

Industrial Printing: The Next Digital Frontier

Though screen printing has remained the industrial segment's primary technology, digital is not far behind.

In 1993, Benny Landa, whom many consider the father of commercial digital printing, said, "Everything that can become digital will become digital, and printing is no exception."

More than a quarter century later, this prophetic statement is a reality for many segments of the printing industry, including commercial, packaging, and wide-format printing. While traditional offset, flexographic, and screen printing continue to incorporate digital technology as a key part of the printing process, industrial printing has continued to use screen printing as its predominant method.

What is Classified as Industrial Printing?

Probably the best definition for industrial printing is print that does not have the primary purpose of carrying a promotional message. Rather, it is part of a manufacturing process. It is print that enables the function of the end product or that enhances its appearance or decoration.

So, the end product being produced may incorporate printing, but printing is only a step in a much more complex production process. As a result, industrial printing is a very broad segment as it incorporates nameplates, instrument panels, gun handles, formed parts, and luggage. Add in architectural construction to provide a sense of just how large and varied this segment is.

Screen Remains Predominate

There are many reasons screen printing has remained the dominant print technology for industrial applications, including:

- The broad array of end applications and materials being printed
- The many stringent test requirements that must be met
- The harsh environmental conditions that the part may encounter
- Exacting print requirements (such as registration)
- Specifications from end customers



By **Terry Amerine**, VP – Sales and Marketing, and **Angela Argit**, Marketing Manager, Polymeric Group

fStop Images - Patrick Strattner, iStock/Getty

Due to digital inks' much lower viscosity, they have traditionally not been able to meet the end requirements or pass the stringent testing requirements for many industrial applications.

- Matching Pantone colors, metallics, and corporate ID colors not achieved through current digital ink technologies
- Achieving a highly opaque or lockout white

In screen printing, both the ink and the print process have successfully met these demands for many decades.

The screen printing process allows for relatively easy replacement of ink. This can be crucial for industrial applications, as they often require more than one ink chemistry due to the use of multiple substrates and varying requirements for the end products. Screen printing supports flexibility whereas digital printing is a “one-size-fits-all” technology in terms of the ink.

Another factor favoring screen in industrial printing is screen inks are formulated with higher viscosities. This allows the ink formulator to incorporate more functional ingredients to meet the aforementioned stringent performance requirements. The lower viscosity needed for digital inks makes formulating more difficult for industrial applications.

The Future Impact of Market Trends

Several factors have enabled digital's encroachment in the commercial, packaging, and large-format screen printing segments. Some of the key drivers include:

- Customization of graphics resulting in smaller print runs
- Shorter lead times
- The narrowing of supply chains
- The focus on minimizing the carrying cost of inventory
- Increasing speed and productivity of digital print equipment

- Reduced labor costs resulting from digital printing

These factors are important as they also impact the industrial segment. In addition to ordering custom-designed products like luggage, shoes, home furnishings, and apparel, consumers can now — to some extent — even design a car to their own preference.

The days of producing 50 different designs for a catalog or for a DIY store — and limiting consumers to just those 50 designs — are quickly disappearing. This extends to the clearance sales for the 10 designs that were not as popular as forecasted. Consumers expect the ability to custom design to their desires and are willing to pay more, resulting in improved margins and higher profits.

Another factor impacting technology choice is the continual drive to engineer costs out of finished products, which results in the use of lower-cost materials that are often more difficult to print. Freight management and other logistical costs, along with the need to create more engaging designs, have also played a role in digital's rise in certain segments.

It's safe to say the same market and business changes that drove other printing segments to adopt digital on a large scale will do the same to industrial print applications.

Current Digitally Printed Industrial Applications

In the past, industrial printers often had to work with printhead manufacturers and digital integrators to custom design a print engine to meet their requirements.

There are a few critical aspects of digital print technology that impact its ability to make inroads into industrial applications. The first is the print engine or printer itself. Industrial applications typically require extreme precision in terms of registration/repeatability, clarity/text crispness, and fit-for-purpose digital ink.

Clarity/Text Crispness

Today's digital printers with printheads capable of precisely jetting ink droplets measuring just a few picoliters in size can easily meet the requirements for clarity and text crispness. Therefore, this is no longer an issue for industrial applications.

Registration/Repeatability

Dependent upon the design, printers are also capable of holding very tight registration and repeatability. Printers with vacuum tables and registration systems/marks offer the best solution for this requirement. There are many digital printers that are very capable of meeting this requirement.

Digital Ink

The development of digital ink for industrial applications is easily the most important and most challenging aspect of providing a digital solution. Due to digital inks' much lower viscosity, they have traditionally not been able to meet the end requirements or pass the stringent testing requirements for many industrial applications.

Additionally, the nature of digital printing and the inability to easily switch inks results in the “one-size-fits-all” requirement for the digital ink. This limits where digital printing can be used in industrial printing applications.

However, improved formulations of digital inks have reduced these obstacles over the past few years. Digital ink adhesion to key substrates, like polycarbonate, polyester, and ABS, has improved. The flexibility of digital ink formulations has improved greatly. For example, many leading digital equipment

suppliers such as EFI and Fujifilm have digital inks that can be vacuum formed to very deep draws. Digital inks are now available that can withstand stringent finishing processes as well.

Another key advancement for digitally printing industrial applications has been the introduction of digital latex ink systems from suppliers such as HP. The flexibility, pigment loading, and color gamut latex inks provide make them ideal for many demanding applications such as plastic thermoforming. The absence of photoinitiators and monomers in the latex ink also eliminates a primary source of concern for direct and indirect food contact applications.

The most recent technical advancement has been the development of digital ink for the graphic overlay and nameplate segment. The ink has been formulated to withstand aggressive adhesives such as 3M 467 and 468 on both polycarbonate and polyester. The ink can be embossed and can stand up to the high number of actuations required by manufacturers. The ink was formulated to also provide adhesion to a range of other key materials to enable it to fulfill the “one-size-fits-all” requirement for digital ink.

Functional Coatings’ Role

Using highly functional clear coatings has long been a part of industrial applications, whether using screen or digital print technology. Typically, the coatings are applied as a top or last-down coating. They are applied using screen equipment or more often, roller coating equipment. The coatings are used to enhance the performance of the ink and finished part. Some examples include:

- Extending weathering
- Providing protection against harsh chemicals
- Scuff/rub resistance
- Moisture/water resistance
- Increased flexibility
- Thermoforming parts
- Providing textures and other key features

Whether using digital or screen

technology, the use and need for functional coatings will continue moving forward. In digital, functional coating will remain an essential part of the solution regardless of what ink technology is employed. Therefore, the method of applying the coatings will be an important aspect to consider when choosing the best solution moving forward.

Industrial Printing’s Future

The functional and industrial printing industry’s future is bright, with the segment expected to grow to nearly \$137 billion by 2024, according to July 2019 reports from Smithers.¹

The printed electronics market itself is estimated to double from \$9.8 billion in 2019 to \$19.8 billion by 2024 according to a Printed Electronics Market study published in December 2019.²

The anticipated growth in the functional and industrial printing industry is expected to benefit both screen and digital printing. Though screen printing will continue to hold the largest share of the industrial print segment for the next several years, digital printing will capture an increasing share. The rate of digital adoption in industrial applications will be slower than what occurred in the retail point-of-purchase segment, but it will continue to happen as market and business forces meet with the advancements of digital print technology.

Therefore, Landa’s statement does hold true for industrial applications. As with many other segments, the solution may well involve the incorporation of both conventional and digital print technology. However, it is best to plan for the increasing use

of digital technology for industrial applications in the future.

It’s important printers consistently engage the suppliers of digital equipment and substrates as well as inks and coatings formulators and ask the “how can we” and “what if we could” questions. Because it is increasingly likely that the solution may exist today — it just needs the right minds sitting around the table to put the pieces together to dramatically change how printing fits into one’s production process. ■

References

¹“The Future of Functional & Industrial Printing to 2024.” Smithers. July 7, 2019. [smithers.com/services/market-reports/printing/function-al-industrial-printing-to-2024](https://www.smithers.com/services/market-reports/printing/function-al-industrial-printing-to-2024)

²“Printed Electronics Market Worth \$19.8 Billion by 2024: Markets and Markets.” Printed Electronics Now. December 18, 2019.

[printedelectronicsnow.com/contents/view_breaking-news/2019-12-18/printed-electronics-market-worth-198-billion-by-2024-marketsandmarkets](https://www.printedelectronicsnow.com/contents/view_breaking-news/2019-12-18/printed-electronics-market-worth-198-billion-by-2024-marketsandmarkets)

Terry Amerine has spent nearly 30 years in the printing industry and has held senior management positions at Sericol, Fujifilm, and Durst. He joined Polymeric, a leading global supplier of inks and coatings used in screen, digital, and direct-to-garment applications, as VP of sales & marketing in 2019.

Angela Argit is responsible for all marketing and customer communication at Polymeric. She has held similar positions in a variety of companies in the IT recruiting, internet, and software segments.

The most recent technical advancement has been the development of digital ink for the graphic overlay and nameplate segment.