KEYPOINT INTELLIGENCE

SERVICE AREA:

Business Development Strategies

ANALYSIS

SMART PRINT MANUFACTURING

PREPARING FOR THE FUTURE OF PRODUCTION PRINTING

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Introduction

Advanced technologies like cloud computing, big data & analytics, artificial intelligence, robotics, and augmented reality are having on impact on print production. They are changing the way that print is produced. Print service providers (PSPs) must evaluate and adopt these technologies, or they run the risk of losing out to highly automated competitors. This document defines Smart Print Manufacturing (SPM), describes how it works, and identifies where it can be applied in a production printing environment.

If you are among the many firms charting a course toward operational excellence for your business, it may be time to consider adding SPM to your plans. Smart Print Manufacturing provides a framework for moving toward workflow automation that helps you to create quality products and services by adding value throughout the supply chain.

Why Is Now the Time for Smart Print Manufacturing?

The pace of change in the printing industry has been marked by peaks of innovation followed by years of continuous improvement. The convergence of modern technologies can enable breakthroughs that were not previously possible, and at a faster pace than ever before. At Keypoint Intelligence, we have identified five core technologies that will ultimately lead to mostly—if not fully—autonomous print production. While the terms "smart factory" and "Industry 4.0" are commonly used as umbrella terms for these technologies, they often don't place enough emphasis on the intersection and dependencies between technology, processes, and people.

What Is Smart Print Manufacturing?

Over the past 100 years, the printing industry has transitioned from a craft to a manufacturing process, driven by an endless stream of enabling technologies. The communication landscape continues to shift and evolve, leaving print to compete against the speed, cost, and targeting capabilities of digital channels. Competition also remains stiff within an industry that remains focused on reducing costs through automation. The next decade will be about redefining print manufacturing to make it smarter as we transition to the next industrial revolution.

SPM starts with streamlining inputs (customers, job onboarding, and production resources) to optimize every stage of production, eliminating or minimizing manufacturing inefficiencies and errors while maximizing uptime and execution. It combines manufacturing methods with industrial technologies to optimize all stages of print production. Many PSPs have already implemented lean and just-in-time manufacturing techniques to optimize their supply chain and minimize waste. Mass customization and autonomous production, however, are still bubbling up. These terms can be defined as follows:

- **Mass customization:** Creating customized, and in some cases personalized, products in small quantities without increasing manufacturing costs.
- **Autonomous production:** The use of data and networked communication to connect machines to management and information systems and other machines to decide and execute the most efficient manufacturing process.

While these concepts may seem advanced, the first generation of mass customization and autonomous production are already here and are being used by online print brands in North American and Europe. PSPs of all shapes and sizes must prepare, plan, and take steps to implement their own version of Smart Print Manufacturing. SPM is not just for the largest printers in the industry. While some technologies (e.g., robotics) might be out of reach for some printers due to cost or expertise, others (e.g., cloud computing) are not. Those who wait will find it increasingly difficult to compete as the efficiencies of competitors trickle down to their cost structure and market pricing.

The Five "C"s of Smart Print Manufacturing

What does this mean for your environment? Enabling lean manufacturing and just-in-time planning can lead to autonomous and automated workflows that enable you to produce customized products at similar scale and costs to mass-produced items. The five "C"s of SPM put it all into perspective: Consolidate, Connect, Collect, Compute, and Create.

Figure 1: The Five "C"s of Smart Print Manufacturing

Source: Keypoint Intelligence

Start at the beginning by **consolidating** your production workflow processes with an automated workflow. Whether you're starting from a completely manual, spreadsheet- and sticky note-driven environment or already enjoy islands of automation, the ultimate goal is an automated workflow that begins at the point of estimation, continues through job onboarding, and ends with delivery to customers. Automated workflows free human capital so they can focus on adding value outside of repetitive tasks.

Connecting all hardware and software, as well as the business processes, and **collecting** relevant data and information from sensors builds the infrastructure that enables multiple

streams of data (e.g. the status of the printer and incoming order volumes) to **compute** real-time decisions that lead to optimized production. The result is the ability to **create** quality products and services while adding value throughout the supply chain. In a Smart Print Manufacturing environment, costs should be optimized and revenue margins should be maximized.

The Five Core Smart Print Manufacturing Technologies

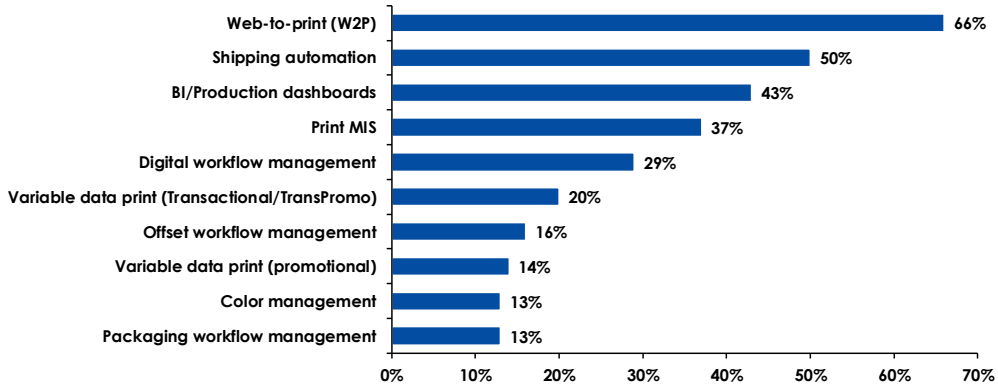
Keypoint Intelligence has identified five core technologies (cloud computing, big data and analytics, artificial intelligence, robotics, and augmented reality) that will ultimately lead to mostly—if not fully—autonomous print production.

Cloud Computing

The pandemic has enabled us to recognize one of the primary value propositions of cloud computing: accessibility. When employers were forced to pivot to a work-from-anywhere model, cloud computing and software-as-a-service solutions eased the transition for businesses that had already adopted the cloud services. According to Keypoint Intelligence's North American Software Investment Outlook research, the use of cloud-enabled software increased by as much as 94% year-over-year when COVID-19 hit. Even cloud-heavy web-to-print (W2P) software experienced a 10% gain as more PSPs needed to provide socially distanced, online ordering. Furthermore, although the pandemic certainly accelerated the adoption of cloud computing, this trend has staying power.

Meanwhile, web-to-print is the software category with the highest level of cloud deployment. Shipping automation, business intelligence/production dashboards, print management information systems, and digital workflow management round out the top 5.

Figure 2: Software Categories with the Highest Cloud Deployment



N = Varies; Base: Respondents who currently own these software products
Source: *NA Software Investment Outlook*, Keypoint Intelligence 2020 – 2021

Big Data and Analytics

When someone mentions big data, the printing industry with its manufacturing base may not come to mind as much as technology companies like Google, Facebook, and Apple. If you look beneath the surface of any printing operation, however, you'll realize that a lot of data is being generated. A print shop's customer relationship management (CRM) system may have hundreds, if not thousands, of contact records and critical pieces of information about clients. The print shop's management system keeps quotes, jobs, and shop floor data to manage and streamline production. The biggest generator of data is likely the shop floor equipment that could be collecting information on the jobs, machine usage, and environmental conditions, while also analyzing the output to ensure quality.

Traditionally, the data within the print shop is turned into reports pulled by key staff and management to monitor important operational and financial metrics. Over the past few years, print management information system (MIS) providers and equipment manufacturers have started offering data analytics. Some of these are built on top of well-established data analytics platforms like Microsoft BI, Sisense, or Izenda, where data can be gathered from many sources. The downside is that these platforms often require professional services to integrate multiple data sources.

Manufacturers have mostly focused on capturing data locally or in the cloud from Internet-connected equipment (assuming customers opt-in) for use in their own data analytics tools. While these original equipment manufacturer (OEM) tools can provide insights related to equipment uptime, overall equipment effectiveness, ink consumption, and other indicators, PSPs need a more comprehensive view of their entire operations. Going forward, we believe data and interchange standards along with the growth of industry technology platforms will alleviate the siloed state of today's data analytics options.

Artificial Intelligence (AI)

Our industry is in the beginning stages of using the vast amount of machine data generated to improve the operation, quality, and autonomy of the printing process. Using large amounts of data, algorithms can effectively train machines to accomplish a particular task. This is a part of artificial intelligence known as machine learning.

One example of machine learning that has come to market recently are printing systems that use visual inspection systems and machine learning to identify, classify, and correct issues in print output. This type of solution uses algorithms and, in some cases, user feedback to improve the accuracy and speed of detecting print defects. Depending on the issue, the software can take corrective action, such as compensation for a clogged inkjet printhead or queuing a reprint if needed. Thanks to artificial intelligence, less skilled operators are required even as strong levels of quality are assured. Another example is in

paper use, where some systems use artificial intelligence to correlate and share up-to-date settings for different substrates when staff members scan the paper ream's barcode. This type of solution automates settings for size, type, color, coating, and weight with the simplicity of scanning the barcode, loading the paper in the printer, and then completing the process with wizard-driven selections as needed.

Robotics

According to the International Federation of Robotics, installation of industrial robots more than tripled globally from 2010 to 2019, putting the total installed base at over two billion. There are several trends that are lowering previous barriers to adoption and making robotics more accessible. The most impactful change has been a steady decline in cost along with a rise in variation and capabilities.

To date, the use cases for production printing are more limited and programs from OEMs are still works in progress, with some offering robotic automation for material movement. Technology-forward PSPs with sizable or complex fulfilment operations have started adopting Automated Guided Vehicles (AGVs) for their warehouses. Adoption will likely accelerate in the coming decade, led by a desire to increase productivity while minimizing or shifting labor costs to higher value tasks.

Augmented Reality (AR)

Augmented Reality is an enhanced version of reality created by overlaying a digital layer, primarily for education or entertainment purposes. Print can further link the digital benefits of augmented reality to the physical world by providing the trigger to initiate the experience through a quick response (QR) code or other techniques. There are many use cases from video explainers on critical customer documents to more creative augmented reality that enables customers to experience a product.

For Smart Print Manufacturing, the focus is on augmented reality that enables or assists print production, not AR that is part of the printed product. The most prevalent use case is augmented reality to diagnose and service printing equipment that can be used by the OEM's service technician or by the end-user. The experience enables the end-user to identify parts and can provide instructions on how to repair or replace items.

Going forward, augmented reality is expected to play a key role in bridging the physical and digital worlds using digital "twins" to visually model different scenarios of the print manufacturing process. Augmented reality could assist in modeling a new physical layout of the print shop or predicting bottlenecks throughout the production processes based on varying print volumes and application mix.

opinion

The Bottom Line

Keypoint Intelligence believes that the printing industry is reaching another peak in innovation, similar to past moments of creative destruction that lead to new opportunities. During moments of creative destruction, the new replaces (or displaces) the old while also creating new opportunities.

The impact of Smart Print Manufacturing technologies is likely to arrive faster and be more disruptive than those that came before, since each technology can amplify the effect of the others. Rather than fearing this transition, it's more productive to focus on some positive effects that have already occurred. Cloud computing displaces the need for local information technology (IT) infrastructure and administration, but it opens access to the growing hybrid and remote workforce. Big data and artificial intelligence will disrupt creative and analytical tasks now performed by people, but will enable us to make better use of our time for higher value work. The key for PSPs is to always plan for the future by identifying and adopting transformative innovations to successfully transition from the old to the new.

Here are some specific recommendations:

- **Fix your "front of house" processes, including job onboarding:** e-mail can no longer be the general-purpose tool for everything. It is not well-suited for customer orders, file submission, artwork approval, or workflow automation.
- **Embrace cloud-based software solutions:** Hybrid work styles will continue where some non-operator staff members may split time between the office and other locations; cloud-based software makes the transition easier. There are also other benefits of the cloud, ranging from security (a growing concern) to reduced administrative overhead.
- **Focus on ease of connectivity:** Start evaluating your current software solutions, and new ones, based on their openness and ease of connectivity. This will be nearly as important as the software's functionality. For cloud and on-premises software, an open set of application programming interfaces (APIs) is required in this decade of smart print manufacturing.

SPM might seem like far-off science fiction, but the transition is coming sooner than you think and will likely occur by the end of this decade because each of these technologies has a compounding beneficial effect on the others. For example, large amounts of data are the fundamental building blocks for machine and deep learning that improves the accuracy and capabilities of artificial intelligence. Simply put, one technology improves the other… so be prepared!

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Comments or Questions?