automation-driven environment.
- **Change Management & Training:** Automation projects succeed when internal champions advocate for the technology, troubleshoot initial problems, and train others.

THE PROCESS AND THE AUTOMATION

The question of *build vs. buy* often arises early in the planning process. Larger operations may lean toward fully integrated platforms with comprehensive vendor support. These solutions frequently carry significant upfront and ongoing costs but offer a high degree of reliability and scalability. For example, systems like Kodak Prinergy Cloud, eProductivity Software solutions, OneVision, or HP PrintOS provide robust ecosystems with cloud-native infrastructure, AI-enabled optimization, and integration with a wide variety of devices and MIS systems. These platforms are designed to grow with your business, offering the peace of mind that comes from working with industry leaders.

On the other hand, some large and small operations opt for a more modular or build-it-yourself approach. They may start with tools from current vendors, downloadable freeware, or lower-cost SaaS tools, combining open-source platforms with low-cost cloud-based automation platforms like Make or Zapier. For file processing, tools that can handle basic preflight and normalization tasks. Spreadsheet software, paired with some scripting know-how, can be used to create batching and even job tracking functions. This is more of an old-school approach, which can offer flexibility and cost savings, but it does require a greater investment in internal expertise, upkeep, and training.

A modern approach for any size company might be to leverage tools like Make or Zapier and pair them with tools you use today in your workflow to begin automating steps, and developing expertise in the tools while streamlining your workflow.

Regardless of approach, integration is key. No matter how robust your tools are, their effectiveness is limited if they operate in isolation. Look for software with open APIs and agents, thorough documentation, and an active user community. Systems should speak to each other seamlessly, passing job data, status updates, and production metrics from one stage to the next.

Seriously consider a web-to-print system if you don't have one. It can be internally facing, client facing, consumer facing, or all of the above. A web-to-print system should generate a job ticket that automatically routes to prepress; prepress tools should preflight and normalize the files; imposition software should pull in the correct template based on job type; press systems should receive optimized files and report production status in real-time; and finishing equipment should use barcode-driven instructions pulled directly from the original job ticket. The goal is end-to-end visibility and flow, with human intervention only where it truly adds value.

One of the most overlooked aspects of building an Automation Universe is business intelligence. Too often, printers invest heavily in production automation but lack a feedback loop that tells them how well their systems are working. Business intelligence platforms like Microsoft Dynamics, or data analyzers like SpencerMetrics and OFS Mavyn, can work with solutions from your Print

TOOLKITS THAT STAND OUT

A few standout options for printing operations include:

- **ChatGPT/Jasper/Copy.ai:** Use for job ticket parsing, automating response templates, or generating content for customer portals.
- **Magical/Make/Zapier/Notion AI:** Useful for internal automation — onboarding new employees, documenting SOPs, or managing scheduling.
- **Tome.app/Grammarly/Wordtune:** Ideal for improving customer-facing communications — from quotes to onboarding emails.

MIS providers to synthesize data from multiple systems and present it in dashboards that reveal production bottlenecks, resource utilization, and profitability by job type. Pair them with AI agents to look at all of the data collected daily in the context of the business goals and a changing market, and these insights become critical not only for improving current operations but also for forecasting and strategic planning. Even for smaller shops, tools like Power BI or Tableau, paired with good data hygiene, can yield significant benefits.

Another dimension of automation worth investing in is customer engagement. Today's print buyers expect transparency, responsiveness, and self-service options. Customer portals that allow file uploads, proof approvals, job tracking, and invoice management are increasingly standard. These front-end systems don't just improve customer experience; they also reduce email traffic, speed approvals, and eliminate redundant data entry. This is an area where even free or low-cost solutions can make a significant difference. Pairing an intelligent onboarding system with a CRM platform or customer communication tools can provide a seamless bridge between sales, customer service, and production.

No automation journey is complete without addressing change management. Implementation is often more about people than technology. That's why phased rollouts, internal champions, and strong vendor partnerships are so important. Start small, test thoroughly, and iterate. Bring employees into the process early and communicate not only what changes are happening, but also why. The best automation projects are those that lift the burden of repetitive tasks from your people and empower them to focus on quality, creativity, and customer satisfaction.

WHAT WILL IT COST?

Budgeting for your Automation Universe should be approached with the same rigor as any other capital investment. For those with significant resources, a full ecosystem implementation can cost between $150,000 and $500,000 or more. But with clear ROI metrics, many print businesses see payback within 12 to 24 months. For budget-conscious operations, incremental improvements costing under $75,000 can yield substantial returns over a two- to three-year horizon. The key is to prioritize high-impact areas, avoid overlapping functionality, and make sure every dollar spent aligns with your long-term goals.

Looking ahead, the most future-proof Automation Universes will be built on cloud-native platforms with flexible licensing models, support for AI-driven decision-making, and secure data governance. As print shifts further into omnichannel and personalized applications, the ability to scale, adapt, and connect with external systems will be essential. That means investing not just in technology but in talent and processes that can evolve alongside your tools.

Ultimately, automation is not about replacing people in print. It's about enabling them to do more of what matters. It's about creating an operation where routine processes flow without friction, where errors are caught before they cause delays, and where your team can focus on what sets your business apart. Whether you choose to buy a prebuilt ecosystem or build your own with the help of AI tools, open-source platforms, and a little creativity, your Automation Universe should reflect the unique DNA of your company.

It's an exciting time to be in print. The tools have never been more powerful, and the opportunity to reinvent how we work has never been greater. So, take stock, dream big, and start building. Because in the Automation Universe, the only limit is your vision.

TECH STACK IDEAS:

For the All-In Buyer (Mid-Large Printers)

- **Budget:** $150K–$500K+
- **Goals:** End-to-end automation from onboarding to analytics
- **Stack Suggestion:**
  - **EFI MarketDirect + IQ**
  - **Prinergy Cloud**
  - **Enfocus Switch**
  - **Ultimate Impostrip**
  - **Boostt.ai for marketing**
- **Outcome:** Full integration, high throughput, measurable ROI in 12–24 months

For the Budget-Conscious Builder (Small-Mid Shops)

- **Budget:** <$75K
- **Goals:** Automate top pain points, grow modularly
- **Stack Suggestion:**
  - **Enfocus PitStop Pro**
  - **Zapier or Node-RED for routing**
  - **Power BI with Excel and Google Sheets**
  - **Rytr or Jasper for automated job ticket interpretation**
  - **Impose Online or low-cost imposition software**
- **Outcome:** Targeted automation, lower risk, gradual ROI over 18–36 months

AI IN PRINT PRODUCTION: NAVIGATING FACT & FICTION

BY PAT MCGREW AND RYAN MCABEE

(This article is excerpted from the WhatTheyThink Quarterly Journal.)

Artificial intelligence (AI), machine learning, and generative pre-trained transformer (GPT) technologies are heralded as revolutionary forces poised to transform every corner of modern business, including the print industry. The promise is bold: intelligent automation, flawless personalization, and creative capabilities that replace human effort. Headlines foretell a future where AI reduces costs, eliminates inefficiencies, optimizes labor costs, and opens new revenue streams.

Beyond the hype lies a more nuanced reality today—one where the true value of AI is in targeted applications that enhance, rather than replace, existing staff and workflows. In the print industry, the story isn't about sweeping, overnight transformation but the steady march to optimize tasks like specification capture, estimating, job onboarding, prepress, maintenance, and customer engagement. The question for printers isn't whether AI lives up to its lofty promises—it's how to cut through the noise and implement solutions that deliver real, measurable benefits.

It is important to remember that this is not magic. It is computer programming paired with models, templates, and algorithms. The science behind AI is a transformative force that touches many industries, and print production—a manufacturing industry—is no exception. It has been a part of the infrastructure for years! From automating routine mechanical or software tasks to enhancing complex workflows, AI techniques offer opportunities for efficiency and innovation, but there are caveats. The imperative for printing companies is to learn to discern between genuine advancements and overhyped expectations.

Let's explore AI's practical applications in print production to see where AI brings value and where the promises may be hype.

AI IN PREPRESS AND WORKFLOW AUTOMATION

One department where there are many repetitive tasks is Prepress. This stage is pivotal in print production because it sets jobs up for success throughout the rest of the production workflow. It includes file preparation, color correction, and layout adjustments, all areas where machine learning and GPT technologies shine. Look at your prepress to find the touchpoints and loops. These are areas where AI technology can optimize processes:

- **Automated File Preparation:** AI-driven software can analyze incoming files, identify potential issues (e.g., missing fonts or low-resolution images), and automatically correct them, reducing manual intervention and errors.
- **Color Management:** AI-enabled algorithms can adjust color profiles to ensure consistency with a targeted intent across different media and printing devices, enhancing the final product's quality. Depending on how a tool implements its AI, these solutions can learn and refine the approach to specific color challenges as they interact with machine configurations and color profiles. However, not every vendor uses the technology in the same way, so it is essential to ask questions about how they use AI and how it impacts your print processes. There are varying levels of sophistication.
- **Layout Optimization:** Using AI disciplines, including machine learning, to optimize layouts, imposition, ganging, and nesting for print efficiency, minimizing waste, and ensuring optimal use of materials has been available in software tools for a decade. The difference today is the availability of more sophisticated tools and faster processors.
- **Why it's important:** Automation saves time, reduces errors, and enhances consistency in production, directly impacting profitability and efficiency.

AI's ability to streamline workflows—such as job intake, prepress, and production—brings measurable value to printers for every job.

Many production print hardware and software companies have added AI-enabled technology to their workflow solutions, enabling file interrogation and adjustments to enhance efficiency. AI's ability to streamline workflows—such as job intake, prepress, and production—brings measurable value to printers for every job. Before you buy, ask what technology they use, how they use it, how they tune it for changing conditions, and feature updates.

PREDICTIVE MAINTENANCE AND EQUIPMENT MONITORING

Two areas targeted by many hardware vendors are predictive maintenance and equipment monitoring. The promise is that AI-enabled routines can help optimize when maintenance is needed, when to replace parts, and even the best time for maintenance routines. Ask your vendors about their AI strategy because it can have a material impact on your maintenance costs. Some vendors claim that moving to AI-enabled processes can save their customers from replacing parts before it is necessary and help them adopt smarter maintenance timing. Ask how they handle:

- **Predictive Maintenance:** What is the best time to service the machine before it fails? Using AI to analyze data from sensors embedded in printing equipment provides data-driven guidance beyond tracking the current state. It uses historical and real-time data to estimate when maintenance should be performed to optimize machine usage and uptime. The financial impact is quantifiable when you optimize how often parts are replaced based on data, not the calendar.
- **Why it's important:** Unplanned downtime is a costly challenge for printers. Predictive maintenance ensures operational continuity and extends equipment lifespan.
- **Equipment Monitoring:** How is the machine running at this moment? Sensor data can provide alerts to immediate deviations from normal operating conditions before failures occur, allowing for timely maintenance and reducing downtime. Monitoring

equipment performance in real-time makes it possible to automate parameter adjustments to maintain optimal operation and prolong equipment lifespan.

Ask your vendors if they use AI processes to monitor press performance and if they can provide insights that help maintain consistent quality and efficiency.

ENHANCING VARIABLE PRINTING APPLICATIONS

A promising area to apply AI is in developing and enhancing personalized applications. Some vendors have quietly added AI-enabled features, like linking to image-generation and text enhancement engines. It improves VDP by analyzing customer data and generating hyper-personalized content at scale. GPT-based tools can even create dynamic messaging and designs tailored to individual recipients. If you are using tools to generate customized or personalized content, look at options from your vendors. Then, look outside your core set.

- **Why it's important:** Personalization and customization are proven to generate higher engagement and better ROI for clients, especially in direct mail and marketing campaigns. Using tools to analyze CRMs and other data pools to find the best messaging near or in real-time can be a differentiator.

The emerging use of AI-enabled tools includes smart linking and formatting for inbound data used for projects and adding embellishment layers to print projects. Take care, however. Most tools have things they do well and things they struggle with. Explain your applications and needs to find the right fit, and then keep testing. These technologies continue to expand their capabilities but at different cadences. Always check the output of any AI-enabled text and graphics. AI tools can and do make mistakes.

AI IN QUALITY CONTROL

Maintaining high-quality output is essential in print production, so ask your vendors about their quality control systems and if they leverage machine learning or other AI technology. Also, ask about defect detection in real-time. These technologies improve print consistency and reduce waste by identifying errors during production. Typical uses in many print manufacturing environments include:

- **Defect Detection:** AI-powered vision systems can detect defects in real time during printing, allowing for immediate corrective actions. These are common in transaction production print today and are becoming more common in book production and direct mail applications.
- **Color Consistency:** AI tools can monitor print using imaging systems and adjust color output by adjusting profiles and configurations in real-time to ensure consistency across different print runs and media.
- **Why it's important:** Maintaining high-quality output is essential for customer retention, especially for demanding applications like packaging or luxury print.

Most digital hardware vendors are testing or have productized AI-controlled solutions that monitor and adjust print quality parameters automatically. Ask your vendors about their current options and for demonstrations of how their solution works.

ENHANCED CUSTOMER EXPERIENCES

AI tools like chatbots and virtual assistants improve customer service by providing real-time updates, automated quoting, and faster issue resolution.

- **Why it's important:** Improved customer experiences foster loyalty and make it easier for clients to do business with print shops.

Beyond production, AI tools shine in faster analysis of large data pools. You can buy or build tools to analyze data from diverse systems, find gaps and bottlenecks, and generate recommendations. Today, printers use everything from well-written prompts in ChatGPT, CoPilot, Gemini, and Perplexity to tools you already have, including Microsoft PowerBI, Tableau, and Domo. Because you can automate the tools, you are not limited to how often you can run the analysis. A person might take a day or more to run an analysis, which might be done monthly or quarterly. That cadence can lead to missing red flags until it is too late. Automating the cadence to hourly, daily, or weekly provides faster insight into changes impacting profitability. Consider AI-based solutions to optimize inventory by tracking purchase orders, deliveries, elapsed time between orders, and cost changes to feed to estimating systems.

THE REALITY CHECK: HYPED EXPECTATIONS

Integrating AI tools into a print shop should begin with an assessment to understand the problems to be solved, bottlenecks and gaps in workflows, and data sources. The solutions available will not work without data. If you can't point to your data sources, no AI tool will help. It doesn't read minds. You have to feed it to get the benefits. It is essential to approach implementation with realistic expectations.

Read the full article in the WhatTheyThink Q1 Quarterly Journal for more in-depth coverage: https://whattheythink.com/quarterly/2025-ai-reality-check/123298-ai-print-production-navigating-fact-fiction.

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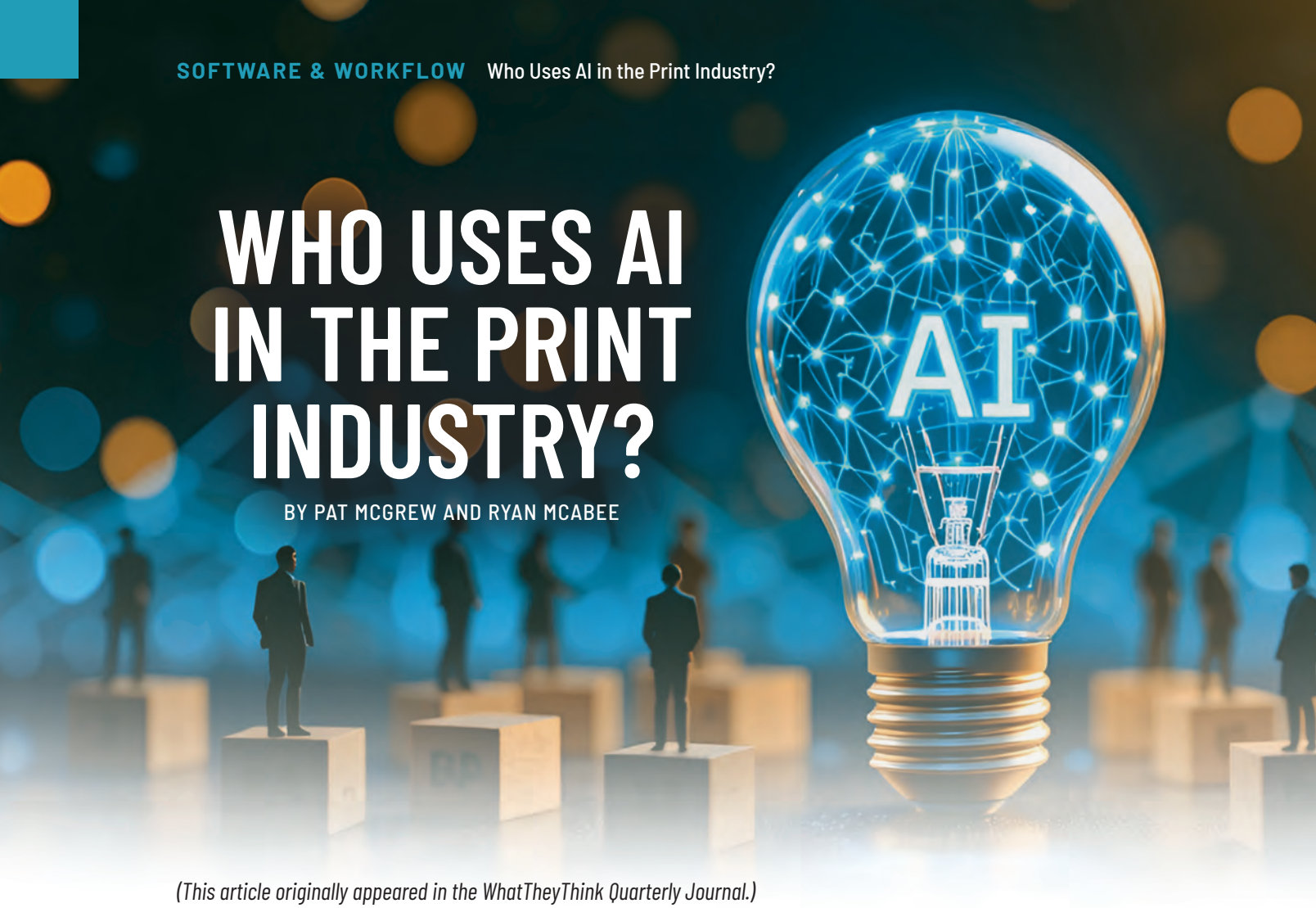
WHO USES AI IN THE PRINT INDUSTRY?

BY PAT MCGREW AND RYAN MCABEE



(This article originally appeared in the WhatTheyThink Quarterly Journal.)

Not every company exposes how they use AI in their products. Some use AI tools to guide their manufacturing processes and code development. Some embed AI technology, including GPT solutions, into their products for preventive maintenance management, color management, and quality control. Here is a list that is not all-inclusive. It features companies leading AI integration and offering innovative solutions that address specific challenges within the industry are:

ADOBE FIREFLY: GENERATIVE AI FOR CREATIVE DESIGN

Adobe's Firefly integrates generative AI capabilities into tools like Photoshop and Illustrator, enabling users to generate images and design elements from text prompts. This facilitates rapid prototyping and creative experimentation, enhancing the design phase of print production.

CANON SOLUTIONS AMERICA: GENERATIVE AI APPLICATIONS

Canon Solutions America explores the practical applications of generative AI in the print industry, focusing on enhancing employee experience and customer satisfaction. Their initiatives aim to balance AI's risks and opportunities to create value for print service providers.

DEEP-IMAGE.AI: IMAGE ENHANCEMENT

Deep-Image.ai offers AI-powered tools that enhance image quality, which is crucial for producing high-resolution prints. Their technology improves visual content across various industries, including print, by providing advanced image processing capabilities.

FUJIFILM'S AI GANGING TOOLS: OPTIMIZED LAYOUT MANAGEMENT

Fujifilm utilizes automated AI ganging tools to group similar jobs and optimize layouts, maximizing material usage and minimizing waste. This approach enhances efficiency in print production, leading to cost savings and improved turnaround times.

HEIDELBERG: AI-DRIVEN WORKFLOW AUTOMATION

Heidelberg has incorporated AI into its Prinect workflow solutions, automating tasks such as file preparation, color management, and layout optimization. This integration

streamlines production processes, reduces manual errors, and improves overall efficiency.

HP: PREDICTIVE MAINTENANCE AND PRINT OPTIMIZATION

HP's PrintOS platform utilizes AI to monitor printing equipment in real-time, enabling predictive maintenance and minimizing downtime. Additionally, HP has introduced AI features like Perfect Output, which ensures that printed content matches on-screen visuals by removing unwanted elements and optimizing resource usage. They also promote HP Print AI: Intelligent Print Management. HP's Print AI experience introduces features like Perfect Output, which automatically detects and removes unwanted content from print jobs, optimizing resource usage. This AI-driven approach ensures that printed materials align with on-screen content, enhancing print accuracy and efficiency.

AI integration offers innovative solutions that address specific challenges within the industry.

PREPRESS.AI: AI-POWERED PREPRESS AUTOMATION

Prepress.ai offers a comprehensive web-based solution that automates prepress workflows, including file management, preflight checks, and PDF editing. By leveraging AI, it streamlines the preparation of print-ready files, reducing manual intervention and minimizing errors.

PRYNTBASE: AI-POWERED SALES ASSISTANCE

Pryntbase explores the use of AI in sales within the print industry, including chatbots and virtual assistants that assist in customer interactions and sales processes. These AI applications aim to enhance sales efficiency and customer engagement.

RICOH: GPT FOR PREVENTATIVE MAINTENANCE

Ricoh uses AI technology for Sensor Data Analysis to capture and review sensors and IoT-enabled components to collect data—such as printhead performance, toner levels, roller conditions, paper feed consistency, and internal temperature. They also feed their Predictive Failure Models to reduce unplanned downtime, increases printer uptime, and extends the life of the machine. Once patterns indicative of upcoming issues are detected, the AI system can automatically issue alerts to technicians, schedule service appointments, or even initiate self-correction routines (in cases of software-based issues

SAPPI PAPERS: AI FOR PRODUCTION EFFICIENCY

Sappi Papers utilizes AI to reduce waste, increase production efficiency, and reduce downtime. Their AI applications focus on optimizing production processes and driving job customization to meet specific customer needs.

SCODIX: AI FOR MACHINE AND IMAGE EFFICIENCY

Scodix has used AI techniques for many years to enable Adaptive Print Calibration and Quality Control, Predictive Maintenance, and Operational Efficiency. They added a new set of Automated Feature Recognition and Enhancement Optimization tools as plug-ins to the Adobe Creative Cloud to allow designers to design for embellishment using tools they already know.

These companies exemplify the diverse applications of AI in the print industry, from automating workflows and predictive maintenance to enhancing customer interactions and personalizing print materials.

Visit the WhatTheyThink Q1 Quarterly Journal for more in-depth coverage of AI in the print industry: https://whattheythink.com/quarterly/2025-ai-reality-check.

DISPLAY GRAPHICS AND SIGNAGE: WHAT KIND OF DAY HAS IT BEEN?

BY RICHARD ROMANO

THE STORY SO FAR

- By the end of the 2010s, the migration to wide-format on the part of general commercial printers had been slowing.
- The COVID pandemic of 2020 struck, and wide-format printing was a saving grace during the pandemic, what with the infamous "pivot" to safety signage, distancing dots, and all the other ephemera of the COVID lockdown that have all but been forgotten now.
- In 2021, things started to return to normal as we spent the year rebuilding the industry (and the economy).
- In 2022, it was "Virus? What virus?" while the infamous "supply chain challenges" dominated the headlines, and obtaining paper, certain types of vinyl, aluminum, and other materials and consumables was a challenge—and expensive.
- By 2023 and 2024, everything was back to normal—or to the "new normal." Shops that specialized in display graphics started to look at diversification into new areas.

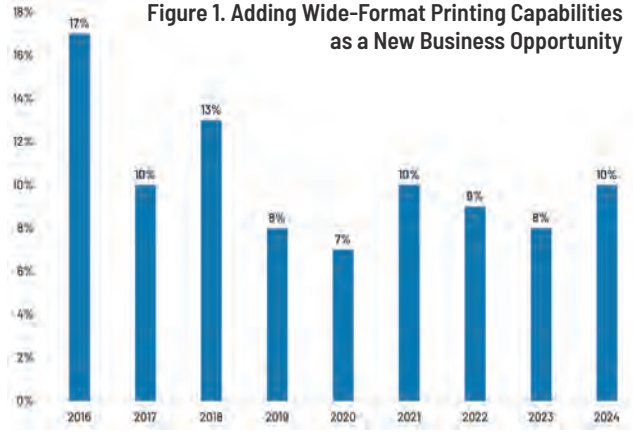
Where does that leave us in 2025?

Smithers has a fairly bearish forecast of the display graphics and signage market. In their report *The Future of Printed Signage in a Digital World to 2028*, they see the global value for "posters, banners, flags, backdrops, point-of-sale (PoS) displays, billboards, decals & transfers, vehicle/fleet graphics, building wraps, corporate graphics, and trade show materials" in 2023 will reach $40.99 billion—down ~$5 billion from their pre-pandemic value. They add:

- Volume of printed signage has fallen from 10.81 billion meters square in 2019, to 8.92 billion meters square in 2020, although demand for printed signage did recover in 2021–2022.
- Output for all printed signage is projected to reach 10.08 billion meters square in 2023
- Upward trajectory is now levelling off thanks to inflation, energy costs, and geopolitical issues.
- Demand for printed signage will only grow marginally—value increasing at 0.2% CAGR to $25.15 billion in 2028.
- Volumes have a 0.7% CAGR to 2028; global output will reach 10.43 billion meters square in 2028.

Smithers is a bit more pessimistic than I would be, but their upshot is that there is an increased need to diversify into new application areas.

Figure 1. Adding Wide-Format Printing Capabilities as a New Business Opportunity



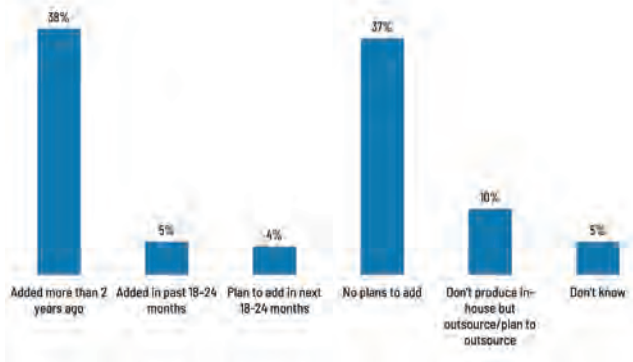
Source: WhatTheyThink Print Outlook surveys, 2016–2024

THE MATURING OF WIDE FORMAT

And it's true that our annual Print Business Outlook surveys have found a cooling—though admittedly stabilizing—of interest in wide-format printing as a new business opportunity (see Figure 1):

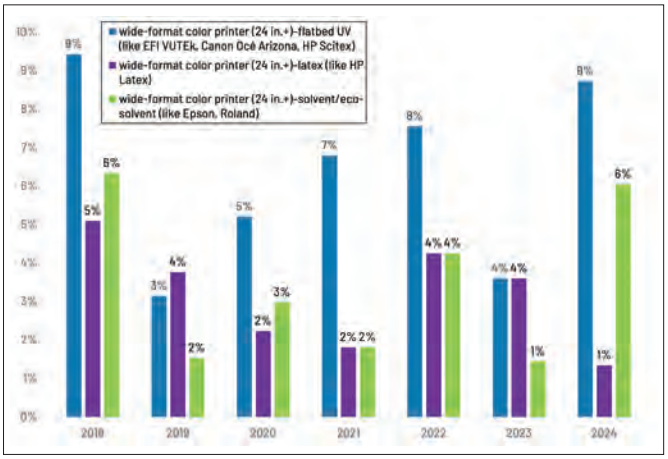
We have generally found that about one-third of the industry falls into the category of what I would call the "never wides," or who have no interest in adding wide-format equipment—or so they say now. Of course, there is no reason for anyone to add it if it falls outside the scope of what it is they produce. A publication printer or a data-driven direct mail business may legitimately have no interest in display graphics. And that's cool. (See Figure 2.)

Figure 2. Have You Already Added or Plan to Add Wide-Format Printing (like Signs, Displays, Banners) Capabilities?



Source: WhatTheyThink Print Outlook survey, 2024

Figure 3. Planned Investment in Wide-Format Printing Technologies



Source: WhatTheyThink Print Outlook surveys, 2018–2024

Investment in wide-format equipment continues, with particular interest in flatbed equipment, which has been a trend for the past few years (see Figure 3):

Solvent printers have also made a little bit of a rebound, particularly as "eco"-solvent ink formulations make them less hazardous than had previously been the case, and given their versatility they can be a less expensive option than UV flatbeds—and they also take up less room.

Adding other kinds of display/signage-adjacent capabilities has been a mixed bag:

- Adding "industrial printing" capabilities peaked in 2022, but is down in our most recent survey.
- Adding traditional signage is not an overwhelming opportunity—it's the purview of specific sign companies and is a resource-intensive application area that a shop isn't going to dabble in as a kind of value-added service. You're either a sign shop or you're not.
- Adding vehicle graphics, though, peaked in our most recent survey, and that's the kind of thing shops can add. The trick is finding installers, but the printing is not out of the grasp of your average wide-format shop.

Over the past decade we have tweaked how we asked about adding textile printing capabilities. For the first five years, we asked generically about "adding textile/fabric printing"—which peaked at 7% of respondents in 2018—but since 2021 we have asked about specific textile printing sub-sectors, such as soft signage (which peaked at 6% in 2022), décor/furnishings (peaked at 4% in 2022), and apparel (never hit more than 3%). So…meh.

As for labels and packaging, packaging has been of more interest than labels—the percentage of our Print Outlook respondents who saw new business opportunities in adding packaging printing capabilities has averaged about 8–9% since 2016, peaking at 13% in 2021. This is likely because a lot of the same equipment they use for display work (i.e., flatbed printers) can also be used for packaging, such as corrugated materials. Indeed, Canon, to name one vendor, has introduced equipment configurations for its Colorado and Texas lines to produce various kinds of packaging.

Adding digital label printing has been a bit less exciting, never rising above 6% of respondents.

WIDE-FORMAT AND DISPLAY GRAPHICS OUTLOOK

As we charge through to the end of 2025, here is what the dominant trends are going to be (in alphabetical order):

- **AI**

Sign and display companies are starting to use so-called "artificial intelligence" (AI). The sign franchises in particular have been using AI for design, as well as for sales. For example, AI can be used for "role-playing" to help salespeople have better conversations with prospective customers in markets with which they may be unfamiliar. The sign franchises in particular are educating their franchisees on how to use AI for these various purposes, and tools like Adobe Firefly are helping these businesses generate design ideas. The idea is not to replace anyone with AI, but to allow employees to use it as a tool to be more productive.

- **Automation**

And of course the ongoing demand for sustainability and automation—not just software automation but things like robotics (i.e., arms for loading and unloading boards). As economies of scale kick in, these add-ons will become more affordable for mid-size and maybe even small shops.

Are we ready for robots? Last summer, Keypoint Intelligence conducted a short survey at the In-Plant Printing and Mailing Association (IPMA) and found that more than 50% of respondents were already thinking seriously about robotics even before any sessions were held on the topic. As they wrote in a WhatTheyThink data analysis feature:

Robots aren't new, but in print, they've arrived with purpose. They're tackling labor shortages, improving efficiency, and helping in-plants stay competitive. This isn't a trend to wait out. It's a shift to lean into. As Mark Boyt puts it: "Don't wait for perfection—start exploring practical automation use cases now."

In-plants are a big market for wide-format equipment, so if they're thinking about robots, wide-format-compatible robotics are probably on a lot of their radars.

- **Diversification**

Diversification is becoming important not just for commercial printers but display graphics producers as well, and now that the same equipment can produce display graphics as well as packaging, POP, etc., there has never been a better time to expand into new areas. (Also, too, textiles.) Wide-format equipment, especially UV units, have long been used to print on 3D objects.

Keypoint Intelligence recently completed a study—Beyond the Big Shops—that looked specifically at

wide-format printing trends among small and mid-size enterprises (SMEs), a demographic that in particular is on the cutting-edge of technology and application trends. These are businesses that "typically have fewer than 100 employees and operate with lean teams, modest space, with fewer resources and limited scale," they wrote in a recent WhatTheyThink data analysis feature. "Despite that, they're finding new ways to grow, especially by offering faster service, more customization, and applications that bigger shops can't handle efficiently."

And diversification is the watchword for this demographic—Keypoint found that more than half of the businesses surveyed plan to expand their application mix in the next 12 to 24 months.

- **Education**

For signmakers in particular, education has become a major vertical—more so than it ever was. WhatTheyThink has been involved in judging the FASTSIGNS Project of the Year Awards for the past few years and well over half of this year's entries were schools, and not just colleges, but middle schools, high schools, grammar schools—there was even a Catholic school entry which was very cool. Schools at all levels have become more competitive than they used to be, and the overall look of the institution is a big part of student recruitment and retention.

FASTSIGNS' 2025 Project of the Year was won by FASTSIGNS Missoula, Mont., who revamped the University of Montana's Lodge Dining Center.

- **The Economy**

Of course, the print business is ultimately at the mercy of overall economic conditions, and, well, there are signs of trouble. GDP growth has been pretty good, but slowing compared to 2024. The job market is showing signs of weakening, and inflation is on the rise. How this will impact demand for print—and the business conditions of print providers, particularly in the display graphics space—remains to be seen.

- **Electricity**

A looming issue is going to be increasing electricity costs, and a number of economists are warning that utility rates are set to increase. Part of this is due to the growth of AI data centers which are electricity hogs and increase overall demand for power, which leads to higher costs. Another part of it is the shift away from less expensive renewable sources like wind and solar and back to more expensive sources like oil, gas, and coal. We often focus on printing technologies and industry-specific trends, but anything that negatively impacts print businesses' costs naturally affects those businesses' profitability. And since a lot of what our industry does requires electricity, we will definitely be impacted, unless we go back to mechanical Gutenberg hand presses.

- **Real Estate**

One indicator I periodically check in on is the American Institute of Architects (AIA)/Deltek Architecture Billings Index (ABI), which is a leading indicator for new commercial real estate investment—and thus potential new signage projects. According to the AIA, in July 2025, demand for design services continued to be relatively sluggish, although there is a glimmer of optimism. The Billings Index has been below 50 for the last year and a half except for October 2024 (anything below 50 is poor). Inflation and a slowing job market were cited as the big issues.

The rule of thumb is that this index leads actual commercial real estate investment by about 9–12 months, so commercial real estate development will continue to be a bit soft as we head through the end of 2025 and into 2026.

- **Tariffs**

The recent "tariffopolooza" will likely impact display graphics producers and signmakers—traditional signmakers use a lot of aluminum construction materials which have already been subject to tariffs (we saw this in 2017). We do know that the uncertainty surrounding US trade policy is leading many businesses to forestall major capital investments until things settle down, although that may not be very soon. But, then again, no small number of companies are saying "Damn the torpedoes—full speed ahead!" and are continuing as usual.

There is a potential bright side. Tariff-induced inflation may very well be a one-time shock to the system. Prices go up, things are tight for a bit, but gradually businesses and consumers adapt. And as long as tariffs don't increase, inflation levels off. (There is a lot more to it than that, and a lot also depends on what the Fed does.) Anyway, we could be in for a rough few months leading into the new year.

RESOURCES

AIA/Deltek Architecture Billings Index: see https://live-aia-web.pantheonsite.io/resource-center/abi-july-2025-business-architecture-firms-remains-soft
"FAST Food: FASTSIGNS Missoula Wins Project of the Year with University Dining Center," https://whattheythink.com/articles/126807-fast-food-fastsigns-missoula-wins-project-year-university-dining-center/.
Keypoint Intelligence—Beyond the Big Shops: What's Driving Wide-Format Printing, https://whattheythink.com/data/127227-beyond-big-shops-whats-driving-wide-format-printing/.
Keypoint Intelligence—Survey Says: Print Service Providers Are Ready for Robots, https://whattheythink.com/data/126827-survey-says-print-service-providers-are-ready-robots/
Smithers' The Future of Printed Signage in a Digital World to 2028, https://www.smithers.com/services/market-reports/printing/future-of-printed-signage-in-digital-world-to-2028.

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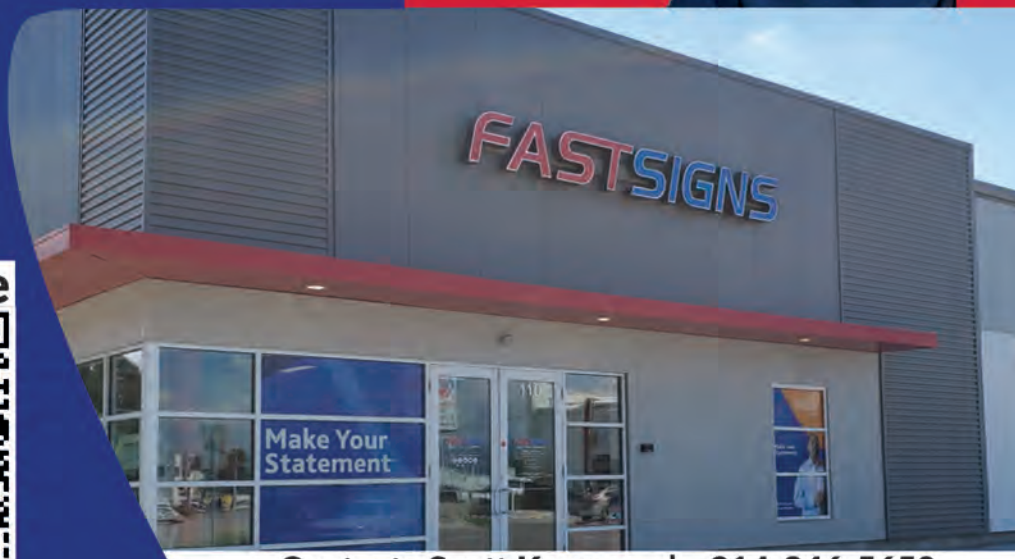

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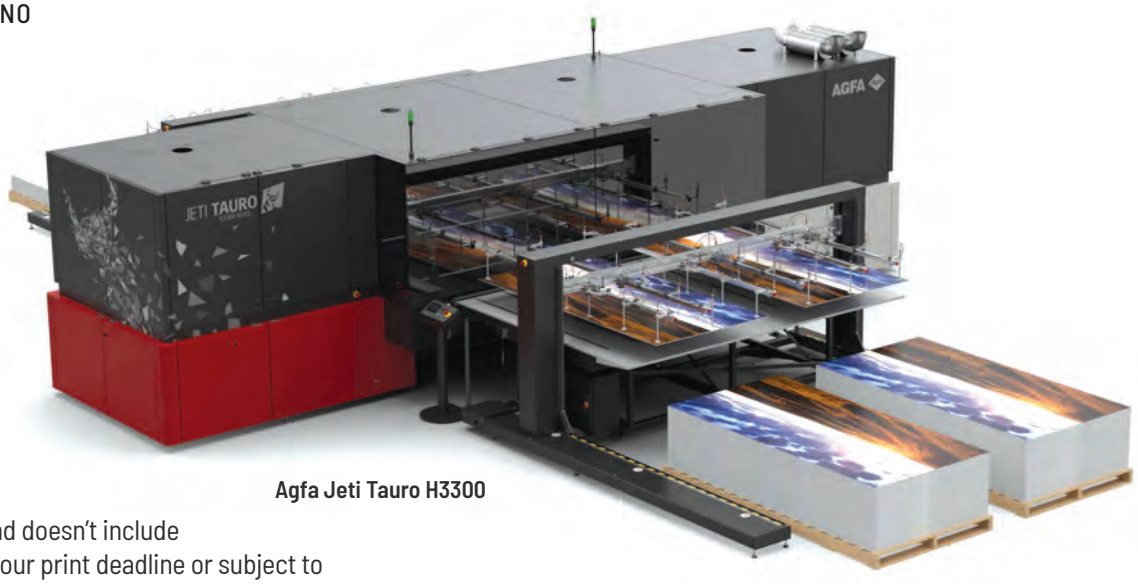
WIDE-FORMAT/SIGN & DISPLAY PRODUCT UPDATES

BY RICHARD ROMANO

This section provides a brief overview of the latest technologies from wide-format equipment manufacturers. Space prevents us from making this a completely comprehensive catalog of new product releases, and doesn't include units released after our print deadline or subject to embargo after this issue's street date. Our live coverage from PRINTING United will update this list where necessary.



Agfa Jeti Tauro H3300

Last spring, **Agfa** launched two new wide-format printers. The latest in the Jeti Tauro line—the H3300 XUHS—is 130-in. hybrid machine capable of print speeds up to 1,280 sq.m/hr., Agfa's fastest yet.

Agfa also launched the new Anapurna Ciervo H2050 and, at the ISA Sign Expo in April, introduced the Anapurna Ciervo H2500 to North America. The 98-in. Ciervo H2500 and 80-in. Ciervo H2050 provide smaller options to the 126-in. Anapurna Ciervo H3200. All three units are hybrid machines that print CMYKcm + white. Agfa touts them as well-suited for sign and display applications, as well as corrugated materials.

The company also released the Onset Panthera FB3216, the single-pass machine that came with Agfa's 2020 acquisition of Inca Digital. It is a 127 x 63 in. flatbed that, the company says, can print up to 16,297 sq. ft./hr.—of course, your mileage may vary. Still, it's a fast machine.

Canon had updated its Colorado and Arizona wide-format platforms in previous years, and in 2025 released hardware and software updates that expand the application range of its Colorado M-series 1.6m roll-to-roll printer, notably increased support for soft signage and thicker media. Specifically, the Colorado M-series feature new print modes—matte density (two layers) and backlit high density (three layers)—designed for soft signage. They enable printing multiple ink layers, which can help optimize the quality of backlit applications, such as silicon edge graphics (SEG) often used in retail locations.


Agfa Onset Panthera

On the Arizona side, new PRISMAelevate XL 2.2 software offers some ink-specific functionality that allows users to create unique applications such as distinctive business cards, keychains, and other promotional items. The

software also enhances "elevation printing" (basically 3D or texture effects), such as allowing transparent ink to be printed on top of layers of colored ink, enabling the creation of braille dots up to 1mm in height.

Durst and Vanguard Digital have been consistently cementing their integration since Durst's 2020 acquisition of Vanguard, and both have been busy introducing new units.

Durst itself was also showing its just-announced P5 X, the latest flatbed based on its P5 platform. The new unit is targeted toward mid-range large format printing, and has been designed for high-end applications in signage, POP/POS, industrial printing, and packaging. Among many other features, the P5 X also offers double-sided printing when printing rollfed, which seems to be becoming a thing.

To help maximize productivity, Durst also offers the P5 350 HS Double 4 (D4)—"D4" refers to a double-CMYK color configuration and is designed for high-intensity production environments. The Durst D4 technology can also be configured for all available P5 350 HS and P5 210 HS versions.

At FESPA last spring, Durst also introduced the P5 500 TEX iSUB, a 5.2m water-based sublimation printer with integrated inline fixation. The company touts it as being ideal for such applications as sustainable trade show graphics, interior design, and wide-format textile products.

Vanguard Digital's most recent introduction is The Radnor, a 3.2m UV-LED hybrid printer that can be configured with up to three rows of printheads, delivering print speeds of up to 6,146 sq. ft./hr. (The machine was named after Tennessee's Radnor Lake; Vanguard is based in Franklin, Tenn., and their new naming convention is based on prominent Tennessee geographical features; its previous product introduction, the Harpeth, was named after the Harpeth River.)

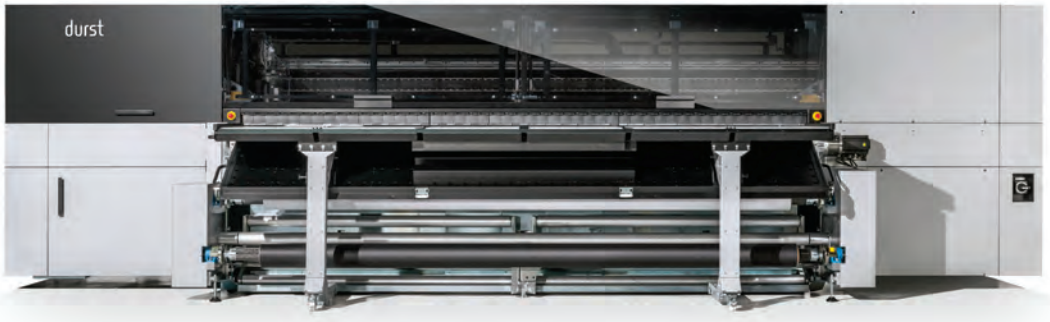
Vanguard Digital Radnor

EFI Pro 30h+

Back at the ISA Sign Expo, **EFI** launched the 126-in. EFI Pro 30h+ hybrid printer, printing CMYK plus four channels of white at a maximum speed of 2,530 sq. ft./hr. It joins the also recently introduced 126-in. high-volume EFI VUTEk M3h hybrid and the 120-in. EFI Pro 30f+ dedicated flatbed LED printer.

On June 12, 2025, **Epson** celebrated the 50th anniversary of the "Epson" brand. The company had launched its first printer—the EP-101 digital electronic printer—in 1968 and it led to the creation of the Epson brand in 1975. The name "reflects the company's hopes of preserving the value of the electronic printer ('EP') while continuing to create many valuable derivatives ('SONs')." (If you ever want to take a historical jaunt through Epson's wide-format history, check it out at ***https://whattheythink.com/articles/118378-display-graphics-evolution-epson***.)

Epson—notable for being one of the few manufacturers to have printers utilizing every ink technology (save for Canon's proprietary UVgel, natch)—this year



Durst P5 350 HS D4

jumped into the direct-to-film (DTF) space with its first true DTF printer (they've had a hybrid direct-to-garment/direct-to-film unit on the market for a couple of years), the SureColor G6070. It offers a 35-in. print width and a front-loading design that optimizes shop floor real estate.

Epson SureColor G6070

DTF is a process by which an image is printed on a sheet or roll of film, and the film is then transferred to the intended surface, usually some form of textile—like a T-shirt or other type of apparel—but the print technology can support other surfaces as well, much as dye-sublimation can be used on surfaces and objects other than fabrics. DTF is seen as an alternative (or sometimes a complement) to direct-to-garment for decorating small patches of clothing, such as adding a logo or other small graphic.

Back in March, Epson also upgraded its 64-in. SureColor S9170 solvent printer, giving it a new look that matches Epson's most recent sleek equipment design, as well as a new 11-color inkset that includes Red, Orange, and brand-new Green.

Interestingly, Epson's parent company, Japan's Seiko Epson, launched a new direct-to-shape printing system called (wait for it…) the Direct to Shape Printing System, an inkjet solution for printing directly on 3D objects like helmets, automotive parts, home appliances, sporting equipment, apparel, accessories, and more. It combines Epson's smallest PrecisionCore printhead with an Epson industrial robot to print on complex shapes. Seiko Epson had launched this system in June at Germany's Automatica show dedicated to automation and robots. No word about whether it will come to North America.

Direct to Shape Printing System

In the sign and display space, **HP** is devoting the bulk of its resources to its Latex line of printers, which have become the workhorses for many a display graphics or signage shop, thanks to the machines' versatility and wide application range.

Early this year, HP had launched the latest in its Latex "R" series, the HP Latex R530 flatbed/roll-to-roll printer, a 64-in. machine designed to help print service providers transition from roll-to-roll wide-format printers—such as the HP Latex 800 Series—to a flatbed. At the ISA Sign Expo, HP launched additional Latex units, the 64-in. HP Latex 730 and 830. Available in four "flavors"—the main differences between the 730 and 830 are speed (334 sq. ft./hr. vs. 388 sq. ft./hr., respectively) and ink capacity (one-liter vs. three-liter cartridges, respectively)—each has a "W" (for "white ink") version.

The new Latexes also feature HP Pixel Control, "the digital color pipeline that enables PSPs to deliver a more robust and consistent image quality at a lower number of passes, allowing customers to print uniform solid colors and greater detail." The new Latex units also enable easy duplexing, for those businesses that want to print two-sided banners, for example.

Inkcups manufactures a variety of screen, pad, and digital inkjet printing machines for industrial printing applications, and in 2017 they launched the Helix, an inkjet direct-to-object printer designed to print on cylindrical drinkware. The Helix ONE is a benchtop, entry-level DTO device and this year they announced some upgrades including Auto File and barcode scanning for automated job setup, a new jettable primer that allows printing on powder-coated drinkware, and support for smaller diameter objects—down to 33mm, which includes items like shot glasses, spice jars, and cosmetics bottles.

Epson isn't the only vendor with an anniversary this

HP Latex units

year—**Mimaki** celebrated the 50th anniversary of Mimaki Engineering and the 25th anniversary of Mimaki USA. Their most recent units include the JV200 Series eco-solvent roll-to-roll printers, the follow up to the CJV 150 (it's essentially the same machine, but without a built-in cutter). It is designed as a low-cost wide-format printer for users looking to upscale from the maker space. It's available in 64- and 54-in. versions, and four or eight colors.

Mimaki UJV-300DTF-75

Mimaki also launched their debut entry in the "UV DTF" market, the UJV-300DTF-75. While we usually talk about direct-to-film in the context of textiles, UV DTF is intended for industrial printing applications—decorating items of all shapes and sizes, including those with uneven or rounded surfaces. Ergo, UV DTF can be used to transfer images to physical objects of all sorts. The UJV-300DTF-75 uses Mimaki's ELS-170 and ELH-100 inks, and the printing process sandwiches the CMYK layer between a base white layer and a top clear layer to deliver high image quality.

In the textiles and apparel space, early this year Mimaki had launched the TX330-1800, a 1.8m machine that can print either transfer-based or direct-to-fabric dye-sublimation using pigment or dye inks. To optimize printing on stretchy or thin materials—such as sportswear—the Tx330-1800B uses a belt conveyor.

Roland DG is going all-in on dimensional and direct-to shape printing. Not only have they rebranded their flatbed UV line as the VersaOBJECT series, they are also expanding their acquisition of DIMENSE, a manufacturer of printers that use a combination of special inks, media, and heat to output unique embossing and texture effects. In June, they launched the new DIMENSE DA-640 Dimensional Surface Printer, targeted for high-value wallcoverings, interior design and décor, and other kinds of display graphics. It's very cool.

Roland has also launched two new models in its VersaSTUDIO line of desktop printers. The BN2-30 is a 30-in. eco-solvent printer/cutter while the BD-12 is a 12-in. UV direct-to-object printer. The company touts the BN2-30 as suited for T-shirt transfer graphics, yard signage, posters, stickers and labels, uniquely shaped displays, and more, especially for users who need a small footprint device.

The BD-12 can print direct to objects up to four inches in height, such as smartphone covers, notepads, sports

Roland DIMENSE DA-640

items, giftware, fashion accessories, and other kinds of promotional items. And Roland has long offered optional rotary accessories that let users print on cylindrical objects up to two inches in diameter, such as water bottles, cosmetics packages, and travel items.

At the start of 2025, **swissQprint** had launched "Generation 5" of its flatbed UV printers. Based on the company's Kudu platform, the next-gen machines include the Nyala 5 and Impala 5. The three primary advantages of Generation 5 over the previous generation are faster speed (3,670 sq. ft./hr.), higher resolution (1350 dpi), and an additional color channel, upping the color options from 9 to 10 (CMYKLcLmLk as well as varnish, white, neon pink, neon yellow, bright orange, and a primer for "difficult" surfaces like glass or metal).

Early last month, swissQprint introduced two new Generation 5 flatbeds, the Topi 5 and the Oryx 5. Topi 5 is a 126-in. flatbed that an print up to 1,356 sq.ft./hr., while the Oryx 5 is a 100-in. wide flatbed that can print up to 1,227 sq.ft./hr., 26% faster than the Oryx 4. Options available for all Generation 5 units include roll-to-roll and dual roll options, an oversize board option for rigid media up to 13.1 ft. long, and a "collector paper option" that catches excess ink when users do full-bleed printing. SwissQprint also backs up its commitment to reliability with an unheard of 36-month warranty on every model in every configuration.

AT THE END OF THE DAY

Look for new product announcements and other updates in our live PRINTING United coverage and of course in our daily WhatTheyThink newsfeed.

THE DIGITAL THREAD: LATEST DIGITAL DEVELOPMENTS IN TEXTILES AND APPAREL

BY CARY SHERBURNE

The textile and apparel industry is undergoing a significant digital transformation, driven by advancements across design, printing, cut-and-sew processes, and integrated software solutions. This evolution is fundamentally reshaping global supply chains, moving from traditional, mass-production models towards agile, on-demand, and highly customized manufacturing. Key innovations are focused on enhancing speed, precision, and versatility, while prioritizing environmental sustainability. This progression enables faster time-to-market, significantly reduced waste, and greater responsiveness to consumer trends, positioning the industry for a more efficient and sustainable future.

If you are producing textile-based products, or planning to, this article will help you determine several options to explore further, based on your company's specific requirements and those of your customers.

Following ITMA 2023 and drupa 2024, there have been few new printer announcements, although more are expected moving forward. For purposes of this article, we provide a round-up of leading technologies that have been brought to market over the past few years that are helping to drive this transformation.

THE DIGITAL TRANSFORMATION OF TEXTILES AND APPAREL

The global textile and apparel industry, historically characterized by labor-intensive processes and significant resource consumption, is currently experiencing a rapid and comprehensive shift towards digitalization, as we have discussed on WhatTheyThink many times. This paradigm change is primarily propelled by a confluence of factors: evolving consumer demands for personalized products and rapid delivery, increasing global pressures for environmental sustainability, and the critical need for resilient and agile supply chains. Digital technologies offer compelling solutions to these challenges by enabling improved efficiency, flexibility, and a substantially reduced ecological footprint throughout the production lifecycle. Digital technologies, of course, eliminate the time-consuming, labor intensive and waste-generating characteristics of rotary screen printing, as well as the chemistry required to prepare and clean screens. Obviously, long setup times for short-run jobs—increasingly demanded by both brands and consumers—incur costs that can make products more costly and less profitable to produce. In addition, the ability to produce textile-based products closer to the point of need can reduce the cost and environmental impact associated with transporting these products around the globe.

This article overviews a variety of options across several segments of the textile and apparel sector. It looks at the innovations in digital printing equipment and their corresponding ink systems and highlights the progress in automated cut-and-sew processes to shed light on the collective impact of these advancements on the industry's overall progression and future trajectory.

DIGITAL PRINTING EQUIPMENT: DRIVING PRODUCTION INNOVATION

The digital textile printing landscape is defined by an ongoing pursuit of enhanced speed, superior quality, and expanded versatility, all underpinned by a growing emphasis on sustainable practices. Manufacturers are

EFI Reggiani BOLT XS

continuously introducing advanced multi-pass and single-pass printers, sophisticated ink systems, and integrated software solutions to meet the diverse and evolving demands of applications ranging from high-fashion apparel to specialized industrial textiles.

EFI Reggiani: Pushing Boundaries in Speed and Sustainability

EFI Reggiani continues to deliver innovation with digital textile printers that significantly elevate production capabilities. The **EFI Reggiani BOLT XS** is positioned as a next-generation single-pass printer, engineered to achieve an operational speed of up to 100 m/min. (328 ft./min.). It offers a resolution of 600 x 4800 dpi in an ultra-compact footprint, offering a digital alternative to traditional rotary printing for mass production. Proprietary electronics and software enable real-time printing, even for very short and frequently variable jobs.

Complementing the single-pass technology, the **EFI Reggiani HYPER** is recognized as the fastest scan digital textile printer on the market. It achieves speeds of up to 33,906 sq. ft./hr., utilizing 72 printheads and a 2400 dpi resolution. The HYPER is strategically positioned to bridge the performance gap between high-productivity scan and single-pass digital printers, offering competitive uptime and reliability through its continuous ink recirculation system. These two printers are well positioned to challenge the dominance of traditional rotary screen printing, even for high-volume production.

EFI Reggiani printers support a wide range of applications through their proprietary reactive, direct disperse, pigment, and disperse sublimation inks.

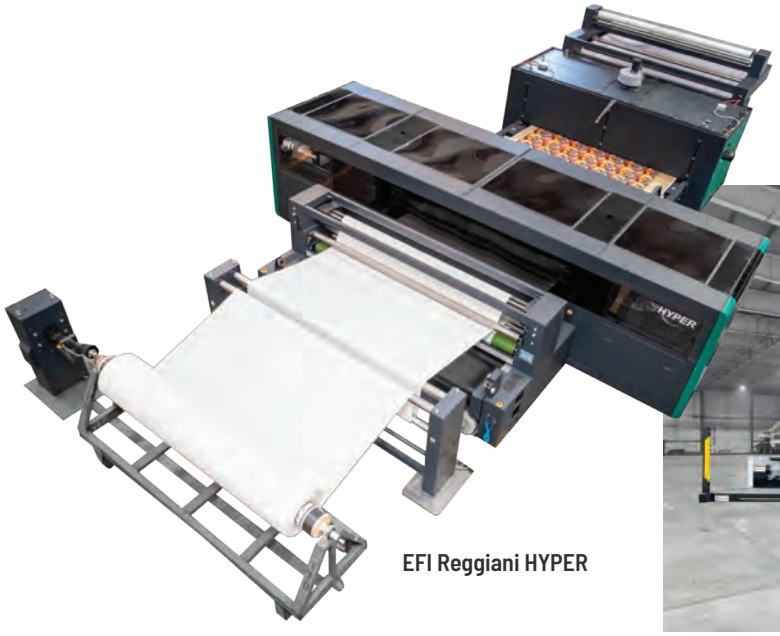
HP: Advancing Dye-Sublimation for Diverse Applications

HP has advanced dye-sublimation printing with its Stitch series, catering to a broad spectrum of textile applications. The **HP Stitch S1000**, which has been on the market now for some time, is a super-wide (3.2m or 126-in.) dye-sublimation production printer engineered for high productivity, reaching speeds of up to 220 sq. m/hr. (2,370 sq. ft./hr.). This printer facilitates long, unattended print runs and features fully automated maintenance functions, easy media loading, and dual-roll printing capabilities. Its user-friendly interface supports remote management via HP PrintOS, enhancing operational efficiency. It can print on both transfer paper and directly onto fabric from a single device.

The **HP Stitch S300** and **S500** are 64-in. dye-sublimation printers designed for varying production volumes, with the S500 achieving speeds of 110 sq. m/hr. and the S300 at 34 sq. m/hr. Both models incorporate a built-in features that reduce daily manual interventions. These printers also support both transfer paper and direct-to-fabric printing.

It should also be noted that a single HP Stitch printer can effectively serve the soft signage, fashion, and home décor markets, expanding market reach and opening new revenue streams. Furthermore, it streamlines operational workflows as operators no longer need to switch between different types of equipment for varied job requirements, leading to improved overall productivity and a more agile response to market demands.

HP's dye-sublimation printers utilize thermal inkjet technology with inks specifically formulated for polyester-based textiles, making them ideal for sportswear, fast fashion, home décor, and soft signage.



EFI Reggiani HYPER

Mimaki: Versatility and Sustainability in Digital Textile Printing

Mimaki, long a provider of textile printing solutions, offers a diverse range of digital

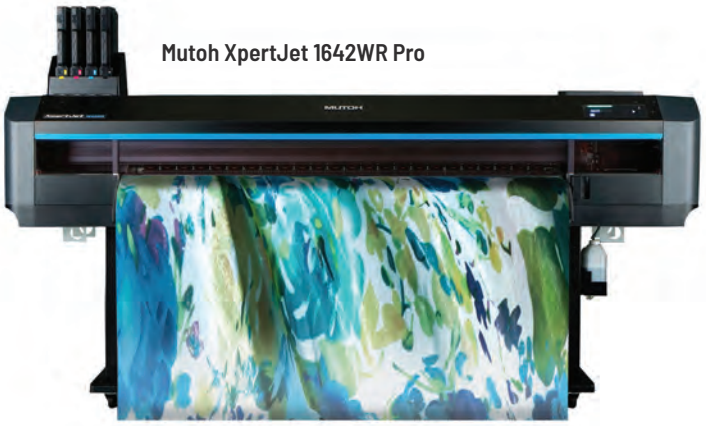
Mimaki Tiger600-1800TS

textile printers, focusing on versatility and environmental responsibility. The **Mimaki Tx300P Series**, including the Tx300P-1800 MkII and Tx300P-1800B, is designed for on-demand production of woven and knit fabrics and enables direct printing on various textile types, including thick, thin, woven, or raised fiber materials. They support five ink types: pigment, dye-sublimation, disperse, reactive, and acid, providing broad application flexibility.

The **Mimaki TxF300 Series**, comprising the TxF300-75 and TxF300-1600, are dedicated direct-to-film (DTF) printers, a technology that has generated significant interest in the marketplace. The TxF300-1600 model can print on rolls up to 63 in. wide. The series integrates software and Mimaki Core Technologies to ensure seamless operation and exceptional results.

The **Mimaki Tiger600-1800TS** is Mimaki's most productive sublimation transfer printer, specifically engineered to accelerate the shift from analog to digital processes within the textile printing industry.

Mimaki offers a comprehensive range of inks, including reactive, acid, pigment, disperse, and dye-sublimation for the Tx300P series which utilizes heat transfer pigment ink PHT50, including white ink with a circulatory function to ensure stable operation and prevent clogging. Mimaki also introduced a Textile Pigment Transfer Printing System and the Neo-Chromato Process, explicitly emphasizing sustainable and environmentally friendly solutions.



Mutoh XpertJet 1642WR Pro

Mutoh: Innovations in Sublimation and Water-Based UV

The **Mutoh XpertJet 1642WR Pro** is a successor to previous models, featuring two new ultra-wide Mutoh AccuFine piezo variable drop print heads and proprietary i-screen weaving technology. These advancements are designed to deliver exceptional print quality at higher production speeds, specifically targeting the sublimation transfer market.

The **Mutoh HydrAton 1642**, a 64-in. (1625mm) roll-to-roll printer, uses innovative water-based UV technology with its AQUAFUZE inks. This enables printing on a diverse range of eco-friendly, heat-sensitive, synthetic, and technical textiles without requiring primers or optimizers.

Mutoh's portfolio also includes the **XpertJet C641SR Pro Printer/Cutter**, which represents Mutoh's first integrated print and cut device. This compact 24-in. (630mm) model combines integrated cutting capabilities with XpertJet SR Pro print technology, offering an end-to-end solution for various applications.

Mutoh's sublimation printers utilize water-based inks compatible with standard dye sublimation papers, enabling transfer onto a wide spectrum of polyester substrates and direct printing onto closed, non-stretch polyester fabrics.

Kornit: Leading On-Demand Sustainable Fashion Production

Kornit Digital is a leader in on-demand digital fashion production, helping to drive the future of fashion technology. The company offers both direct-to-garment and direct-to-fabric solutions.

Kornit Presto MAX is a direct-to-fabric printing solution that is ideal for building full-scale microfactory production models or creating custom fabrics. This printer uses eco-friendly NeoPigment Robusto inks and is particularly noted for its ability to print white on colored fabrics.

Kornit's **Atlas MAX PLUS and Atlas MAX POLY** printers leverage Kornit's MAX and XDi technologies, offering

Kornit Presto MAX

Durst Alpha Series

improved productivity and enabling unique applications such as XDi-3D effects, neon colors, and vibrant white prints. The XDi technology specifically allows for 3D decorative applications, capable of emulating embroidery, high-density prints, vinyl, and screen transfer effects in minutes.

Kornit has announced a wide range of partnerships that enhance its overall production ecosystem, perhaps more than any other supplier to the industry. Most recently, this includes, but is not limited to:

- **MAS ACME USA (May 21, 2025):** This collaboration aims to optimize supply chain and manufacturing efficiencies by pairing Kornit's on-demand production solutions with MAS ACME USA's data diagnostics. This is combined with solutions from Syrup Tech, a leading (Ai) machine-learning decision-support engine for inventory management.
- **Gooten (May 6, 2025):** This print-on-demand fulfillment and technology company is integrated with Kornit's Global Fulfillment Network.

The company hints at more to come in the not-too-distant future.

Ricoh: DTG/DTF Solutions for Varied Production Volumes

Ricoh offers a lineup of direct-to-garment (DTG) and direct-to-film (DTF) printers, designed to cater to various production scales. The **RICOH Ri 4000 Garment Printer** is ideal for mid to high-volume production, featuring built-in Enhancer technology that automates pretreatment, significantly streamlining the printing process on both cotton and polyester fabrics. This innovation eliminates the need for manual pretreatment.

The **RICOH Ri 2000 Garment Printer** is Ricoh's fastest DTG and DTF printer, offering vibrant and accurate color reproduction. It features auto table height adjustment and easy automated maintenance, capable of printing full-color graphics in under 10 seconds.

For mid-volume production, the **RICOH Ri 1000X Garment Printer** provides faster speeds, enhanced print detail, and improved performance. It features an improved stability platen and custom T-shirt printer, capable of printing full-color graphics in under 28 seconds.

RICOH Ri 100Lt Direct to Garment Printer serves as an entry-level DTG solution, ideal for startups or on-the-go use, making it easy for anyone to print beautiful, long-lasting garments.

Ricoh's DTG/DTF printers offer high-resolution prints up to 1200 x 1200 dpi and 3 pL minimum ink drop size. The versatile quick-change magnetic platens allow accurate printing on a wide variety of apparel types and sizes, including shirts, hoodies, hats, and shoes. These printers include the ColorGATE RIP software and automated maintenance features, such as intelligent auto cleaning and white ink agitation, reduce upkeep time.

Durst: Integrated Solutions and Advanced Ink Systems

Durst Group provides several digital printing solutions for textiles, emphasizing integrated technologies and proprietary ink systems. The **Alpha Series** of textile printers, including the Alpha 330 Textile Edition and Alpha 190 Textile Edition, represents the fifth generation of Durst's automatic printer line. The Alpha 190 can print at 900 sq. m/hr., while the Alpha 330 reaches up to 1,470 sq. m/hr. in single-roll mode.

RICOH Ri 4000 Garment Printer

Durst also offers the **P5 TEX iSUB** system for textile printing with inline sublimation for a wide range of applications, including soft signage, wallpaper, home textiles, athleisure, sportswear, and digital fashion printing.

Durst Group offers reactive, pigment and dye-sub inks to enable printing on a wide range of fabrics.

Epson: Precision Dye-Sublimation for Production Class

Epson's SureColor F-Series dye-sublimation printers are engineered for high performance, versatility, and superior print quality in production-class environments. The series includes models such as the **SureColor F6470, F9570, F10070 Series**, and **F11070 Series**. These printers are designed to deliver high performance and reliability, with all components, including printheads, expertly crafted to work seamlessly in the production of apparel, signage, decor and promotional products.

Epson SureColor F10070 Series

Epson's dye-sublimation technology is powered by **PrecisionCore**, delivering high quality at high speeds with low waste across a wide range of applications. The printers utilize **UltraChrome DS Ink** technology, which produces bold colors and rich, high-density blacks.

There are also textile printers available from Color Jet, based in India; and HPRT based in China.

FOCUS ON SUSTAINABILITY

A prominent trend across the industry is the development of more eco-friendly ink systems. Water-based inks are becoming a standard, significantly reducing the environmental impact compared to traditional solvent-based alternatives.

The emphasis on certifications such as GOTS (Global Organic Textile Standard) and OEKO Passport for inks, is seen from most, if not all, digital textile ink manufacturers these days, to assure that inks meet stringent ecological and toxicological requirements throughout their lifecycle. The broader availability of such certified, water-based, and low-impact inks contributes to a circular fashion economy by enabling the production of garments with a reduced environmental footprint, aligning with growing consumer demand for eco-friendly products.

IMPROVED RIP CAPABILITY

Adobe PDF Print Engine is included in the Raster Image Processing (RIP) software for a number of textile printer vendors, including Caldera, ColorGATE, Epson, EFI, and Onyx. This ensures consistent color reproduction, high-definition image fidelity, and seamless workflows, allowing for precise translation of digital designs to printed fabrics. By leveraging Adobe PDF, designs created in popular creative suites translate accurately and consistently to the printer, significantly reducing errors, minimizing costly revisions, and decreasing material waste, thereby accelerating the entire design-to-production cycle.

Epson's recent acquisition of Fiery from Siris, Fiery's former parent company, may also foretell more textile-oriented applications taking advantage of Fiery's industry-leading color management and workflow as Epson integrates these products into its printer portfolio. For example, the Epson SureColor G6070 is a dedicated direct-to-film (DTF) printer that is bundled with Fiery Digital Factory DTF Epson Edition software for the North American market.

CUT-AND-SEW DEVELOPMENTS

There are a number of cutting solutions available for textiles from companies such as Lectra, Zund, and Gerber that offer laser and/or knife cutting. But sewing is often called the "last mile" in apparel production automation. Ideally, one would like to see a fabric printer in line with a cutting table, with robots assisting humans in picking and transporting cut fabric to sewing stations, each with a specific type of sewing expertise and/or thread color. The closest I have seen to this vision is the Bespoke Manufacturing Company (BMC) in Scottsdale, Ariz., a tech-enabled company specializing in on-demand, custom garment and home fashion production. The company offers a model that portends the future of a more sustainable on-demand production operation that reduces waste and improves time to market. It still requires talented sewists, a capability that robotics are not likely to replace anytime soon.

That being said, there have been some new innovations in sewing machines such as the Brother Luminaire 3 Innov-ís XP3, offering features like wireless LAN, app-based control, and over 1,500 built-in embroidery designs.

Sewbo, headquartered in Oakland, Calif., is also an interesting solution whose approach to fabric handling enables off-the-shelf industrial robots to work with a wide range of fabric and sewing machines. It temporarily stiffens

Sewbo prototype face mask sewing system

fabrics, allowing off-the-shelf industrial robots to easily build garments from rigid cloth, just as if they were working with sheet metal. The fabric panels can be easily molded and welded before being permanently sewn together.

The water-soluble stiffener is removed at the end of the manufacturing process with a simple rinse in hot water, leaving a soft, fully assembled piece of clothing. The stiffener can then be recovered for reuse.

INDUSTRY IMPLICATIONS

The textile and apparel industry is undergoing a transformative period, largely propelled by the rapid evolution of digital technologies across its entire value chain. The latest developments in digital printing equipment, ink systems, design software, and cut-and-sew automation collectively point towards an industry that is becoming faster, more versatile, more integrated, and significantly more sustainable.

These collective advancements enable several significant shifts in the textile and apparel industry. These developments are not isolated but when interconnected, form a comprehensive digital ecosystem that has the ability to redefine manufacturing paradigms.

As a result, the industry is moving—albeit slowly—towards highly integrated and automated workflows, from design through printing to the final cut-and-sew stage as we have outlined here. There is also increasing use of AI for such capabilities as color matching, ink mixing, and predictive maintenance from several companies which further enhances efficiency and reliability. This integration across the value chain means that design changes can be implemented rapidly, production can be scaled efficiently, and overall operational control is significantly improved.

Furthermore, sustainability is no longer a niche concern but a core driver of technological innovation. The shift towards water-based, eco-friendly inks from a variety of companies, including EFI, HP, Mutoh, Mimaki, Kornit and more, can eliminate the need for pre- or post-treatment chemicals, reducing water and chemical consumption.

The ability to produce on-demand, facilitated by digital technologies, inherently reduces overproduction and inventory waste, contributing significantly to a more sustainable fashion ecosystem. With more geographies requiring compliance with regulations designed to keep fabric waste out of landfills, brands and manufacturers will increasingly be required to seek solutions that enable them to comply.

The trajectory of technological progression indicates a future where the textile and apparel industry could operate as a highly interconnected, intelligent, and responsive ecosystem. This digital thread, weaving through design, printing, and manufacturing, promises not only enhanced profitability and efficiency but also a more responsible and adaptable global supply chain, poised to meet the dynamic demands of the 21st-century consumer.

NEW DEVELOPMENTS IN TEXTILE-TO-TEXTILE RECYCLING

BY CARY SHERBURNE

As we have stated many times—as have most other news and analysis sources covering the textiles industry—textile waste is a huge problem. Greenpeace reports that internationally, a staggering 92 million tons of discarded garments find their way into landfills, out of the 100 billion produced every year. They also note that many people will dispose of clothes within a year, often after no more than 10 wearings!

Discarded textiles are also incinerated, which adds to CO_2 in the atmosphere.

Yet we're still manufacturing more and more garments, the majority of which are made of, or at least contain, synthetic materials sourced from oil. And then there's the dyeing. Not only is textile dyeing the world's second-largest polluter of water, since the water leftover from the dyeing process is often dumped into ditches, streams, or rivers, but the dyes also make textile-to-textile recycling difficult. How do you remove the dyes without damaging the structure of the fibers?

Another huge issue for textile-to-textile recycling is the fact that most fabrics consist of multiple types of fibers,

rather than being mono-fiber; for example, poly cotton. How do you separate the fibers from each other, and how do you even determine exactly what fibers are in textiles that are disposed of?

You might wonder why textile-to-textile recycling is getting so much attention of late. Well, one big reason is that the more fiber we can recapture and reuse, the less virgin fiber is required to keep up with the demand for textile-based products, whether those fibers are natural, such as cotton or silk, or synthetic, such as polyester or elastin (Lycra). If we can recapture the fibers at scale and in the process remove (and reuse!) the dyes, that would be a major step in addressing textile waste. So that's the background. And now the good news—technology is catching up with the need, and there is some good progress being made.

TEXTILE-TO-TEXTILE: THE REGULATORY IMPACT

As usual, Europe is ahead of the U.S. in terms of its recycling efforts, and even ahead of its own regulations in some cases. Case in point: Circ is building its first (we hope of many!) industrial scale textile-to-textile recycling plant in France. Reju is doing the same in The Netherlands. While these are laudable achievements, it is interesting to note that Teijin launched the first chemical textile recycling process in Japan two decades ago! This according to a recent article in The Sourcing Journal.

The publication cites a report by Systemiq which notes that despite recent advances in textile recycling technology, adoption is still "frustratingly embryonic." The bottom line is that access to suitable feedstock is a challenge, pretty much around the globe. Why? Because the current system is set up to send textile waste to landfills or incineration, and changing massive systems such as those represented by the global textile industry is not a trivial undertaking. Also, as the Systemiq report points out, "Producing recycled polyester from post-consumer textile waste in Europe costs roughly 2.6 times more than pumping out a virgin version in Asia. Even employing used PET bottles still comes out the better deal, fiscally speaking." So there's that. There's little real incentive to drive change.

So while the efforts of the likes of Circ and Reju should be applauded, regulatory changes and enforcement will also be required to get to scale. Currently, according to the report, the European Union has an annal 30,000 metric ton depolymerization capacity. Systemiq identifies three ways it could get to 340,000 tons, still only 15% of Europe's projected demand, nonetheless a breakthrough. As noted, access to appropriate feedstock needs to be improved; market demand needs to be bolstered – brands, retailers, and consumers alike need to drive this change; and reducing production costs – bringing them more in line with the cost of using virgin feedstocks.

Circ uses a proprietary hydrothermal process that recovers the original materials from polycotton blends, a unique process that shows a great deal of promise. This process, unlike previous attempts, is able to not only separate the fibers but recover both for reuse in like-new textiles, according to the company.

Reju cites a terrifying statistic from The World Counts, a good source of real-time data on the state of the planet. They state that at the rate we are going, we will need two planets to sustain us by 2030!! And as we have stated many times:

And if past is prolog, most stakeholders are not going to make the required dramatic changes without a push—from consumers refusing to buy their products (not likely) to requiring producers to pick up at least part of the tab. According to The Sourcing Journal article referenced above, "Earlier this year, EU legislators adopted a requirement that all member states establish an EPR [Extended Producer Responsibility] scheme, one that mandates that all domestic and international businesses placing textiles in their national markets shoulder the financial responsibility of collecting, sorting, and recycling their products." This won't happen overnight, but it could go a long way toward balancing the financial impacts of virgin versus recycled fibers.

The article concludes with a quote from Clara Luckner, director and fashion lead at Systemiq: "In the absence of policy or other mechanisms, so without targeted policy and industry action to address both affordability and accessibility barriers, depolymerization will remain stuck

in pilot purgatory, and the breakthrough to mass adoption will not happen. The linear status quo will continue to deepen Europe's and the world's textile waste crisis." And really, these efforts are primarily taking place in Europe at present, whereas they need to be global efforts.

FIBER-TO-FIBER: AN INNOVATIVE APPROACH

Another—and likely more sustainable—approach comes out of the University of Nebraska-Lincoln. Yiqi Yang Charles Bessey Professor. Department of Textiles, Merchandising & Fashion Design, and his team have come up with a different way of handling textile waste.

We spoke with Dr. Yang recently and he explained their process. The goal was to reduce microplastic pollution by reducing the usage of virgin materials by recycling them in a closed loop system. He says, "Recycling textiles sounds easy, but it's not. It's not like an aluminum can, because most of the textiles that we use are blended fabrics, composite materials. They might be pure cotton, but they might include elastin. It might be poly cotton, etc. So you can collect the stuff, but then what?"

He also points out that it's not just as simple as recycling the fabric. Apparel, for example, has other components, ranging from buttons and zippers to facing material. Of course, separating out those components with human hands (or robotics?) can be done. But human hands cannot separate polyester from cotton in a blended textile, obviously. And the current processes for mechanical recycling are destructive, requiring adding more than 50% virgin fibers to the recycled fibers to make usable yarns.

In addition to the composition of the fabric, you have to take into consideration of the dyes being used. How do you separate the dyes without damaging the fibers? And can you recycle those dyes for reuse as well? And what about the chemicals used to separate fibers? Most current processes dispose of the chemicals, causing another pollution problem.

His team tackled all of those challenges and had developed a very promising solution. Once collection sites are set up, and the collected items sorted using infrared means such as that used by TOMRA, his process kicks in.

First, they have developed a technology that produces high-quality fibers, reducing the need for virgin fibers to create new fabric. In a textile recycling first, Yang and his team have found a way to remove the dyes without damaging their foundational structure or the fibers. He says, "It not only recycles the fibers successfully, but also recycles the solvents and dyes used in the process"—a closed-loop system that also reduces water waste. Yang is pursuing a patent for the technology. He notes that everything they did in developing this system was done with large-scale production in mind, and ensuring excellent fiber quality as well as competitive cost.

As if that were not enough, he's also looking at creating new fibers using agricultural waste such as chicken feathers.

Of course, to launch this solution at scale will require significant investments and a change in behavior for both brands and consumers. Yang's team has done the heavy lifting, making something previously thought impossible, possible. Now we need the rest of the stakeholders to do their part. Yang suggests formation of a consortium of big name brands to share the cost burden of making this process a reality at scale. He asserts that the fibers output from the system, and the dyes, can be used without any major changes in the apparel manufacturing process. The consortium could also be an arm for educating consumers about the value of products made from these recycled products—the value to them, to the brands, and of course, to the planet.

LOOKING AHEAD

While these developments are encouraging, there is still a great deal of work to do. As consumers, we can buy less and use the products longer, or resell or upscale them at end of life. As brands and retailers, we can aggressively work to adopt these newer technologies to substantially reduce our dependence on virgin fibers and as a side benefit, to reduce the amount of microplastics in the environment.

We'll be watching as these promising technologies mature, and hopefully scale rapidly so we don't need two planets by 2030!

RESOURCES

Circ: https://circ.earth/
Reju: www.reju.com/
Sourcing Journal: https://sourcingjournal.com/sustainability/sustainability-materials/europe-systemiq-polyester-textile-recycling-tipping-point-1234749274/
Systemiq: www.systemiq.earth/
Teijin: www.teijin.com/
TOMRA: www.tomra.com/waste-metal-recycling/applications/waste-recycling/textiles
The World Counts: www.theworldcounts.com/

View the full video conversation with Yang Charles Bessey here.

THE PRINT-AWARE MARKETING STACK: BUILDING A ROADMAP TO SUCCESS

BY JOANNE GORE

Marketing has become a complex, tech-fueled balancing act, where every day is a race against shifting priorities, fragmented platforms, and relentless demands for ROI. From campaign launches and CRM updates to analytics reviews and last-minute sales requests, the margin for error is razor thin. It's in this chaos that your marketing tech stack either holds everything together or lets it all unravel. To better understand where the friction points lie, let's walk through a typical day in the life.

7:45 AM—COFFEE AND CALENDAR CHECKS

First thing: double espresso and a glance at the day's calendar. Three back-to-back meetings, a campaign launch deadline, and a pile of CRM alerts that somehow multiplied overnight.

Before the world fully wakes up, the marketing manager opens the dashboard: pipeline metrics, lead-gen performance, and open rates from yesterday's email blast. Nothing's on fire. A good start.

8:30 AM—CRM CLEANUP AND "THE LIST"

The CRM isn't perfect—but it's better than it was. Still, there's a chunk of time each morning blocked for data sanity: scrubbing duplicates, logging missing info from last week's webinar attendees, and flagging stale leads.

Marketing can't function without clean data. If sales doesn't trust the CRM, nothing flows. It's tedious work—

but foundational. And today, there's a cross-functional campaign depending on it.

9:15 AM—QUICK SYNC WITH SALES

This morning's huddle includes a look at the upcoming campaign for a new packaging solution. Sales wants more bottom-of-funnel content; marketing reminds them they also need lead nurture. They settle on a compromise: a new product sheet for direct outreach plus a case study drip campaign for Marketing Qualified Leads.

Before signing off, someone jokes: "Add that to the MarTech stack." The manager winces—they do need to revisit the stack.

10:00 AM—CAMPAIGN LAUNCH PREP

Time to push a new LinkedIn ad set live. It's targeting procurement leads in the health and wellness space.

Everything's in place: audience segments, creative, copy, UTM links, thank-you page tracking. One last pass through the ad dashboard and it's go time. The manager hits "publish," then sends a quick Slack to the digital team: "Campaign's live. Watch spend & conversion triggers."

Next on the list: draft a launch email for the sales team. No point launching a campaign if sales doesn't know how to follow up.

11:30 AM—MARTECH REVIEW: TOO MUCH, TOO LITTLE, JUST RIGHT

There's a spreadsheet with 27 MarTech (Marketing Technology) tools—most of them used sporadically, a few not at all. The manager blocks time this week to assess what's driving value and what's just draining budget.

Today's focus is the marketing automation platform. It's time to upgrade—but which tier, and do we need all the bells and whistles? The manager compares workflows, runs a few "if-this-then-that" scenarios, and adds questions to the vendor meeting agenda.

They also shoot off a message to the web team: "Can we confirm if the MAP's tracking pixel is firing correctly on the contact page?"

1:00 PM—LUNCH + LEARNING

A short break—and a webinar from an industry peer on using AI for segmentation. The manager snacks and multitasks—absorbing tips, grabbing screenshots, forwarding a few slides to the content specialist with the note: "Let's test this on the October campaign."

The learning never stops in B2B. Today's trick: AI-assisted lead scoring based on email interaction patterns.

2:00 PM—INTERNAL STATUS MEETING

Marketing, sales, and product gather virtually for the weekly roundup. Key metrics. What's working. What's not.

The manager shares that last month's campaign generated more leads than forecast—but many were "cold" and still early in the journey. Product asks for more webinar content to educate. Sales wants easier access to assets. Everyone agrees the CRM needs more tagging options.

More work for marketing—but also more alignment. A win.

3:30 PM—CONTENT HANDOFF AND CRM ALERTS

A blog post is ready for review. The manager scans it for tone and accuracy, tweaks the headline, and schedules it for Friday. SEO keywords were woven in earlier—but the headline makes all the difference.

Ding. CRM alert. A warm lead filled out a form after viewing the pricing page and downloading two case studies. Time to nudge sales.

4:15 PM—DASHBOARDS AND DEBRIEFS

With the campaign live, the manager pulls the early metrics into a dashboard. CTR looks strong. Landing page conversion? Not great. A/B testing begins tomorrow.

There's a note to review budget pacing, another to finalize Q4 goals. The manager scribbles both onto the whiteboard before the thoughts disappear.

5:30 PM—WRAPPING UP

The inbox still holds a few surprises: a request to evaluate a new social scheduling tool, a client asking for metrics on a co-branded campaign, and a Slack from the CEO asking: "Are we using that new AI copy tool yet?"

The day winds down, but the mind doesn't. The manager jots down tomorrow's top three priorities, then powers down for the night.

Sort of.

In an industry where the line between manufacturing, service, and software continues to blur, print businesses of all shapes and sizes—OEMs, PSPs, software providers, converters, and in-plants—are being challenged to market smarter, not harder. Whether you're selling digital presses, workflow tools, or branded print solutions, the ability to attract, engage, and convert

buyers hinges on the strength of your marketing technology stack.

A modern MarTech stack is a mission-critical part of your revenue engine. It connects your website to your CRM, your content to your leads, your emails to your sales team, and your campaigns to your ROI. It's the digital infrastructure that fuels your marketing efforts.

Artificial intelligence (AI) is rapidly shaping the MarTech ecosystem, enhancing nearly every part of the stack—from content generation and segmentation to predictive analytics and real-time personalization. For print businesses of all types, AI makes it easier to work efficiently, engage meaningfully, and compete effectively.

HOW AI IS RESHAPING THE MARTECH LANDSCAPE

According to the 2023 State of Marketing AI Report from the Marketing AI Institute and Drift, 64% of marketers consider AI very or critically important to their success—up 13 points from 2022. By enhancing productivity, creativity, and precision across the stack, these technologies are now essential for understanding consumer behaviors, automating repetitive tasks, and achieving faster, smarter outcomes. By incorporating AI, marketers can shift from short-term hacks to long-term, scalable marketing strategies that:

- **Enhance Personalization:** By analyzing customer data to better personalize campaigns across email, ads, landing pages, and print.
- **Use Predictive Analytics:** By forecasting behaviours and optimizing segments, lead scores, and campaign timing.
- **Automate Customer Service:** By deploying chatbots and virtual assistants for instant, AI-driven support.
- Generate and Optimize Content: By leveraging generative AI (like ChatGPT) to produce copy, visual, and video content.
- **Optimize Search:** By improving visibility for both voice and visual search engines.

> A marketing technology stack should be tailored to your company's size, goals, resources, and sales cycle.

AI also strengthens integration with traditional marketing. For instance, pairing AI insights with direct mail timing and personalization creates high-impact campaigns that blend the digital and physical—known as "phygital." This combination increases ROI, engagement, and lead quality.

THE CORE CATEGORIES OF A PRINT-AWARE MARTECH STACK

A MarTech stack refers to the collection of software platforms, tools, and integrations that empower your business to plan, execute, analyze, and optimize marketing efforts. In the print industry, this includes everything from capturing trade show leads and nurturing prospects via email, to launching an online storefront or running automated direct mail campaigns.

According to the 2025 ChiefMartec Landscape, more than 15,000 marketing technologies are now available—a 9% increase from the previous year. For OEMs and PSPs alike, the challenge has shifted from access to clarity.

While stacks vary based on company size and marketing maturity, most fall into five functional categories:

1. **CRM (Customer Relationship Management): Your Contact and Opportunity Hub**
   Solutions like HubSpot, Zoho, and Salesforce support relationship management, lead tracking, sales funnel management, and coordination between marketing and sales teams.
2. **Marketing Automation & Email Tools: Your Campaign Engine**
   Platforms like Mailchimp, Constant Contact, Zoho, and Hubspot enable multi-channel campaigns, lead nurturing, segmentation, and workflow automation.

3. **CMS (Content Management System): Your Digital Home Base**
   Tools like WordPress, Webflow, or custom CMS platforms are used to create, store, and distribute content across websites, blogs, and landing pages for consistent communication, publishing, landing pages, and SEO.
4. **Content & Campaign Development: Your Creative Spark**
   Content is the fuel that drives engagement. Tools like Canva, Gamma, Adobe Creative Suite, and ChatGPT help spark its development.
5. **Analytics & Reporting: Your Reality Check**
   Tools like Google Analytics, Tableau (Salesforce), and Power BI provide multi-channel performance measurement and attribution, track KPIs, and inform data-driven decision-making.

WHERE DOES VARIABLE-DATA PRINTING (VDP) FIT IN THE STACK?

If you believe in the power of print (and data), VDP is your not-so-secret weapon for supercharging B2B campaigns. VDP bridges digital data and physical marketing by enabling you to personalize print pieces (like direct mail, brochures, or catalogues) at scale using CRM, e-commerce, or campaign data. This means you can deliver relevant, targeted print communications—matching the data-driven personalization seen in email or online campaigns.

While not a traditional "martech stack" category like CRM or automation, its role is crucial, especially for B2B marketers passionate about print and personalization. VDP is an application layer that integrates with:

- **CRM and Data Platforms** (for feeding customer data, segmentations, purchase history)
- **Marketing Automation** (for triggering print campaigns as part of omnichannel journeys)
- **Content Management** (for managing templates and creative assets)
- **Analytics/Attribution** (to track print campaign effectiveness alongside digital channels)

WHY DOES VDP MATTER?

- **Personalization at scale:** VDP lets you customize offers, images, names, even maps for each recipient, bridging the digital/physical gap and boosting response rates.
- **Print as a True Data-Driven Channel:** Today's digital print tech and VDP software make it cost-effective to personalize every physical mailer, label, loyalty piece, or catalog. No more "one-size-fits-all" in print.
- **Integrated Campaigns:** Use VDP-triggered pieces as crucial touchpoints in B2B nurture flows (e.g., hyper-personalized invitations, high-value direct mail, ABM content packs).

Marketers cite higher ROI and response rates with VDP-powered print compared to traditional static pieces. Leaders in B2B (especially in sectors like manufacturing, financial, or associations) leverage VDP to make their printed touchpoints as smart and relevant as their digital ones.

VDP TECH LEADERS (2025)

- **XMPie (Xerox), EFI, HP SmartStream, Quadient:** Power back-end VDP tech and services, often integrated with martech stacks via APIs or workflow automation.
- **Integrated print automation platforms:** Some marketing automation and CRM platforms offer built-in VDP connectors or apps to trigger campaigns.

BUILDING A STACK THAT WORKS

Many companies find themselves overwhelmed by the number of options available and delay investing altogether. But indecision has a cost: lost visibility, missed leads, slower pipelines, and disconnected marketing and sales.

Before you evaluate a single tool, define the foundation. No amount of automation, analytics, or AI will fix a broken message or scattered positioning. If you're unclear on who you help, how you help, and why it matters, your stack will amplify confusion, not performance. Knowing this is what allows you to segment properly, create meaningful content, select the right channels, and ultimately improve your time to revenue.

A marketing technology stack should be tailored to your company's size, goals, resources, and sales cycle. There's no one-size-fits-all formula—but there are patterns. Most successful stacks are phased in over time, starting with a strong foundation (website, CRM, email), followed by campaign execution tools, then enhanced with analytics, personalization, and automation.

As you scale, determine who will execute, manage, report, and optimize your campaigns. Assign ownership for setting up automation, building workflows, developing content and CTAs. Consider whether your team has the skills internally—or whether hiring, training, or outsourcing is the smarter path.

Start small, stay focused, and scale intentionally. Connect with folks who have "been there—done that", (like me) to help you choose what you need now, next, and later as you build your marketing roadmap to success.

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POSTPRESS GETS SMART, FAST, AND RESPECTED IN THE PRINT PRODUCTION WORKFLOW

Whether operating inline or offline, digitally controlled postpress systems are coming into their own as linchpins of automated print manufacturing.

BY PATRICK HENRY

Postpress is as integral to print production as the prepress and press stages, and in a business sense, it's even more critical: only after it takes place does the printed matter turn into something that can be delivered to the customer as a finished job in functional (and billable) form. But despite the value it adds, clinging to postpress is its reputation for being the least automated, most labor intensive, and least profitable part of the print manufacturing sequence.

However, a review of recent advances in postpress technology marks that opinion as almost wholly obsolete. As these developments make clear, the digitization of print has not left postpress behind. Far from it. Where setting up a folder, for example, used to require a complicated set of manual adjustments, now the machine can take its instructions from XML feeds or bar codes.

This is not the case—yet—with all postpress equipment, but it clearly is the direction in which the technology of print finishing is headed.

Many advances in postpress stem from its increasing support of the JDF (job definition format) specification, an XML-based framework for managing the interchange of data between systems in an automated production environment. CIP4, the organization that develops and administers JDF, says it enables a print job to become an interconnected workflow that includes cutting, binding, and other postpress tasks in its sequence of digitally controlled production events.

THE NODE KNOWS

As CIP4 explains it, a JDF-supporting piece of postpress equipment represents a node defined by inputs—the resources it uses and the parameters that control it—and outputs—the intended product, such as a set of finished booklets. Data from the press node would become the input resource for postpress operations such as folding and cutting.

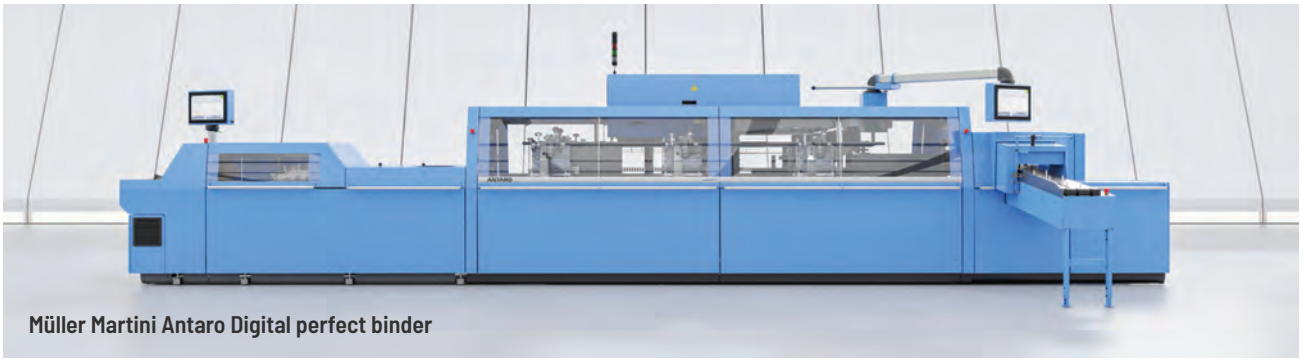
In this way, JDF makes it possible to define the entire job up front from prepress through postpress and sometimes to shipping as well. Its job messaging format (JMF), a command-and-control language, links shop floor operations to the plant's MIS for scheduling, job planning, and data gathering.

At the postpress stage, this coordinated flow of instructions from node to node translates into benefits like shorter setup times between jobs and integration with the plant's manufacturing workflow as a whole. These are critical abilities for the bindery to have as runs grow smaller, turnaround times get tighter, and profit margins increasingly depend on data-driven production efficiency.

FROM THEORY TO PRACTICE

Manufacturers of postpress systems and equipment are stirring JDF into their mix of solutions for printers who want automation at all stages of production.

Duplo DC-746 Cutter Creaser



Müller Martini Antaro Digital perfect binder

At drupa 2024, for example, Duplo demonstrated the JDF integration of its DC-746 Cutter Creaser, which can receive finishing instructions directly from the job ticket produced in the upstream workflow. Its JDF console has been validated to operate in workflows from digital press suppliers such as HP Indigo, Canon, Ricoh, and Xerox. An SDK (software development kit) is available for print companies that wish to develop their own JDF workflows.

Müller Martini began digitizing its manufacturing 20 years ago with the introduction (at drupa 2004) of a CIP4 JDF/JMF compliant workflow for its SigmaLine book production system. At drupa 2024, Müller Martini and Hunkeler (acquired by Müller Martini in 2023) coordinated efforts to present smart factory solutions for networked, fully automated post-print processing.

The concept was illustrated in two live demonstrations: one that connected its SigmaLine Compact book block maker with its Antaro Digital perfect binder (further details below); and another that paired Hunkeler's Starbook Sheetfolder with Müller Martini's Vareo PRO perfect binder. Müller Martini equipment could also be seen operating at the stands of some of its other partners during the show.

1:1 WITH THE FRONT END

The automation of postpress seeks to shrink or even eliminate the productivity gap that has long existed between it and the stages of production that precede it in the workflow.

At drupa 2024, Heidelberg said that with the help of automated folding equipment and robotics for sheet handling, it had achieved a 1:1 ratio between printing and postpress: in the company's words, "What a Speedmaster XL 75 or XL 106 delivers, a folding machine can do." Heidelberg noted that autonomous production also helps to alleviate the effects of personnel shortages, a chronic complaint in the bindery.

Optimization through integration was a keynote of this year's Hunkeler Innovation Days, where exhibitors of postpress and converting equipment included Horizon, Müller Martini, Duplo, Bluecrest, Bowe Systec, Kern, W+D, Contiweb, c.p. bourg, digibook, Harris & Bruno, Ibis, Meccanotecnica, Plockmatic, and Quadient.

As reported by WhatTheyThink (https://whattheythink.com/articles/123046-hunkeler-innovationdays-its-wrap/), the event showcased integrated end-to-end production lines for both continuous web and sheet finishing with inline solutions from multiple vendors. In one demonstration, presses from several vendors shared a finishing line. Also emphasized was the desirability of connecting printing machines not just to each other, but to the logistics and the data structure of the supply chain as a whole.

AT A DISCREET DISTANCE

Integration with printing is a major step forward for postpress, but it's important to note that optimizing the process through automation can take place offline as well as inline. For example, a printing company whose story is told below found that it could make significant gains in productivity by decoupling a bookletmaker from the digital press it had been an adjunct to.

This reflects the philosophy of drupa 2024 exhibitor Solema, a supplier of finishing and material handling systems for graphic arts and packaging applications. The company says that the goals of automation in these areas should be reducing manual handling, optimizing space, and increasing productivity.

Solema is committed to the idea that finishing—post-print functions such as stacking, boxing, and palletizing—should take place in an area separate from the end of the manufacturing line so that bottlenecks do not happen as the product is being delivered. Solema's approach is to custom-design and equip separate "work islands" where integrated lines of conveyors, stackers, feeders, boxing machines and palletizers optimize the flow of product according to each customer's requirements.

SPECIMENS IN ABUNDANCE

drupa 2024 was full of examples of the great gains in function and efficiency that postpress has been making.

Among them was Duplo's iSaddle SENSHI, a highly

automated saddle stitcher for flat-to-finished book production. Duplo says it can set up jobs in under 60 seconds by selecting or entering a custom paper size. The stitcher then automatically makes the score, stitch, fold, and trim settings. Specs can be stored for an unlimited number of jobs. A reporting function integrates job data with MIS.

Horizon showed its BQ-500 perfect binder, equipped for the first time with iCE LINK, a cloud-based platform that provides device monitoring, KPI (key performance indicator) analysis, schedules and alerts for preventive maintenance, scheduling, job creation, and editing in a JDF/JMF workflow. The BQ-500 features 21 automated sections for quick setups and variable production at speeds up to 800 books per hour.

Horizon iCE BINDER BQ-500

Tecnau's technology partnerships at drupa 2024 included demonstrations of its finishing solutions in integration with printing equipment from Canon, Fujifilm, Kodak, and Screen. It also partnered with Horizon, Smyth, and Heidelberg in joint demonstrations of cutting, feeding, and stacking operations. Plockmatic, a manufacturer of bookletmaking equipment, had devices running inline with presses from partners such Fujifilm, Kyocera, and Riso.

New from Tecnau is its new guillotine Cutter c7, engineered for seamless integration into finishing lines along with saddle stitchers, folders, and book sewing machines. The Cutter c7 supports paper weights up to 400gsm as well as lightweight stock as low as 60gsm. Web widths up to 23 in. can be accommodated.

ALL-IN-ONE APPROACH

Among many announcements from BOBST at drupa 2024 was the introduction of DIGITAL MASTER 55, an all-in-one digital printing and converting platform for the folding carton industry. Combining printing, embellishment, quality control, and die-cutting inline at 100 meters per minute, the DIGITAL MASTER 55 features automated quality inspection and print adjustment. It is aimed at runs up to 6,000 B1 equivalent sheets, where it is said to be capable of reducing production time by up to 80%.

Müller Martini demonstrated how three of its systems could be transformed into a smart factory production cell for industrial book production: the SigmaLine Compact, the Antaro Digital perfect binder, and the InfiniTrim trimming robot. Producing up to 2,000 copies per hour, the combination permitted fold formats to be changed in less than 10 seconds with no significant setup procedure or loss of press speed.

All jobs shown at drupa were completed fully automatically by the six-clamp Antaro Digital, which can produce up to 2,000 finished softcover books per without operator intervention. In its digital book block feed, the book thickness of each product is measured and the barcode is scanned. All relevant product information is stored in the barcode.

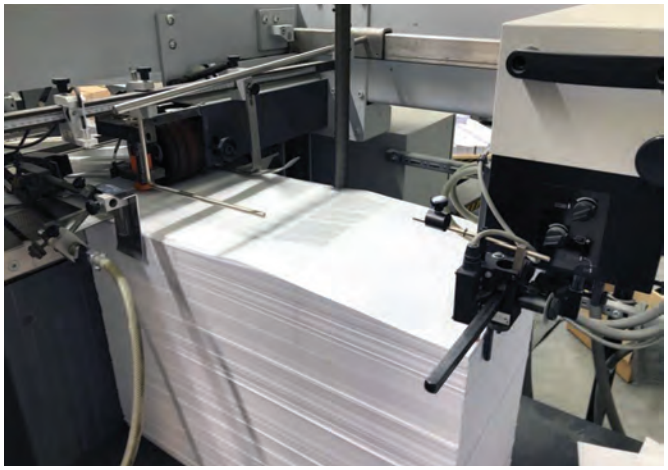
THE END-USER EXPERIENCE

The true test of postpress technologies comes not at trade show stands, but in the plants of end users of the equipment. Three recent manufacturer case studies indicate the extent of the benefits to be gained from bringing automated postpress into a variety of production environments.

In Biloxi, MS, Knight Abbey has recently shifted most of its production from traditional cut-sheet to roll-to-roll in order to keep up with the tight deadlines of casino industry it serves. This has included investing in a Stahlfolder TH 66 folder from Heidelberg and an unwinder/sheeter from Tecnau in a first-of-its-kind configuration for roll-to-finished production.

Since transitioning to this workflow, Knight Abbey has eliminated the need to move sheets between six to seven

BOBST DIGITAL MASTER 55



Heidelberg Stahlfolder TH 66

different touch points before getting the job into the mail stream. One of the company's standard jobs, which previously required 39 hours to complete using traditional methods, is now finished in under eight hours with the new configuration.

According to Heidelberg, Knight Abbey's increased capacity has enabled the company to onboard eight new casino clients in a single month. Despite the increase in workload, improved efficiency has kept operations running smoothly through several recent personnel retirements—without the addition of new staff.

SELECT SEWN OR GLUED

This year OnPress Book Printing of Pennsauken, NJ, became the first company in the industry to install a Meccanotecnica Universe-Sirio multifunctional book finishing line, which combines four fully automatic book-finishing machines to produce books with Smyth sewing and perfect binding. Finishing options include softcover and hardcover preparation.

The line's versatility and flexibility enable it to produce different jobs within the same roll. It can be fed either inline or near-line by the Universe series of automatic folding and Smyth sewing machines in both cut-sheet and continuous feed configurations.

OnPress says the sewn book blocks produced by the Universe-Sirio line provide enhanced durability, making them ideal for yearbooks, high-use books, picture books, and premium publications that demand a superior finish. It expects the new addition to produce durable, high-quality sewn book blocks that meet the exacting standards of authors, publishers, and yearbook creators.

HALF, AND HALF AGAIN

Another New Jersey printer, Bellia Print & Design of Woodbury, has cut job costs in half and increased its booklet orders by 50% by taking its bookletmaking offline to a Duplo 700i Booklet System. It had discovered that while inline production was mechanically efficient, it penalized overall output and kept the shop from taking on types of jobs that the inline configuration couldn't support.

One issue was that whenever the digital press went down, so did the bookletmaker, canceling both capabilities. Running the press at half-speed to accommodate inline stitching created a bottleneck. What was more, stitched jobs still needed to be face or three-side trimmed at the guillotine cutter, adding a labor-intensive step.

The inline system was costing Bellia more than just time. It also restricted the formats the shop could print to a maximum size of 12 x 18 in. and a minimum size of 8.5 x 11 in. That ruled out winning projects outside the system's size range. It also added clicks and cost on the press by making it impossible to run booklets multiple-up on a larger press sheet.

BETTER AND BIGGER

Bellia solved all of its problems with Duplo's 7001 Booklet System. By combining the DBM-700 Bookletmaker with the DSC-10/60i Suction Collator, the system transforms flat sheets into finished booklets at up to 5,200 units per hour. It also accommodates larger paper sizes up to 14.02 x 24.02 in., enabling the shop to process two-up applications.

Operating the bookletmaker independently of the digital press doubles the printing when running flat sheets. Bellia reports that running projects multiple-up on a single sheet saves click charges, cuts job costs in half, and increases billable capacity—all proof of the ROI potential of automated finishing in whatever configuration suits the shop's needs best.

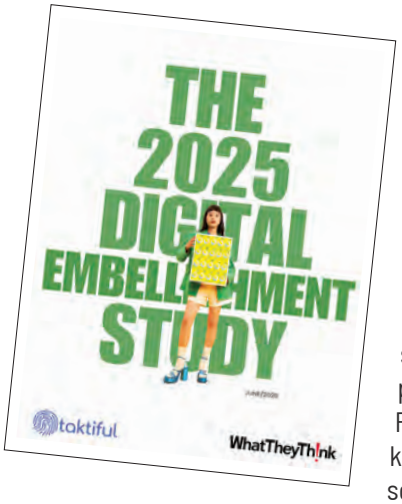
Meccanotecnica Universe-Sirio multifunctional book finishing line

(Image courtesy Harris & Bruno)

THE TACTILE TIPPING POINT: REVIEWING THE 2025 WHATTHEYTHINK/TAKTIFUL DIGITAL EMBELLISHMENT STUDY

BY KEVIN ABERGEL, *CEO TAKTIFUL*

On a crisp fall morning in Chicago, my friend Alex walked into the headquarters of a major brand for a high-stakes pitch, carrying two brochures that would tell his story better than any slide deck. The conference room gleamed with glass walls and polished steel, a reflection of the company's stature and expectations.



The first brochure was solid and conventional, with a clean layout and vivid CMYK colors that were perfectly executed. The second seemed similar at first glance. But when the client picked it up, her expression changed. Light caught the logo, creating a metallic shimmer, and the tagline rose from the page in a glossy, textured varnish that invited her fingertips. Almost without thinking, she traced the raised letters. Alex watched as a smile spread across her face. In that instant, the promise of print's newest magic, digital embellishment, became something she could see, touch, and remember.

What happened in that moment? A simple meeting, a simple brochure, yet something clicked. The client's expression said it all: this was different, this was memorable. As she left, she kept touching the cover, perhaps without even realizing it. For Alex, it was a small victory. He knew not every client understood so quickly. Many had been hesitant to spend extra for foils and coatings, unsure of the return. But those who did often came back with a revelation. Their customers noticed, their brand felt elevated, their message stood out. It was the kind

of human response a spreadsheet's ROI column cannot capture, a reaction rooted in senses and perception.

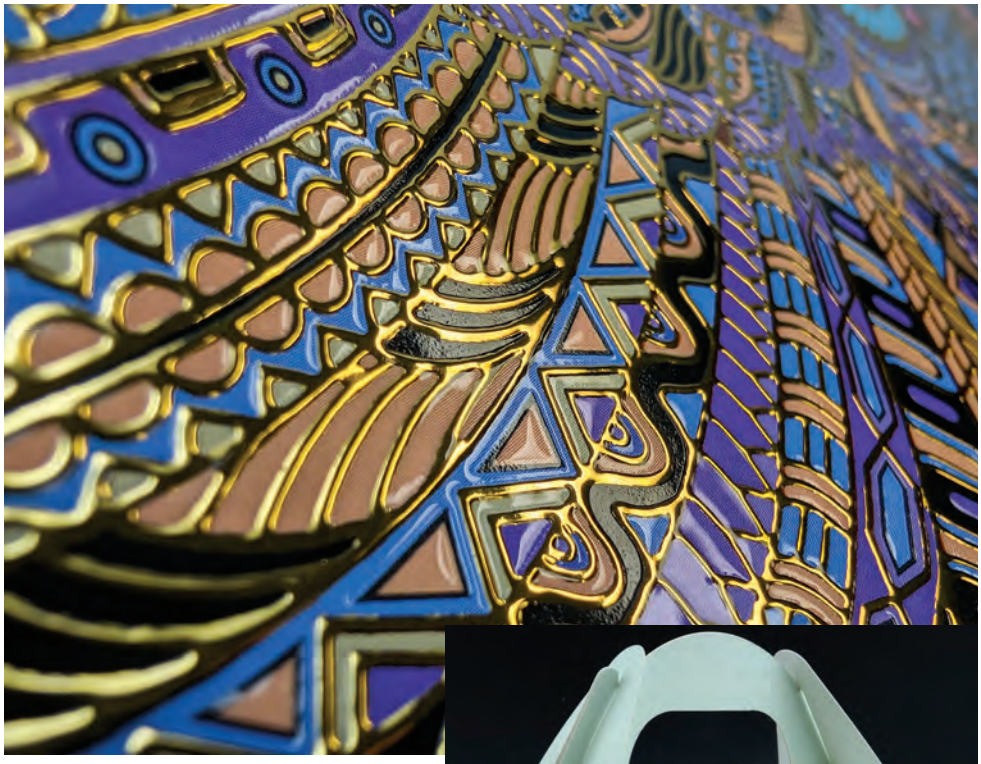
The newly released *2025 Taktiful/WhatTheyThink Digital Embellishment Study*, the most comprehensive research to date on this growing market, confirms what Alex has seen firsthand. Across commercial, packaging, and specialty print providers, the data shows that when print is enhanced with texture, shine, and tactile effects, it changes the way people engage, and that shift has powerful business implications.

PROFIT IN THE SHINE, SALES IN THE SHADOWS

Digital print embellishments, such as metallic foils, tactile varnishes, specialty toner and inks have been hailed as the next big value-add in print. They promise to turn ordinary ink-on-paper into a multi-sensory experience. According to the comprehensive 2025 survey, those promises are largely being kept, at least on the bottom line. Printers who have invested in this technology overwhelmingly report strong profitability on these jobs. More than one-third of surveyed print providers, 35%, said that every single embellished job is "always" more profitable than its plain CMYK counterpart, and an additional 44% said this is "usually" the case. Add in the ones who see a profit boost at least occasionally, and you have virtually everyone agreeing. These enhancements can make a print piece more than just pretty. They make it lucrative.

So, case closed, shiny equals money, right? Not exactly. The same study reveals a perplexing gap that printers like Alex grapple with daily. Nearly two-thirds, 65%, of providers are satisfied with the profit they earn from embellished projects, yet only 37% are satisfied with their sales of those projects. In other words, the folks running these presses are saying, "We make good money when we sell embellished printing, but we are not selling enough of it." It is a classic case of untapped potential, a

(Images courtesy Duplo)



(Image courtesy Harris & Bruno)

(Image courtesy Konica Minolta)

profitable offering that has not been fully realized in the marketplace.

This profit-versus-sales paradox is more than just a curious statistic. It is a window into the state of an industry innovation at a crossroads. The product, enhanced print, is good. Customers who use it love it. Printers make margin. But the distribution of that product, the selling, the convincing, the educating, is lagging behind. The survey underscores this. Eighty-eight percent of print businesses say their clients show interest in digital embellishments, yet a top challenge reported is "clients not understanding what digital embellishments are." There is an education gap to close, and perhaps a psychological one as well.

FROM NOVELTY TO MAINSTREAM: OVERCOMING THE GAP

Why the hesitation? To understand, it helps to rewind a few years. Not long ago, digital embellishment was a novelty reserved for the early adopters and the adventurous. Printers were cautiously dipping their toes into special effects, so to speak. Many print buyers had never heard of these effects. Those who had might recall receiving a flashy business card or a luxurious wedding invitation with foil accents, special pieces but not everyday marketing fare. In early studies around 2023, a large portion of customers, nearly three-quarters, were not familiar with embellishments at all. Inside many print companies, there was resistance. Embellishments were seen as expensive toys, finicky to design for, and hard to justify to cost-conscious clients. "Why add foils and gloss when standard ink gets the job done?" was a common refrain.

Fast forward to 2025, and the ground has shifted. What was once seen as an extra frill is edging toward mainstream practice in print marketing. Printers who installed embellishment equipment a couple of years ago have steadily educated their markets. Before installing digital embellishment presses, only a small fraction of their customers were "extremely familiar" with these effects. After a year or two of exposure, familiarity jumped sharply, with many moving into the "very familiar" category. Across the industry, more printers report that their markets are becoming knowledgeable about embellishments, and about one-third say awareness has grown in just the past year.

There are signs of a tipping point. Eighty-six percent of survey respondents now use their digital embellishment equipment daily, which is a 400% increase since 2023. Applications are expanding too. Business cards remain the most common entry point, but direct mail has surged into second place as marketers discover that a mailer

with shimmer or texture can spark curiosity and lift response rates. Even traditionally reserved categories like books and catalogs are now experimenting with these special effects on covers. Packaging, from labels to folding cartons, increasingly features digital foils and spot varnishes to grab attention on crowded shelves. Simply put, novelty is fading and habit is forming. Usage is rising, applications are diversifying, and competition is catching up. In 2025, nearly half of print providers say many of their competitors offer digital embellishments, up from about one-third just two years ago.

(Image courtesy Sharp)

Yet familiar obstacles remain. Cost justification is still the number one objection, cited by 44% of providers as the toughest barrier to overcome. Close behind is simple lack of understanding, with 23% saying their clients still do not know what these embellishments are. Old habits die hard. Some designers skip the idea entirely, worrying it will complicate production. The reality is more forgiving. While designing and setting up an embellished job often takes longer than a CMYK job, the difference is not dramatic. One in four respondents said it takes about the same time, and a small number even find it faster, proof that familiarity and process can close the gap.

The industry has recognized that digital embellishments can be a profit driver and a differentiator. That is why over half of surveyed print businesses invested in these capabilities with the explicit goal of increasing profit, far ahead of those who acted only at a client's request. Nearly 80% say these jobs carry higher margins than standard work. The technology has matured, machines have become faster and more reliable, and major trade shows now devote entire halls to embellishment equipment. What lags is not capability but communication. The technology is ready, the market is almost ready, and success will now hinge on training, storytelling, and consistent sales focus.

THE PSYCHOLOGY OF TOUCH AND WHY IT MATTERS

Closing the gap requires understanding how humans respond to sensory input. Print has an advantage that digital media cannot match. You can touch it. Humans are wired in surprising ways when it comes to physical sensation. In one well-known Yale experiment, people holding a warm cup of coffee rated a stranger as friendlier than those holding an iced coffee. In another study, interviewers holding a heavy clipboard judged résumés as more substantial. Our brains link weight to importance, texture to quality, and even temperature to emotion.

Digital embellishments play directly into these instincts. When someone feels a silky varnish against a soft-touch paper, or sees light bounce off a foil accent, there is a split-second of delight. It is more than visual appeal. It is engagement of an additional sense, and multisensory experiences tend to be remembered longer. This is why luxury brands in cosmetics, fashion, and spirits have long used embossing and foiling on packaging. It signals value without a word. Now, digital technology allows the same premium feel for shorter runs and more targeted campaigns.

The key to selling embellishments is often simply putting a sample in the client's hands. Until they feel it, many will dismiss it as decoration. But once they do, the conversation changes from "Why would I need this?" to "How can I use this?" In the 2025 study, the proportion of print buyers described as very or extremely interested in embellishments rose to 49%, up from roughly 30% two years earlier. Exposure builds interest. The sensory experience sells itself, once it has a chance.

This is part of a larger shift toward sensory marketing. In a world of constant screen time, something tangible has novelty and weight. Marketers know that a physical, textured, or metallic print piece can surprise the recipient and improve recall. Research has shown that multi-sensory campaigns can increase brand recall dramatically, sometimes by as much as 70%. Humans are not purely logical decision-makers. We respond to what we can hold, feel, and keep.

SELLING THE SIZZLE: TRAINING MINDS AND TELLING STORIES

The technology is proven. The human factor is the challenge. The survey makes this clear. The biggest obstacle to growth is not cost or production, it is people.

(Image courtesy Skandacor)

When asked to rank obstacles to selling embellishments, providers put their own sales team at the top of the list. This admission says a lot. It suggests salespeople may not fully understand the features or benefits, or they may lack confidence in presenting them. Some assume clients will say no before the conversation even starts.

Many companies are addressing this with targeted training. Four in ten businesses have given their sales teams extensive preparation on how to sell these capabilities, from technical knowledge to hands-on familiarity with samples. One effective approach is personalizing the experience. Some sales managers have their teams design their own business cards using multiple embellishment techniques. Once they see and feel their own names in foil and gloss, they become natural advocates.

Branding also plays a role. Simply listing "spot gloss available" in a brochure is not persuasive. Giving the service a distinctive name turns it into a feature worth asking for. In the survey, 62% of providers created their own branded offerings for embellishments. A printer that rebranded foil as "Signature Shine" found customers began asking for it by name. The sales team had a story to tell, not just a technical option to mention.

Those who plan their rollout tend to do better. About half of respondents had a business plan for introducing their new capability. They were slightly more likely to report high satisfaction with results. Intentionality matters. Treating an embellishment press as a new product line, with training, branding, and promotion, leads to stronger uptake.

A FEEL FOR THE FUTURE

By 2025, digital embellishments have moved past the fad stage. Will they become as common as full-color printing? The signs are positive. About two-thirds of current users expect to invest in another embellishment press, a strong signal that this is not a passing experiment but a growth area. As adoption spreads, more customers will encounter these effects and begin to expect them.

Technology will keep improving. Set-up times will shrink, design tools will become more intuitive, and the range of effects will expand. The slight complexity gap will narrow, making embellishment as easy to integrate as standard print. We may also see more blending of tactile print with digital interactivity, such as foil-enhanced QR codes or augmented reality triggers.

In a crowded media environment, sensory appeal is a powerful differentiator. Print embellishments give marketers a way to stand out, not just visually but physically. They remind us that while technology changes, human senses remain the same. We still value what we can hold and feel.

For print companies, the path forward is clear. Equip the sales team to tell compelling stories, use branded offerings to create demand, and keep showing samples until the value becomes self-evident. The tipping point is near. The shimmer, the texture, and the touch are here to stay.

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Members of ISO/TC130 gather during the May 2025 working group meetings at the X-Rite headquarters in Grand Rapids, MI.

DOING THE WORK:
STANDARDS DEVELOPMENT IN ISO/TC 130

BY JULIE SHAFFER

A technology outlook for the graphic communication industry wouldn't be complete without including a look at what's going on in the world of standards development. Sure, new product development is exciting, but standards development is another critical an engine driving our industry, one that helps ensure consistency, stability and interoperability across the graphic communication value chain.

While the world of print and imaging standards is supported by a rich "ecosystem" of organizations – some operating nationally, others globally, and many catering to niche industry segments – for the scope of this article, we'll sharpen our focus. We're zeroing in on a critical player: ISO/TC 130 (Graphic Technology).

ISO TC/130 BASICS

ISO/TC 130 is an International Standards Organization (ISO) Technical Committee and addresses standardization across all phases of the graphic communication process, from creation to final delivery, whether electronic or physically to a substrate and finished according to its end application. ISO/TC 130 standards also include things like terminology, visual appearance evaluation, data exchange, process control, management, conformity assessment, testing and environmental impact. Over the years, ISO TC 130 working groups have created more than 100 standards covering nearly every area of graphic technology. Few of those standards are known by name — SO 12647-7 anyone?—but many, such as the PDF/X series, are used every day without the user even realizing they are working with ISO standards.

WHO DOES THE WORK?

The membership of ISO/TC 130 is comprised of national standards bodies that each get one vote on standard ballots. For the United States, ANSI (American National Standards Institute) is the U.S. member body to ISO. U.S. Technical Advisory Groups (U.S. TAGs) are responsible to develop U.S. positions for ISO working groups and there is a U.S. TAG to ISO/TC 130. Individuals can join as Participating (voting) or as Observing (non-voting) members. Membership is open to individuals representing

industry organizations (OEMs), print service providers, educational institutions, government, or who are individual subject-matter experts. Voting members must be approved by existing membership through a ballot.

U.S. TAG members are responsible for developing the U.S. position on technical subjects and coordinating the U.S. participation in the work of ISO/TC 130. ISO/TC 130 meetings take place semi-annually, rotating between participating countries in Europe, Asia and the Americas. Participants are encouraged to attend in person, although hybrid attendance is allowed.

THE ISO/TC1 30 WORKING GROUPS

ISO/TC-130 is structured around a framework of Working Groups (WG) and Joint Working Groups (JWG). These are based on the functional areas of a print workflow, from the print buyer's request, through manufacturing, to the end user, whether print or digital. Members join specific working groups based on their areas of expertise. Current active WGs include:

ISO/TC 130 WG 1 (TERMINOLOGY)

Develops terminology in the field of printing and graphic technologies. This includes both an overview and reconciliation of the terms and definitions used in TC 130, and the development and review of standards concerned with proofreading of text and other related topics.

ISO/TC 130 WG 2 (PREPRESS DATA EXCHANGE)

Develops standards for the exchange of digital data used in the graphic arts and print production.

ISO/TC 130 WG 3 (PROCESS CONTROL AND RELATED METROLOGY)

Develops and reviews ISO Standards and related documents in process control and related metrology for the production of printed matter used within the scope of ISO TC 130.

ISO/TC 130 WG 4 (MEDIA AND MATERIALS)

Develops and review of ISO Standards and other documents in the area of media and materials used within the overall scope of ISO TC 130.

ISO/TC 130 WG 5 (ERGONOMICS - SAFETY)

Develops international safety standards for Prepress and press equipment and systems, binding and finishing equipment and systems, converting equipment and systems, stand-alone platen presses.

ISO/TC 130 JWG 7 (COLOUR MANAGEMENT)

JWG7 (Joint TC 130 and ICC WG) under the leadership of TC 130 works with the ICC around the standardization of colour management and its implementation. ISO/TC 42 and others are invited to join in this JWG.

ISO/TC 130 WG 10 (SECURITY PRINTING)

The scope of this group centers around management of security printing processes.

ISO/TC 130 WG 11 (SUSTAINABILITY OF GRAPHICS TECHNOLOGY)

Develops standards related to the sustainability of graphic technology within the overall scope of ISO/TC 130.

ISO/TC 130 WG 12 (POSTPRESS)

This group works to develop and review standards and other documents concerning print methods, process control, quality control, testing, measurement and other topics related to postpress.

ISO/TC 130 WG 13 (PRINTING CONFORMITY)

This group develops assessment requirements around printing conformity.

ISO/TC 130 JWG 14 (PRINT QUALITY MEASUREMENT METHODS)

JWG 14 (Joint TC 130 - TC 42 - ISO/IEC JTC 1/SC 28 WG) develops print image quality metrics and their related measurement methods. These metrics are not limited to the assessment of prints produced using any specific printing technology.

ISO/TC 130 TF 3 (COMMUNICATIONS)

The scope of TF 3 is to be "the voice of TC 130" to stakeholders in the printing and graphic technology industries by maintaining the TC 130 website with articles and news. To create new, and update existing, guidance documents on how to apply relevant ISO standards in print and publishing production. To support the secretariat for TC 130 in future updates of the Scope and Strategic Business Plan.

WANT TO HELP DO THE WORK?

Together, the members of ISO/TC-130 share a common belief that standards are important and want to see the standards they develop used for the good of the global graphic communication industry. If you do too and have subject-matter expertise in one or more areas mentioned here, consider joining the standards development community To learn more about ISO/TC 130, visit ***https://committee.iso.org/home/tc130***.

If you work for an organization based in the United States, and you are ready to help with the work of the U.S. TAG, send a note saying so to ***standards@aptech.org***.

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