

# Shifts in Retail Photofinishing and Their Impact on Printing Technologies

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## Abstract

*The shift from film-based to digital photography in the past decade has resulted in significant changes in the photo printing needs at retailers. Consumers now want to choose the pictures that they print, compose and edit their images, and expect a choice of service levels (instant, one-hour, and two-day fulfillment) for their “standard” prints. At the same time, some retailers have experienced significant declines in their daily print volumes, making it difficult for those retailers to continue operation of a silver halide minilab in those locations. In response to this changing market landscape, Kodak and other suppliers of innovative retail printing solutions have had to look beyond traditional AgX printing technology to meet market needs. This paper will identify the key attributes a printing technology must meet for each of the three retail printing segments – instant (kiosk), behind-the-counter (minilab), and off-site (wholesale) – and then compare how each of the digital printing technologies – Silver Halide (AgX), Dye Diffusion Thermal Transfer, Electrophotography, and Inkjet – addresses those needs.*

## Introduction

In the past decade, the use of digital technologies in the consumer imaging experience – taking, sharing, and storing their pictures – has gone from a novelty for “techies” to the accepted norm for the masses. Images are easily captured with no need to worry about reloading film into the camera and can now be taken almost anywhere, anytime, by anyone with a cellular phonecam. Sharing now takes many forms and is no longer limited to sending or handling prints of one’s pictures. As consumers have adopted these new technologies and embraced new behaviors, there have been significant impacts on the retail photofinishing marketplace. This paper will examine those impacts and discuss how they have created opportunities for the use of different printing technologies for photofinishing.

## Shifts in the Retail Photofinishing Market

The widespread acceptance of digital cameras by consumers has led to an explosion in the number of images captured each year, as has been well documented. For the retail photofinishing market, this would have seemed to represent an opportunity for growth in photo printing. However, we have all witnessed, many of these digital images are not being printed. Instead, print volumes at retailers have declined. There are multiple reasons for this decline in printing at retailers:

- Images captured on film had to be printed to be viewed, whereas digital images could be viewed immediately on the camera screen or later on a computer screen.

- With the ability to preview digital images before printing, consumers could now print only the images they wanted.
- It was no longer necessary to print images to share them. Images could be shared by emailing them, uploading them to a photo-website for online sharing, loading them onto a digital photoframe, or just pulling them up on the display of the phonecam or digital camera.
- Consumers could choose to send their images to an online photo fulfillment website and have their pictures mailed to their homes.
- Print quality and speed of photo-enabled home printers improved significantly.

Within retail, digital technologies were causing a shift in consumer behavior as well. In the film-based imaging era, consumers dropped off their film, decided on 1) single or double prints, and 2) prints in an hour or prints in days. As digital images became pervasive, consumers needed a new way to order their pictures. They were reluctant to drop their memory card into a photo mailer as they had with their film and often did not want to print every image on their card. The solution was the photo kiosk. Photo kiosks had been present in the market for several years but were primarily used by consumers to scan and reprint pictures from their collections at home. Photo kiosks were adapted to read the images from the consumer’s digital media, help them compose their order, and select whether they wanted their prints in *minutes*, hours, or days. The convenience and speed of printing at the photo kiosk was now available for printing these digital images, shifting more print volume away from the on-site minilabs and off-site wholesale labs.

These changes in consumer picture-printing behavior have led to the consideration and application of printing technologies other than silver halide (AgX) at retailers, namely dye diffusion thermal transfer, drop-on-demand inkjet, and electrophotography (EP). However, no one technology meets the demands of all retail applications today. To understand this we need to look at the key attributes that affect the choice of printing technology. Those attributes include:

- Print quality
- Printing speed
- Image permanence
- Configuration flexibility
- Cost

## Image Quality

The quality of the printed images is arguably the most important attribute for pictures. It is also one of the more difficult attributes to measure, requiring the use of trained experts to assess the acceptability of the printed images.

A set of test images was used to generate 4" x 6" prints on various pieces of printing equipment representing the four printing technologies. These images were then judged by a panel of expert judges from Kodak to determine what percent would be acceptable to consumers. The results are shown below.

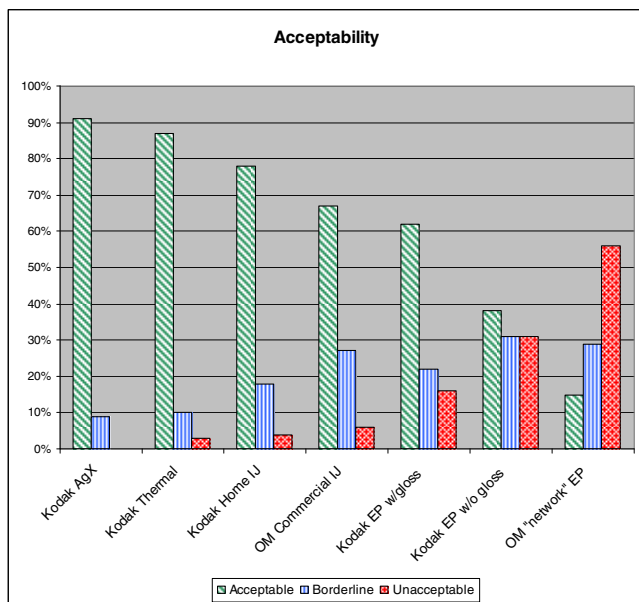


Figure 1. Consumer acceptability of 4" x 6" prints as judged by an expert panel.

The AgX printing technology produces the best print quality results in the sample while the thermal printing technology comes very close to AgX benchmark. The two inkjet printing technology samples are judged to be moderately worse than the thermal printing samples. The EP printing technology samples are all judged to be much worse than the other three technologies. While most consumers would accept the prints from the AgX, thermal, and inkjet technologies, the EP prints would almost certainly be rejected.

## Printing Speed

The expectations for printing speed vary for the kiosk (in minutes), minilab (in hours), and wholesale lab (in days) environments.

For the kiosk environment, many orders are relatively short (100 prints or less) and often are only a few prints. Once the consumer has finished composing the print order, they want their order finished in just a few minutes. Typical kiosk print speeds are 8–12 prints per minute; time-to-first-print can vary somewhat depending on the image content but is typically less than a minute. The printing equipment also needs to fit within the typical retail space requirements for a kiosk. The thermal, inkjet, and EP printing technologies meet these requirements; however, with its long time-to-first-print and larger space requirements, the AgX printing technology is judged unsuitable for kiosk applications.

For the minilab environment, retailers often promote that prints from their minilab will be delivered in 1–2 hours. As such, time-to-first-print is less important and can be longer than for the kiosk; the running speed is more important to meet the expected

delivery time. Rated printing speeds for minilabs typically range from 600 to 2,400 prints per hour. All four printing technologies can deliver the needed print speeds for minilabs.

For the wholesale lab environment, time-to-first-print is nearly irrelevant for these print factories. The premium is placed on printing speed with equipment in this environment typically rated at 5,000–10,000 prints per hour. AgX and EP can deliver the needed productivity but this speed requirement is currently beyond the capabilities of thermal and drop-on-demand inkjet.

## Image Permanence

Consumers have come to expect that their pictures will last a lifetime or longer, based on their experiences with their AgX prints and in some cases on claims from manufacturers. Any competing printing technology needs to meet the same rigorous standard of "lasting a lifetime."

For prints to "last a lifetime," they must robustly withstand exposure to light, heat, humidity, and ozone with minimal degradation in print quality for approximately 100 years. Manufacturers can assess the image permanence of their technologies using various tests for these four degradation agents. Retailers and consumers need to ask for this information and know that the printing technology will indeed resist degradation by *all four agents* for a lifetime.

## Configuration Flexibility

With the changes that digital technologies have precipitated in the retail photofinishing environment, it is extremely difficult for a retailer to predict what his printing volumes will be in the future. Given this dynamic environment, printing technologies that are scalable and flexible will help the retailer adjust accordingly.

Thermal, inkjet, and EP printing technologies are all suitable for scalable system designs of kiosks and minilabs. This allows retailers to add or remove printing capacity as future needs dictate. AgX printing technology does not lend itself well to these scalable system designs.

In wholesale labs, AgX and EP printing technologies are well suited for scalable system designs of these high production systems. Thermal and inkjet printing technologies are not suitable for these designs, in large part due to the number of print engines that would be required to meet the production requirements of these systems.

## Cost

Two elements of cost must be considered, the fixed (capital) cost of the equipment needed in the retail environment and variable (consumables and service) cost.

In the kiosk printing environment, monthly print volumes tend to be lower – typically 150 prints per day – than those in the minilab or wholesale lab environment. Low fixed costs are necessary for the printing technology to be economically viable; variable costs can be modestly higher than those at the minilab or wholesale lab, since the retailer can charge a somewhat higher price for the convenience of prints in minutes. Thermal printing technology has tended to dominate the kiosk marketplace due to its favorable combination of low fixed cost and competitive variable costs. Inkjet printing technologies have entered the kiosk marketplace and may be a viable alternative to thermal. As

previously noted, EP printing technology does not deliver the level of quality consumers expect in their 4" × 6" prints; if EP technology were introduced as a kiosk printing technology, this weakness would push service costs to an unacceptable level. The fixed costs and service costs associated with AgX printing technology make it uncompetitive in kiosk applications.

In the minilab printing environment, monthly print volumes are higher and have a broad range. Some retail locations only print a few hundred prints per day, while others print two thousand or more per day. In the lower volume environments, the retailer is still very sensitive to fixed cost, much like the kiosk printing environment. At these lower volumes, the higher fixed, service, and operating costs associated with AgX printing technology make it noncompetitive with solutions based on thermal printing or inkjet printing technologies. In the higher volume environments, the higher fixed, service, and operating costs become secondary to consumables costs and AgX printing technology continues to dominate with its lower consumables cost. EP printing technology, with its very low consumables cost, is a potential alternative to AgX in this higher volume segment but the aforementioned image quality shortcomings must be addressed first.

In the wholesale lab printing environment, monthly printing volumes are very high – hundreds of thousands. Variable costs – consumables, operating, and service – are the dominant cost element. Similar to the higher volume minilab environments, AgX technology dominates with EP as a possible alternative in the future should image quality improve.

## Summary

The retail photofinishing marketplace has undergone radical changes over the past decade during the digital conversion of

consumer imaging. In the analog past, silver halide was the dominant printing technology and the retailer's primary concern was choosing a minilab based on expected print volume. In the new digital world,

- thermal printing technology is preferred in the kiosk printing environment,
- thermal and inkjet printing technologies are viable options in lower volume minilab environments,
- silver halide printing technology is still the preferred choice for higher volume minilab environments and wholesale lab environments, and
- electrophotography is a technology that is not yet ready for photofinishing but bears watching.

Retailers must assess what their photofinishing needs are now and in the future, examine alternative printing technologies – thermal or inkjet today, possibly electrophotography in the future – and choose the printing technology that is optimal to best serve their customers and their bottom line.

## Biography

*Michael Devoy joined Eastman Kodak Company in 1980 with a Bachelor's of Science Degree in Mechanical Engineering. Prior to joining Kodak, Mike had worked for the General Electric Company. He has spent the majority of his career at Kodak in product development, product commercialization, and business management roles in Kodak's copier/printer business and consumer imaging business. Mike is currently Advanced Development Manager for Retail Systems Solutions in Kodak's Consumer Digital Imaging Group with responsibilities that include technology development, product planning, and intellectual property management.*