Multifunction Products

Industry & Trade Summary

UNITED STATES INTERNATIONAL TRADE COMMISSION

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PREFACE

The United States International Trade Commission (USITC) has initiated its current Industry and Trade Summary series of reports to provide information on the rapidly evolving trade and competitive situation of the thousands of products imported into and exported from the United States. Over the past 20 years, the U.S.' international trade in goods and services has risen by almost 400 percent. International supply chains have become more global, and competition has increased. Each Industry and Trade Summary addresses a different commodity or industry and contains information on trends in consumption, production, and trade, together with an analysis of factors affecting industry trends and competitiveness in domestic and foreign markets. This report on the multifunction product (MFP) industry primarily covers the period 2004–08.

ABSTRACT

This report addresses trade and industry conditions for the multifunction product (MFP) industry for the period 2004 through 2008.

- The global MFP industry is a result of the consolidation of the printing and photocopy machine industries. This convergence has occurred over the past 10 years as original equipment manufacturers (OEMs) in both industries have used digital technology and forged strategic partnerships to combine the functions of printers and photocopy machines into one unit. The global MFP industry was valued at approximately $12.8 billion in 2008 and is dominated by approximately 13 printer and photocopy machine OEMs.

- MFPs can be broadly classified as either print-centric or photocopy machines. HP and Canon represented 61 percent of the manufacturing of print-centric MFPs, while Ricoh, Canon, and Xerox accounted for nearly 70 percent of the world's production of photocopy machines.

- Because of the globalized supply chain and production process of MFPs, U.S. production of MFPs is limited. Instead, the United States is engaged in high-value-added activities that require a skilled labor force, such as research and development (R&D) and the manufacturing of consumables—replacement parts for MFPs such as ink-jet and toner cartridges. Conversely, MFP manufacturing—a labor-intensive process—occurs primarily in Asia and Mexico, due to the relatively low cost of labor in these countries.

- The United States, the world's largest market for MFPs, is being influenced by four trends: (1) a growing preference for A4 MFPs (devices that print on paper measuring up to 8 ½ x 11-inches), sales of which is forecasted to increase from 18 percent in 2006 to 27 percent in 2010; (2) more affordable color MFPs, as OEMs have introduced ink-based technologies and single-pass printer engines to increase speed and reduce the cost of printing and photocopying in color; (3) the increasing popularity of managed print services, which help workgroups economize the use of MFPs and manage workflows efficiently; and (4) greater workgroup adoption of "smart" MFPs—photocopy machines with expanded functionality.

- Price is the chief determinant for U.S. consumers in deciding whether to purchase or lease an MFP. Print-centric MFPs range in price from $60 to $350 and are frequently purchased, whereas photocopy machines, which cost between $10,000 and $60,000, are most often leased. Additional consumer considerations include the reliability of the MFP and its relative output capabilities.

- In 2008, the United States was the world's largest importer of MFPs, accounting for 33 percent of the world's total imports. U.S. imports of MFPs increased by 24 percent from $3.9 billion in 2004 to $4.8 billion in 2008. Similarly, U.S. imports of MFP consumables increased by 200 percent, from $673,000 in 2007 to $2 million in 2008. The U.S. trade deficit for MFPs increased by 25 percent to $4.7 billion over the past five years, while the U.S. trade surplus for consumables decreased by 39 percent from $182 million in 2007 to $111 million in 2008.

- The majority of U.S. MFP exports are refurbished MFPs. Between 2004 and 2008, the United States exported most of its MFPs to Latin America. Demand for MFPs from the region's growing small and medium-sized enterprises (SME) is one possible explanation. Between 2004 and 2008, U.S. exports of MFPs decreased by 0.8 percent from $145 million to $143.9 million.

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INTRODUCTION

Multifunction products (MFPs) play key roles in managing the documents of a variety of sectors, including healthcare, education, and the government. These products are also integral components of home offices and corporations, conveniently allowing users to print and photocopy documents from one device.[1] In 2008, 70 percent of all copying or printing devices in the United States were MFPs, and by 2012, this share is expected to exceed 80 percent.[2]

MFPs may be broadly categorized as either print-centric MFPs or photocopy machines.[3] The former typically have low printing speeds, offer modest copying capabilities, cater to much smaller workgroups, and are mostly low-to mid-end devices (table 1). Conversely, photocopy machines are intended for multiple users at a time, deliver high-speed printing and scanning functionality, and are most commonly middle-to high-end MFPs (table 1).

TABLE 1 Segmentation of monochrome MFP devices

Segment number	Monochrome speed (ppm)	Output (thousands of pages)	Type of MFP	Types of workgroups	End-users per workgroup	General description
1	11–20	20	Print-centric	Personal–Small	1–9	Low–end
2	21–30	51	Print-centric	Personal–Small	1–9	Low–end
3	31–40	123	Print-centric	Small–Medium	10–99	Mid–end
4	41–69	145–315	Photocopy machine	Medium–Large	100–499/ 500–1,000	Mid–end
5	70–90	350–530	Photocopy machine	Medium–Large	100–499/ 500–1,000	High–end
6	91–150	750	Photocopy machine	Enterprise	1,000+	High–end

Source: Industry officials, telephone interviews by Commission staff, October–December 2008; IDC, *Worldwide Quarterly Hardcopy Peripherals Tracker*; Copiers Refurbished, "The Best Selection of Refurbished Copiers—Anywhere," n.d.; Dixon et al., "Predicts 2008: Smart Print Management," December 21, 2007; Buyers Lab Advisor, "How to Buy a Copier or MFP: 2009"; Dixon, "The Evolution of Color Will Broaden the Market," September 24, 2007.

Note: ppm refers to the number of letter-sized (8 ½ by 11 inch) pages that an MFP can produce per minute at full speed. MFPs are assigned segment numbers based on their ppm—a higher segment number corresponds to a high ppm for an MFP. "Output," also referred to as an MFP's duty cycle, is the maximum monthly page output for an MFP.

The MFP industry is a product of the convergence between the printer and photocopy machine industries, which has occurred over the past 10 years. As a result, the global MFP industry comprises original equipment manufacturers (OEMs)[4] in both industries. This report frequently distinguishes between printer and photocopy machine OEMs. Printer OEMs are companies that have traditionally made printers, single-function or otherwise. Photocopy machine OEMs are companies that manufactured single-function photocopy machines before the advent of MFPs and presently specialize in

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[1] All MFPs allow both printing and photocopying, while other variations of MFPs add scanning and faxing capabilities.

[2] Estimate based on number of units sold. Industry official, telephone interview by Commission staff, October 17, 2008.

[3] Large digital printing presses are not covered in this report.

[4] OEMs are companies that design, manufacture, and sell MFPs under their name (e.g., Xerox, HP, Lexmark, etc.). OEMs own the proprietary information associated with their MFPs.

manufacturing multifunction photocopy machines. Strategic partnerships between these OEMs are generating greater competition across all MFP product segments.

The MFP industry is highly globalized, as OEMs rely on a combination of in-house production and outsourced manufacturing. The U.S. MFP industry is oriented toward high-value-added activities such as research and development (R&D) and consumables[5] manufacturing. Conversely, the manufacturing of MFPs, which is more labor–intensive, primarily occurs in Asia and Mexico. The U.S. MFP industry is characterized by significant import dependence, as reflected in the sizable deficit in MFP trade between 2004 and 2008. The U.S. trade deficit in MFPs increased by 25 percent over the past five years, rising from $3.7 billion in 2004 to $4.7 billion in 2008. Although the United States is a net exporter of consumables and refurbished MFPs, these exports were less than 5 percent of the total value of U.S. MFP imports in 2008.

This summary analyzes the production processes of MFPs and associated consumables, explores industry trends, discusses product innovations affecting demand, and provides a general overview of the global and U.S. MFP industry for the period 2004–08. The first section discusses the MFP industry worldwide, including the U.S. and foreign MFP industries. The second section examines the U.S. and foreign MFP markets, while the final portion of this report discusses U.S. trade in MFPs.

INDUSTRY COVERAGE

MFPs can be broadly divided in two categories: print-centric MFPs and photocopy machines.[6] Although both types of MFPs have very similar equipment, they can be distinguished by the differences in finishing options and page output capabilities. Photocopy machines provide finishing capabilities such as collated copying, stapling, hole-punching, and binding, and can produce between 145,000 to 750,000 pages of output per month (figure 1). Print-centric MFPs lack finishing options and are not intended for numerous users, ranging in output from 20,000 to 123,000 pages per month.

Another way to distinguish print-centric MFPs and photocopy machines is the size of paper that each machine can accommodate. Print-centric MFPs can handle up to 8½ x 11-inch paper, which is otherwise known as A4 sized paper. Therefore, print-centric MFPs are often thought of as A4 machines. Similarly, because photocopy machines can accommodate tabloid-sized 11 x 17 inch paper (A3 sized paper), these devices are called A3s. Additionally, A4s and A3s can be differentiated in four ways:

Design: A3 MFPs are networked versions of single-function photocopy machines with added printing, scanning, and faxing capabilities; A4 MFPs are networked laser printers that can copy, scan, and fax. Ninety-five percent of A3 machines are photocopy machines

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[5] Consumables are the replacement parts for MFPs. For more information on examples of consumables see box 1 or consult app. A.

[6] Sales of multifunctional photocopy machines have almost entirely displaced sales of single-function photocopy machines. Moreover, OEMs have phased out the production and design of single-function photocopy machines in favor of multifunction photocopy machines over the past decade. For this reason, photocopy machines are considered MFPs. Industry official, telephone interview by Commission staff, October 2008.

with a wide assortment of finishing options[7] not offered on A4s, whereas the same percentage of A4 devices are print-centric.[8]

Page output: A3 MFPs can produce hundreds of thousands more pages than comparable A4 devices.

Cost differential: A3 MFPs can cost thousands of dollars more than comparable A4 devices[9] but have a lower cost per page because A3 MFPs have greater page printing capacity than A4 MFPs.[10] For instance, an A3 device with monochrome output costs about 9 cents per page whereas an A4 MFP in the same speed segment costs 15 cents per page.

Targeted workgroup: Primary users of A3s are medium-sized to large workgroups of between 500 and 1,000 users. The largest purchasing segment of A4 MFPs is the personal-to-medium sized workgroups, which comprise 1 to 500 users.[11]

Over the past six years, OEMs have introduced "smart" MFPs, which have expanded on the functionality of photocopy machines. Specifically, smart MFPs allow software, which is often customized to a workgroup's needs, to be programmed directly into the machine.[12] The most basic workflow management software can allow users to change the order of queued printing jobs and convert paper-based documents into an electronic format, which reduces paperwork.[13] More sophisticated software provides document encryption, delivers advanced privacy settings including mutli-tiered approval routings, streamlines workflows by connecting to back-office systems, databases, and enterprise applications,[14] and reads information off USB flash drives that are plugged into the machine.

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[7] Examples of finishing options include duplex printing, which enables the user to print on both sides of a page, and collated copying, which automatically separates completed printing jobs.

[8] Industry official, telephone interview by Commission staff, October 17, 2008.

[9] Hughes, "The Canadian MFP Market at the Crossroads," June 12, 2007.

[10] The additional output generated from A3 machines requires "wider fusers, wider chassis, wider paper trays, and a wider paper path," than what is required for A4 devices, and increases the price differential between these two machines considerably. Hoskins, "The A4 MFP," January 2009.

[11] Copierquestions.blogspot.com Web site, "MFP Wars 'Rise of the A4s,' September 15, 2008.

[12] Gartner webinar, http://www.itbriefingcenter.com/programs/Gartner_502_hp.html (accessed December 15, 2008).

[13] Prema, "Smart MFPs Streamline Process and Reduce Costs," July 14, 2005.

[14] In particular, smart MFPs allow users to scan to e-mail, folders, and content management applications.

FIGURE 1 Distinguishing MFPs: print-centric, photocopy machine, and smart MFPs

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                          ┌──────────────┐
                          │    MFPs      │
                          └──────────────┘
                         ╱                ╲
                        ╱                  ╲
          ┌──────────────┐          ┌──────────────────┐
          │ Print-centric│          │Photocopy Machine │────────┐
          └──────────────┘          └──────────────────┘        │
                  │                          │          ┌─────────────────┐
                  │                          │          │  "Smart" MFPs   │
                  │                          │          └─────────────────┘
                  ▼                          ▼                   │
   ┌────────────────────────┐  ┌────────────────────────┐       ▼
   │ • Handles up to 8 ½ x   │  │ • Handles up to         │  ┌────────────────────────┐
   │   11-inch paper         │  │   11 x 17-inch paper    │  │ • Photocopy             │
   │                         │  │                         │  │   machines with         │
   │ • Mostly A4 machines    │  │ • Mostly A3 machines    │  │   expanded              │
   │                         │  │                         │  │   functionality         │
   │ • Printer with copying  │  │ • Photocopy machine with│  │                         │
   │   capabilities          │  │   printing capabilities │  │ • Allow customized      │
   │                         │  │                         │  │   software to be        │
   │ • Few users, low page   │  │ • Many users, high page │  │   uploaded              │
   │   output, low cost      │  │   output, high cost     │  │                         │
   └────────────────────────┘  └────────────────────────┘  └────────────────────────┘
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Source: Compiled by Commission staff.

Consumables—replacement parts for MFPs—are an important component within this industry. Although there are a number of parts associated with MFPs (box 1), this report focuses on the manufacturing and trade of MFP inkjet and toner cartridges, which are two of the most commonly purchased and produced consumables in the industry.

BOX 1 Basic types of consumables

Inkjet cartridge: One of the two options to transmit images onto a document ("toner" or laser is the other). Inkjet technology is traditionally used in low-end MFPs within the personal/small workgroup segment due to their low speeds and inability to handle multiple users. Advantages to inkjet technology include minimal warm-up time, few moving parts, low maintenance, and the relatively low price of ink jet MFPs.

A major disadvantage of inkjet technology is the high cost-to-yield ratio of cartridges. For instance, the typical replacement cost for a 5 mL inkjet cartridge from an OEM, which only produces 170 pages of output, can be $15. The typical personal/small workgroup can spend close to $1,600 annually on ink cartridge replacements alone. For this reason, most workgroups tend to prefer toner, which is used in laser MFPs.

Toner cartridge: Toner is a black or colored powder that is used to transmit images onto a document. MFPs that use toner (commonly referred to as "laser" MFPs) and replacement toner are more expensive than inkjet devices. For instance, a laser MFP that costs $400 will have a $115 toner cartridge, while inkjet cartridges rarely exceed $30.

Inkjet Cartridge

Toner Cartridge

However, this toner cartridge can produce up to 8,000 pages of output, translating into a cost of 69 pages for every dollar spent versus the typical inkjet device, which generates 11 pages for every dollar spent on replacement cartridges. High-yield laser cartridges can process between 7,500 and 10,000 pages, requiring less frequent replacement. Laser MFPs also print at much higher speeds, which can accommodate users in larger work groups.
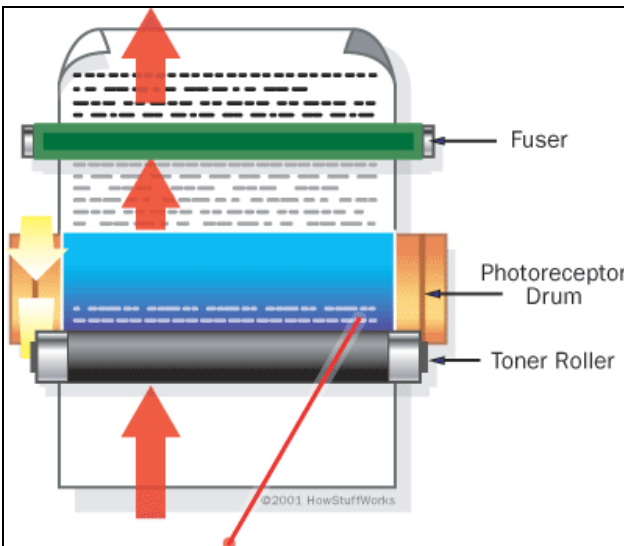
Toner Roller, Photoreceptor Drum, and Fuser

Fuser: The part of a laser MFP that melts toner onto the document.

Photoreceptor drum: A metal roller compsed of photoconductive material that transmits the toner powder onto the document, which is then sent to the fuser.

Toner roller: A device that transmits toner onto the photoreceptor drum. When the drum is electrically charged by corona wires (not pictured), it attracts the toner particles.

Source: Brewer, "Printers vs. Copiers"; Howstuffworks Web site, http://www.howstuffworks.com/photocopier.htm (accessed June 4, 2009); Robb, "Hardware & Equipment: Inkjet Versus Laser Printers," July 2005. Images (in order of presentation) courtesy of Hewlett-Packard, http://www.shopuk.com, and http://www.howstuffworks.com.

GLOBAL INDUSTRY

The global MFP industry is a product of the convergence between the printing and photocopy machine industries. The merging of these two industries has occurred over the past 10 years as the adoption of digital technology has enabled OEMs in both industries to streamline production and consolidate the functions of printers and photocopy machines into one device.[15] As a result, the global MFP industry encompasses OEMs in both the printing and copy machine industries. In 2008, the global MFP industry was valued at approximately $12.8 billion.[16]

The supply chain and production process of MFPs is global, and OEMs rely on a combination of in-house and outsourced production to electronic manufacturing services (EMS). Generally, developed markets such as the United States, Canada, and Western Europe are engaged in high-value-added activities such as R&D and consumables production, which require a skilled labor force. Conversely, the majority of MFP manufacturing—a labor intensive process—occurs in Asia and Mexico, due to the relatively low cost of labor in these regions.

Two emerging industry trends include international compliance with environmental regulations and the increasing availability of managed print services (MPS). The former development has affected parts procurement and led OEMs to create products that consume less energy and reduce the industry's carbon footprint. OEMs are promoting the latter to increase revenues in response to business retrenchments in hardware spending.

Firms and Industry Structure

The global MFP industry comprises about 13 printer and photocopy machine OEMs,[17] with the majority located in the United States and Japan (table 2). These OEMs can be distinguished by the products they manufactured before the convergence of the printer and photocopy machine industries. During this time, printer OEMs specialized in producing single-function printers, while photocopy machine OEMs exclusively manufactured single-function photocopy machines. The majority of these single-function devices have since been replaced by MFPs,[18] but the distinctions between printer and photocopy machine OEMs have remained relatively intact as printer OEMs specialize in print-centric MFPs, while photocopy machine OEMs focus on producing multi-function photocopy machines.

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[15] Brewer, "Printers vs. Copiers," March 2009.
[16] Estimates based on eChannelLine, "Color MFP Continues to Do Well," June 3, 2009.
[17] Commission staff estimated the total number of firms based on numerous interviews with industry officials between October 2008 and July 2009.
[18] Single-function printers are still relatively common; however, single-function photocopy machines have almost completely been replaced with MFPs. Industry official, telephone interview by Commission staff, March 2009.

TABLE 2 Notable printer and photocopy machine OEMs, 2008

Printer OEMs	Country	Photocopy machine OEMs	Country
Brother	Japan	Canon Incorporated	Japan
Dell Inc.	USA	Konica-Minolta Corporation	Japan
Epson	Japan	Kyocera-Mita Corporation	Japan
Hewlett-Packard	USA	Océ N.V.	Netherlands
Lexmark	USA	Ricoh Corporation Limited	Japan
Oki	Japan	Sharp Corporation	Japan
		Xerox Corporation	USA

Source: Compiled by Commission staff.

Increasingly, however, printer and photocopy machine OEMs are competing across product segments of the global MFP industry. This competition is facilitated by strategic partnerships between MFP OEMs. For instance, Canon—a photocopy machine OEM—manufactures and sells printing engines to Hewlett-Packard (HP), a printer manufacturer.[19] The two companies are presently the world's leading producers of print-centric MFPs (figure 2). Similarly, another printer OEM, Lexmark, receives printing engines from Fuji Xerox,[20] a photocopy machine OEM.[21] Moreover, Dell, despite lacking a historical presence in R&D or product development of MFPs, has leveraged partnerships with Lexmark, Samsung, Kodak, and Xerox to become the world's fastest-growing MFP manufacturer.[22] Strategic partnerships among MFP OEMs have led to hardware that is virtually identical across all manufacturers, especially in the print-centric segment of the MFP industry.

These partnerships have developed out of the need for OEMs to address gaps in their respective product portfolios.[23] Cross-collaboration allows printer OEMs to compete upstream in the higher-end segment of MFP production, while photocopy machine OEMs can manufacture downstream, producing low-end MFPs. The result is that photocopy machine OEMs are now producing print-centric MFPs in direct competition with printer OEMs, while printer OEMs are challenging photocopy machine OEMs in high-end MFP manufacturing.

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[19] Brewer, "Printers vs. Copiers," March 2009.

[20] Fuji Xerox is a joint venture between Xerox and Fuji Photo Film. The company handles Xerox's operations in the Asia-Pacific region.

[21] Brewer, "Printers vs. Copiers," March 2009.

[22] Dell has earned more than $1 billion in revenue since entering the MFP industry "…despite little IP, process manufacturing engineering experience" in print-centric MFPs. The company's strategy for increasing its industry presence is almost entirely premised on forging profitable partnerships with other MFP manufacturers. Wang, "Dell's New Printers: A Threat to HP Without IP?" Current Analysis, undated.

[23] Brewer, "Printers vs. Copiers," March 2009.

FIGURE 2 World's leading print-centric MFP manufacturers, by estimated shipments, 2008

All others
12%

Lexmark
5%

Brother
7%

Epson
15%

HP
44%

Canon
17%
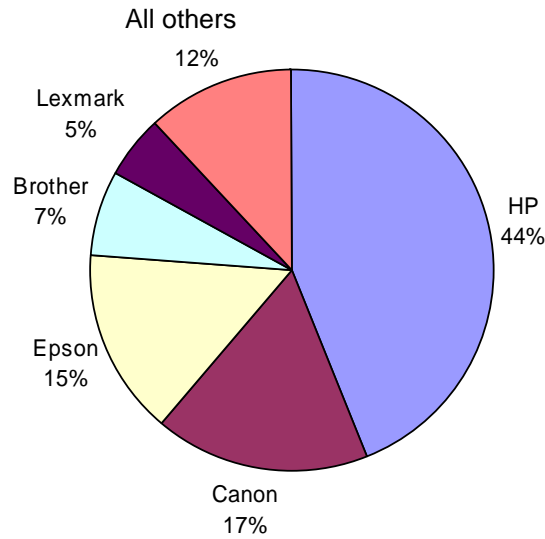
Total = 26.4 million units ($12.8 billion)

Source: Estimates based on eChannelLine, "Color MFP Continues to Do Well," June 3, 2009.

Despite facing greater competition from printer OEMs, photocopy machine OEMs remain the dominant manufacturers of high-end MFPs (table 3). The world's production of these MFPs is concentrated in the hands of approximately eight OEMs,[24] most of which are based in Japan (box 2). The three leading OEMs—Ricoh, Canon, and Xerox—collectively accounted for nearly 70 percent of the world's production of photocopy machines in 2008. Although many printer OEMs are actively trying to develop photocopy machines, HP is the only company to have achieved notable success.[25] As a result, photocopy machine OEMs are expected to remain the dominant producers of these high-end MFPs for quite some time.[26]

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[24] Commission staff estimate based on numerous interviews with industry officials, October 2008–July 2009.
[25] Over the past five years, HP has been making inroads into the photocopy machine production segment. Montgomery, "Optimizing Infrastructure with HP MFPs," January 2008.
[26] Industry official, interview by Commission staff, March 17, 2009.

TABLE 3 World's leading photocopy machine OEMs, by estimated revenues of imaging segment, 2008

Company	Imaging segment revenues (million $)	Approximate global market share (percentage)
Ricoh Corporation Limited	21,084	31.0
Canon Incorporated	15,390	22.6
Xerox Incorporated	9,828	14.4
Hewlett Packard (HP)	7,500	11.0
Konica-Minolta Holdings, Inc.	7,473	11.0
Océ N.V	2,900	4.3
Sharp Corporation	2,300	3.4
Kyocera Mita Corporation	1,587	2.3

Sources: Web sites and annual reports of listed companies.

Note: Each company defines the MFP industry differently, which makes direct comparisons of revenues difficult. For instance, Ricoh's earnings for the imaging segment were unavailable and were estimated from the company's reported earnings statement. Approximate market share totals are calculated from a total of $68.1 billion, derived from totaling the earnings of the imaging segment.

BOX 2 History of photocopy machine OEMs

Xerox was the first photocopy machine OEM in the industry, introducing and marketing the world's first photocopy machines in the United States in 1959. Over the next 17 years, the United States was the leader of the industry, facing little competition from other countries. However, during the 1970s, Japanese companies such as Ricoh, Sharp, and Canon became very successful at creating dealer networks through which they could sell low-end photocopy machines along with OEM consumables to workgroups in the United States.

The success of Japanese OEMs stemmed from their application of innovative production techniques, such as "lean manufacturing," which used "cell" production techniques and "just-in-time" inventory practices. These tactics enabled Japanese OEMs to acquire supplies as they were needed, which reduced the need to maintain inventories and cut costs on warehouse facilities. The key concept behind these manufacturing philosophies was reducing extraneous costs while adding value to the finished good.

As a result, Japanese OEMs required fewer suppliers, had significantly shorter product lead times, assembled products that had fewer manufacturing defects, and were able to establish production lines in less time than their counterparts in the United States. Between 1976 and 1982, the U.S. industry's global market share fell from 82 percent to 41 percent due, in large part, to the success of Japanese companies during this time. This legacy of efficient manufacturing has endured as Japan continues to claim the world's highest number of OEMs in what is now the MFP industry.

Sources: Boulton, "The Plain Paper Copier Industry," 1995; "Xerox Corporation: Surviving the Competitive Crisis," 1996.

Supply Chain and Production Processes

The global supply chain for MFPs consists of a combination of in-house production and outsourcing (figure 3). Although OEMs have established in-house manufacturing facilities and R&D competencies in emerging markets such as Asia and Latin America, an increasing amount of production and development has been outsourced to electronic manufacturing services (EMS).[27] EMS companies are third-party partners contracted to perform various activities along the supply chain for OEMs, including parts procurement

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[27] Industry official, telephone interview by Commission staff, March 15, 2009.

FIGURE 3 MFP production flow

Value-added activities

High ➤ Low
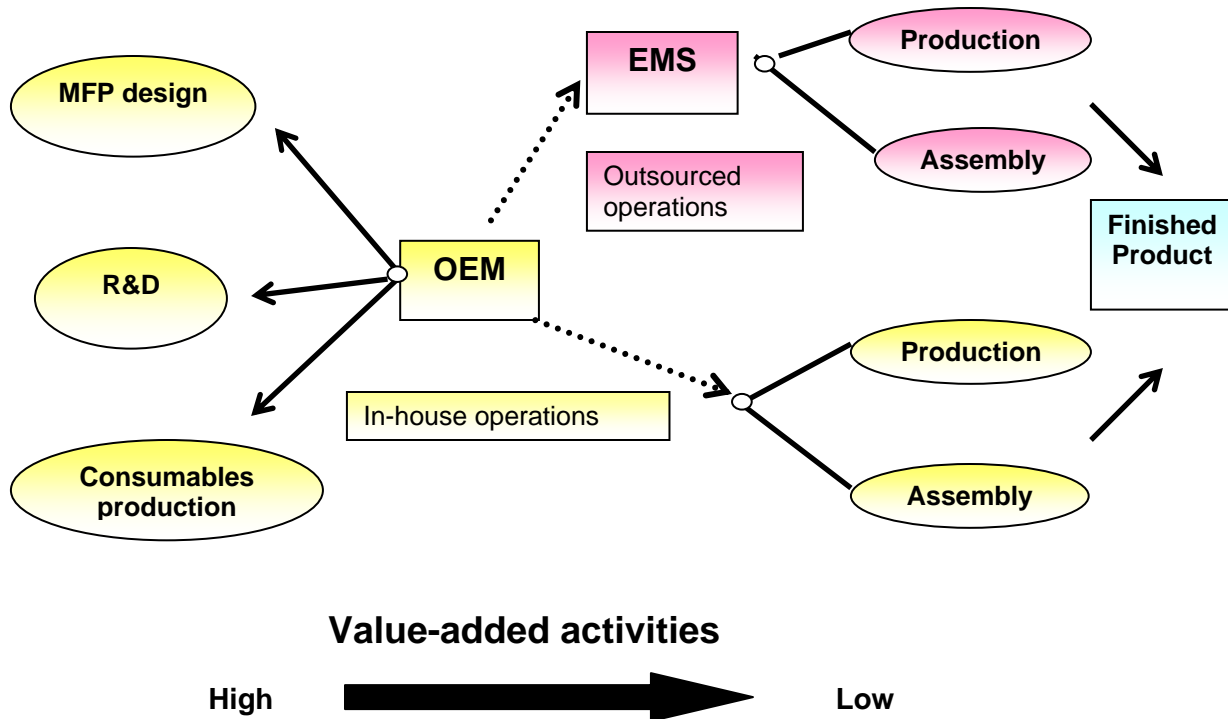
OEMs: Original equipment manufacturers of MFPs have increasingly outsourced low-value-added activities such as production and assembly, but still retain some of these capabilities in-house. OEMs mainly focus on high-value-added activities such as MFP design, R&D, and consumables production.

EMS: Electronic manufacturing services may be contracted to procure parts, assemble MFPs, and mass-produce MFPs. Outsourcing low-value-added activities, such as manufacturing, enables OEMs to defray costs.

Source: Compiled by USITC staff; map template from DIY Maps Web site http://monarch.tamu.edu/~maps2/.

and manufacturing of MFPs. Motivated by the need to reduce costs, OEMs have increasingly outsourced low-value-added activities to EMS companies. For instance, Flextronics, an EMS based in Singapore, has managed aspects of parts procurement and product assembly for HP and Xerox for the past decade.[28]

Although OEMs continue to perform these functions as well, the majority of in-house operations are directed towards high-value-added activities, such as the development and production of proprietary inputs of key MFP components, including circuit boards and molds.[29] Other high-value-added activities that are most commonly performed in-house include MFP design, R&D, and consumables production.

The MFP industry is becoming less vertically integrated as a growing share of parts procurement and manufacturing is no longer conducted exclusively in-house. This development is due to recent retrenchments in consumer and enterprise spending over the past eight years stemming from global economic volatility, saturation of MFPs in the marketplace, and general pressures to reduce costs. As a result, outsourcing many of these activities has proven a reliable way for OEMs to reduce operating expenses.[30]

[28] Industry official, telephone interview by Commission staff, July 18, 2009.
[29] Canon Web site, http://www.canon.com/about/activities/production.html (accessed June 8, 2009).
[30] Celia, "Mutual Benefits Drive EMS Outsourcing," January/February 2006.

MFP manufacturing is very labor-intensive. These devices are most commonly assembled using "cell" production techniques,[31] which require employees to work in teams to manually assemble MFPs in stages (box 3). The majority of in-house and outsourced MFP manufacturing occurs in Asia and Mexico because of low-cost labor there and the fact that employees of MFP manufacturing facilities require less specialized training. For example, Fuji Xerox moved nearly 90 percent of its MFP manufacturing to China during 2004–2008.[32]

BOX 3 General overview of cell manufacturing

Cell or cellular manufacturing is designed to generate production efficiencies while facilitating mass production. Production workers are divided into "semi-autonomous and multi-skilled teams" or cells who manufacture either complete products or—as in the case of MFPs—complex components of products. Both process design and product design operate in discrete modules or cells, which allows problems to be detected and resolved quickly without having to overhaul the entire production line. Each cell assumes responsibility for quality control, ordering of parts, and general inspection of each cell's final product. The chief benefit of cell manufacturing is low inventories and a reduction of waste, which ultimately reduces overall costs.
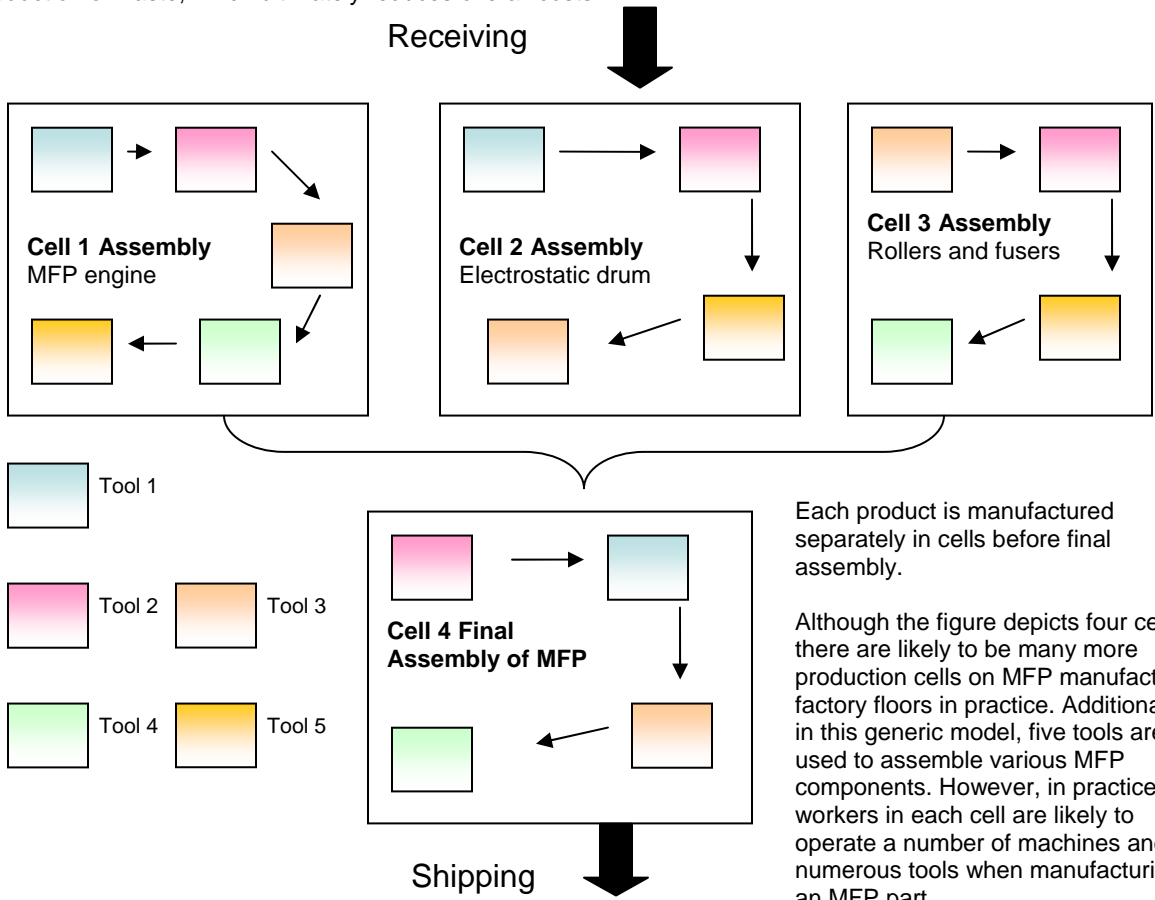
Each product is manufactured separately in cells before final assembly.

Although the figure depicts four cells, there are likely to be many more production cells on MFP manufacturing factory floors in practice. Additionally, in this generic model, five tools are used to assemble various MFP components. However, in practice, workers in each cell are likely to operate a number of machines and use numerous tools when manufacturing an MFP part.

Source: Wikepedia.com and Canon Web site, "Procurement, Production, Distribution," http://www.canon.com/about/activities/production.html (accessed various dates).

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[31] Canon Web site, http://www.canon.com/about/activities/production.html (accessed July 7, 2009).
[32] Fuji Xerox, "Expands Manufacturing in Shanghai," November 1, 2004.

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Global Industry Trends and Developments

Environmental Regulations

The global MFP industry is being affected by a number of environmental regulations aimed at reducing carbon emissions. Measures such as the EU's Restriction on the Use of Hazardous Substances (RoHS)[33] and its Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) have been particularly influential. Together, these initiatives call on all parties throughout supply chains to reveal and register the chemicals used in their products[34] and prohibit OEMs and EMS companies from using certain chemicals in MFPs. These regulations have altered parts procurement practices in the industry[35] and have made OEMs more careful to develop partnerships only with companies that adhere to these provisions.[36]

Environmental initiatives are also influencing the types of products OEMs manufacture. Energy conservation is expected to remain a prominent public policy issue, and MFP OEMs will mostly likely continue to boost their efforts to employ energy-saving technology in their new hardware and to develop new products that generate less waste. For instance, U.S. policies such as the Environmental Protection Agency's *EnergyStar* certification for imaging equipment have led OEMs to manufacture products that consume less energy by "powering down" when not in use.[37] Additionally, OEMs are developing office equipment that is less carbon-intensive, working with customers to reduce extraneous MFPs in the workplace, and establishing goals to limit paper consumption.[38] Other environment-friendly products include Xerox's "solid ink technology," which is estimated to generate 427 pounds less waste than cartridge-based toners,[39] and "erasable paper" technology that transmits information onto paper using a chemical that disappears within 24 hours of being printed, allowing the page to be reused for copying or printing.[40]

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[33] China has a similar policy, "China Order No. 39: Measures for the Administration of the control of Pollution by Electronic Information Products," which is more commonly referred to as China RoHS. American Electronics Association (AeA) Web site, http://www.aeanet.org/GovernmentAffairs/gabl_ChinaRoHSpage0905.asp (accessed August 13, 2009). Although the United States has not initiated its own RoHS legislation, a number of states, including California, have implemented legislation that bans the purchase of electronic devices that are not compliant with the EU RoHS rule; California's is Senate Bill 20: the Electronic Waste Recycling Act of 2003. California Integrated Waste Management Board Web site http://www.ciwmb.ca.gov/electronics/Act2003/ (accessed August 13, 2009).

[34] Datamonitor, "Xerox Corporation SWOT Analysis and Company Profile," April 29, 2005.

[35] Including lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether (PBDE) flame retardants. Overbeek, "RoHS: Its Impact Now and in the Future," n.d.

[36] Industry official, telephone interview by Commission staff, March 9, 2009.

[37] "To qualify for the EPA's new EnergyStar for Imaging Equipment label, output devices that print faster than 20 pages per minute (ppm) color and 25 ppm monochrome must be equipped with standard automatic duplexing. Products must also meet more-stringent energy usage while operating, as well as in idle or sleep modes." Dixon et. al., "Predicts 2008: Smart Print Management Underpins Operational Success," December 21, 2007.

[38] By the end of 2009, an estimated 30 percent of U.S. businesses are expected to establish goals to decrease paper consumption and use recycled paper in offices. Dixon et. al., "Predicts 2008: Smart Print Management Underpins Operational Success," December 21, 2007.

[39] Industry official, interview by Commission staff, July 17, 2009.

[40] Xerox, "Public Gets Sneak Peek," September 26, 2008.

Managed-Print Services (MPS)

In recent years, MFP OEMs have shifted their tactics towards promoting managed print-services (MPS) instead of selling MFP hardware. This trend has been largely confined to large, mature markets, such as the United States and Western Europe.[41] However, in recent years, OEMs have expanded MPS to developing regions such as Asia.[42] By 2013, MPS is expected to account for 35 percent of total revenues in the global MFP industry.[43] Device saturation among the majority of workgroups in these countries,[44] coupled with reduced consumer demand owing to the global economic recession in 2008, have led to declining global spending on MFP hardware. As a result, OEMs are relying on sales of MPS to boost revenues and remain competitive.

MPS can be defined as a document management service provided by an outside party that enables customers to reduce printing costs by removing unneeded MFPs and monitoring paper consumption.[45] Under an MPS agreement, a service provider typically assesses the customer's use of printing equipment and other devices, measuring page output per month, for instance, and finding ways for the customer to use the MFPs in the workgroup more efficiently. The service was developed in early 2000 as a way to allow customers to "outsource the entire office printing function"[46] and catered mostly to large corporations in North America and Western Europe. From 2000 through 2005, MPS evolved to emphasize cost reduction. MPS was then bundled into the price of leasing contracts, along with the conventional costs of consumables and a per-page monthly quota. Between 2006 and 2008, MPS expanded to address the printing needs of small to medium-sized workgroups.

U.S.-based OEMs HP and Xerox are the world's leading providers of the services. HP, the world's largest manufacturer of print-centric MFPs, has leveraged its reputation as a leader in the information technology (IT) industry to provide MPS across a number of industries, while Xerox, through partnerships with Fuji Xerox, delivers MPS throughout North America and Asia.[47] Together, HP and Xerox commanded more than one-half of global revenues from MPS in 2008.[48]

U.S. INDUSTRY

The U.S. MFP manufacturing industry is primarily engaged in high-value-added activities, including consumables production, R&D, and distribution of new and refurbished MFPs. As previously discussed, nearly all MFPs are manufactured outside the United States, in part due to the lower labor costs overseas. In contrast, the United

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[41] Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.

[42] Over the next five years, the Asian MPS market is forecasted to expand from $420 million in 2008 to $863 million in 2012. Photozio Group, "Six Things You Should Know About Managed Print Services," June 1, 2009.

[43] Photozio Group, "Six Things You Should Know About Managed Print Services," June 1, 2009.

[44] The employee to MFP ratio in most of these workgroups averages 2:1. These offices tend to have a combination of low-end to high-end MFPs. A standard high-end machine can accommodate more than 15 users at a time. Photozio Group, "Six Things You Should Know About Managed Print Services," June 1, 2009.

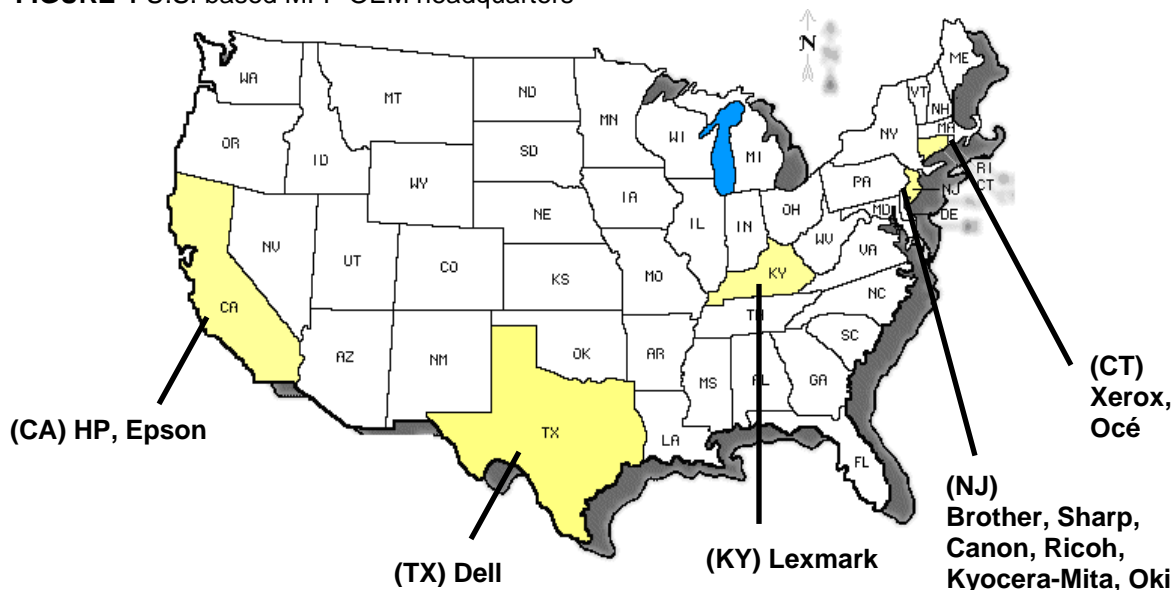[45] Feldman, "HP's Enterprise Printing Blog," March 9, 2009.

[46] Drew, et al., "Magic Quadrant for Managed Print Services Worldwide," September 24, 2008.

[47] Crowley, "Managed Print Services Corner," April 2009.

[48] SmartBrief, "Xerox Leads Worldwide Market Share in Managed Print Services," December 18, 2008.

States has a comparative advantage in highly skilled engineers and scientists, which is necessary for R&D, product testing, product development, and other activities that rank high on the value chain.[49] Each of the world's leading MFP OEMs have U.S. based subsidiaries that are primarily engaged in selling, marketing, and R&D for MFPs (figure 4).

FIGURE 4 U.S. based MFP OEM headquarters

(CA) HP, Epson

(TX) Dell

(KY) Lexmark

(CT) Xerox, Océ

(NJ) Brother, Sharp, Canon, Ricoh, Kyocera-Mita, Oki

Sources: Listed companies' Web sites; map template from DIY Maps Web site http://monarch.tamu.edu/~maps2/.

Consumables Production

Despite lacking a strong manufacturing presence in MFP hardware, the United States continues to produce consumables (figure 5). OEMs prefer to manufacture in close proximity to leading markets, and the United States is one of the world's largest markets for consumables.[50] Retaining U.S. competencies in consumables manufacturing, therefore, enables OEMs to reduce transportation costs and provide a more timely supply response. Canon's largest manufacturing center in North America has operated out of Virginia since 1985,[51] and Xerox, the world's largest producer of consumables,[52] has a $60 million manufacturing plant in New York.[53] Both companies have expanded their existing facilities within the past two years to meet the growing demand from U.S. consumers.[54] Additionally, a number of third–party manufacturers and distributors of consumables operate in the United States.[55] Third–party consumables are manufactured to be compatible with OEM MFPs and compete directly against OEM-branded consumables in the marketplace.

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[49] Industry official, interview by Commission staff, July 18, 2009.

[50] Industry official, telephone interview by Commission staff, July 17, 2009.

[51] Canon Web site, *Canon Annual Report 2002–2003*.

[52] Business Wire. "Xerox Unveils $60 Million Next Generation Toner Plant," September 17, 2007.

[53] Ibid.

[54] Industry official, interview by Commission staff, Rochester, New York, July 17, 2009.

[55] Industry officials, interviews by Commission staff, Las Vegas, Nevada, March 17–19, 2009.

Obtaining specific locations of third-party parts suppliers is difficult, as many of these companies are small players in the industry.

FIGURE 5 OEM consumables manufacturing plants in the United States (number of facilities)
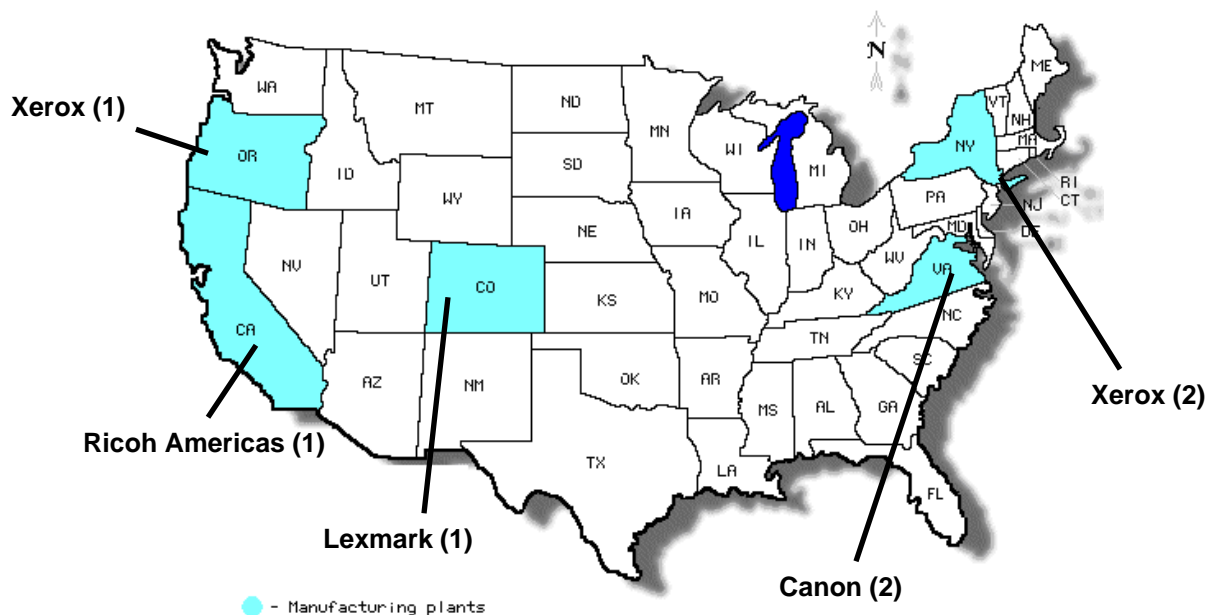
Unlike MFP manufacturing, consumables production is capital-intensive and highly automated.[56] As a result, there is less of a labor cost advantage to moving consumables production overseas. Additionally, consumables manufacturing requires a skilled pool of high-quality chemical engineers and technicians—both are readily available in the United States—who help design consumables and oversee the production of inks and toners in assembly plants.[57]

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[56] USITC staff observations from consumables factory tour in Webster, NY, July 17, 2009.

[57] For example, at Xerox's Rochester facility, the company employs more than 40 chemical engineers. Clean Technology and Sustainable Industries Organization (CTSI), "Xerox Unveils $60 Million Next Generation Toner Plant," September 17, 2007.

Research and Development

Robust investment in R&D is critical for all MFP OEMs to maintain competitiveness in the global MFP industry. R&D spending often translates into innovative products that have created new market opportunities for OEMs across all segments. For instance, a heavy emphasis on R&D has enabled OEMs to capitalize on the increasing consumer preferences for high-speed, affordable color MFPs.[58] Three of the leading inventions pertaining to color MFPs over the past five years include Xerox's solid ink technology, a cartridge-free, resin-based stick of ink that generates less waste than cartridge-based toner; HP's introduction of "edgeline technology," an ink-based printing engine that uses page-width print heads to generate a color image; and Silverbrook Research's "memjet" inkjet technology, which came to market after the company filed more than 1,400 U.S. patents between 2001 and 2006.[59] During this time, OEMs also invested in technology that led to the creation of single-pass engines, which increased the speed of color-capable devices (box 4).

R&D investment also helps MFP OEMs adjust to economic recessions. For instance, during the U.S. recession of 2001–02, OEMs sought to increase sales of new MFPs amid retrenchments in hardware spending by increasing R&D expenditures. Heightened investment in R&D during these two years led to the creation of "smart" MFPs in 2003.[60]

The United States has proven to be a leading destination for MFP OEMs to establish R&D facilities.[61] In part, this is because the country has a highly skilled pool of engineers as mentioned earlier, along with exceptional research capabilities and profitable market opportunities. Moreover, U.S. OEMs are leaders in R&D investment, as evidenced by the work of Xerox and HP. Over the past five years, Xerox has spent more than $700 million annually on R&D[62] and was among the world's top 33 in new U.S. patents awarded during this time.[63] Similarly, HP invested a total of $1.4 billion in R&D between the years 2000 and 2007.[64]

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[58] As highlighted in the U.S. Market section of this report.

[59] Lyra Research Inc., The Hardcopy Observer 2008 Year in Review, December 15, 2008.

[60] Gartner webinar, http://www.itbriefingcenter.com/programs/Gartner_502_hp.html (accessed December 15, 2008).

[61] Xerox conducts all its R&D activities in the United States, Canada, and Europe. Xerox Web site, "Annual Report 2008," and industry official, telephone interview by Commission staff, October 17, 2008.

[62] This R&D spending includes but is not limited to MFPs and related products.

[63] Much of Xerox's research occurs in the company's Palo Alto Research Centre (PARC), which received nearly 600 U.S. utility patents in 2007. Additionally, Xerox has established cross-licensing agreements with companies like Canon, Microsoft, IBM, HP, and Océ. Xerox "Annual Report 2008," January 2008.

[64] Montgomery, "Optimizing Infrastructure with HP MFPs," January 2008.

Color MFPs produce a variety of colors by using three sets of toner: yellow (Y), magenta (M), and cyan (C). Black toner ("K" in the diagram below) is also used to improve the clarity of the image. The mixture of these colors under the traditional "intermediate transfer method" meant that these colors were blended through another medium before being transmitted onto the page. This process slowed the speeds of color-capable devices considerably; monochrome devices could reproduce images in 25 percent less time. The immediate transfer method of imaging used a single light source or light amplification by stimulated emission of radiation (Laser) that transmitted small dots individually onto the page.

The introduction of single-pass engines, however, has streamlined this process by applying the combination of colors directly to the paper without passing them through another medium. The technology employs four digital light-emitting diode (LED) heads that apply the dots in rows rather than one at a time. The feed belt unit passes the paper under the imaging unit or toner cartridges, and the light source from the LED heads transmits electrostatic images through a series of dots, which are transformed into a "toner image" that is imprinted onto the paper through the fusing unit. The result of this new technology is a color-capable MFP with speeds comparable to those of a monochrome device.
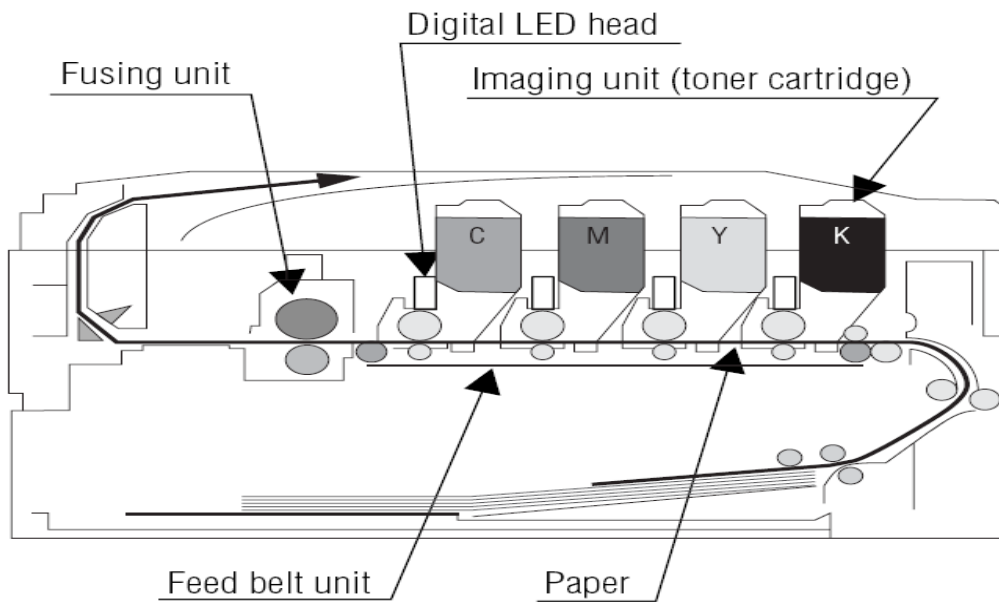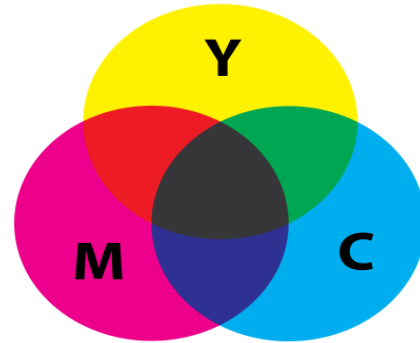
Source: Matsuda et al., "High-speed Color Printer Engine," Oki, n.d.

FOREIGN INDUSTRY PROFILES

The foreign MFP industry is heavily oriented towards the manufacturing of MFPs. This section will pay particular attention to Japan and China, two of the dominant manufacturers and distributors of these products during 2004–08.[65] In addition to manufacturing, China is beginning to develop competencies in higher-value-added
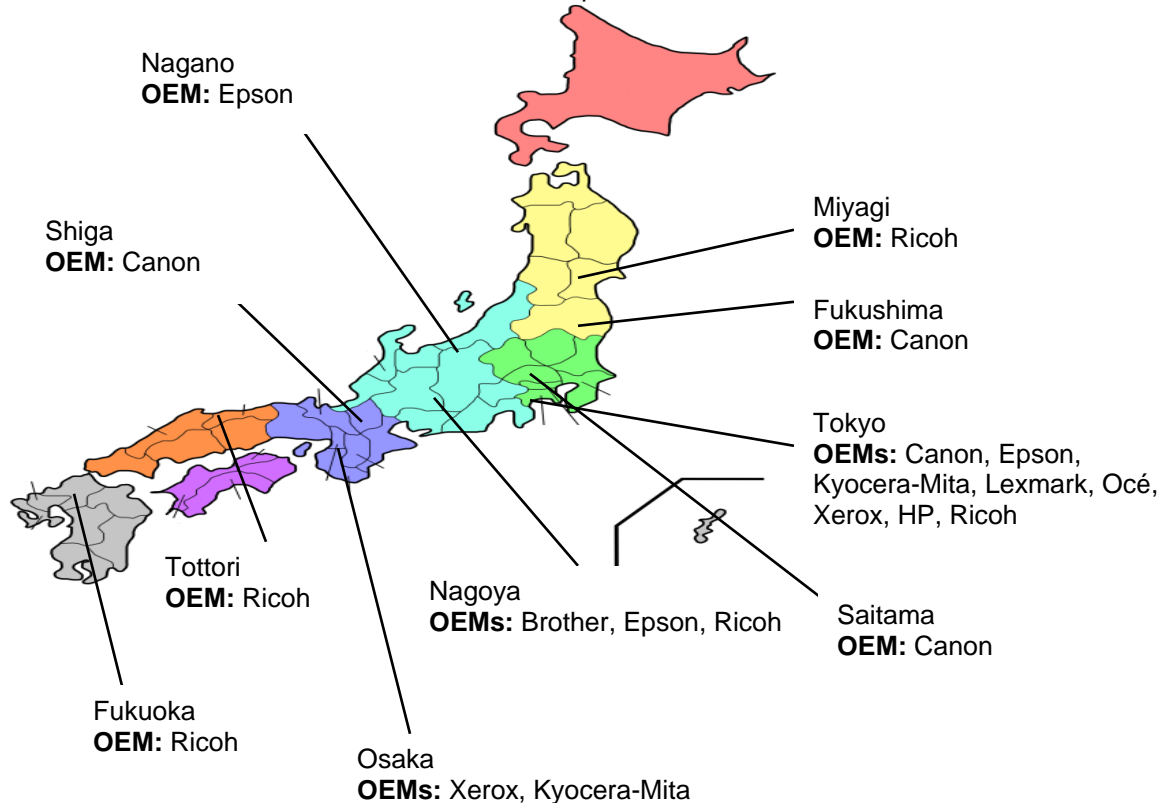
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[65] Due to the unavailability of shipment and production information, export data are being used as a proxy for these activities. These data are presented in greater detail in the U.S. Trade section of this report.

activities, such as R&D and marketing, while Japan remains an industry leader in all these activities.

Japan

Despite having the highest labor costs in Asia, Japan has remained one of the world's leading manufacturers of MFPs.[66] Japan is home to a majority of the world's leading MFP OEMs[67] (figure 6), and many of these companies believe that retaining manufacturing within Japan can enable the country to produce higher-value-added products.[68] Additionally, Japanese OEMs have proven successful at developing and selling the most recent technologies at a high markup before their foreign competitors "catch up."[69] This strategy requires close collaboration between each OEM's local manufacturing facilities and its R&D departments within the country.[70]

FIGURE 6 Locations of MFP OEM facilities in Japan, 2008

Nagano
OEM: Epson

Shiga
OEM: Canon

Miyagi
OEM: Ricoh

Fukushima
OEM: Canon

Tokyo
OEMs: Canon, Epson, Kyocera-Mita, Lexmark, Océ, Xerox, HP, Ricoh

Tottori
OEM: Ricoh

Nagoya
OEMs: Brother, Epson, Ricoh

Saitama
OEM: Canon

Fukuoka
OEM: Ricoh

Osaka
OEMs: Xerox, Kyocera-Mita

Sources: Compiled by USITC staff; locations courtesy of Bureau van Diik Orbis Database; map courtesy of Wikipedia Web site, http://upload.wikimedia.org/wikipedia/commons/4/4f/Regions_and_Prefectures_of_Japan_2.png (accessed August 19, 2009).

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[66] Shipment information is unavailable; using export data as a proxy for MFP manufacturing and sales, Japan trails only China and Malaysia as a leading producer of MFPs. The latter was omitted from this discussion due to a lack of industry data and information.

[67] Japan is the headquarters to seven out of thirteen leading OEMs in the industry.

[68] Van Blokland, "U-turns for Profit," Spring 2006.

[69] Ibid.

[70] Ibid.

Retaining manufacturing within the country has also helped to protect intellectual property, as Japanese employees of OEMs are considered very loyal to their employers; they rarely leave to search for other opportunities, as is common with Japan's low-cost competitors.[71] Additionally, Japan's use of cell manufacturing has streamlined production and generated cost savings, which has helped Japanese OEMs compete with the abundance of low-cost labor in China and other countries.

Despite these manufacturing advantages, Japanese-based OEMs have increasingly expanded MFP manufacturing into other countries in the region in an attempt to capitalize on the lower labor costs associated with these countries. Beginning in the mid-1990s, increases in the value of the yen relative to the U.S. dollar reduced the profit margins on manufactured equipment from Japan and led Japanese OEMs to relocate manufacturing facilities to countries where low labor costs would translate into lower production costs.[72] Throughout this past decade, Japan has continued to outsource MFP manufacturing to countries such as China, Malaysia, and Thailand. For instance, by 2004, nearly 40 percent of Canon's manufacturing base operated outside Japan, with two-thirds of it located in China.[73]

China

China is believed to be one of the world's leading producers of MFPs.[74] Over the past 30 years—before the advent of MFPs—printer and photocopy machine OEMs established production facilities in China primarily to take advantage of the county's low-cost labor (figure 7). More recently, however, these OEMs have looked to China for sales and marketing services in an effort to develop a presence in Asia. For instance, Canon carries out most of its solutions marketing for the North Asian market through its headquarters in China, as well as managing its independent dealers within Asia.[75] Several MFP OEMs seeking to expand investment in R&D are establishing these operations in China. In 2005, HP erected a research laboratory in China with the aim of fostering collaboration between the company and China's research universities.[76]

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[71] Van Blokland, "U-turns for Profit," spring 2006.
[72] Boulton, "The Plain Paper Copier Industry," 1995.
[73] Van Blokland. "U-turns for profit" spring 2006.
[74] Manufacturing data are not available; exports are used as a proxy for production.
[75] Canon Web site, http://www.canon-asia.com/section/aboutus/ (accessed August 17, 2009).
[76] Recharger, "HP Announces China Research Lab," November 15, 2005.

FIGURE 7 Approximate locations of OEM facilities in China, 2008
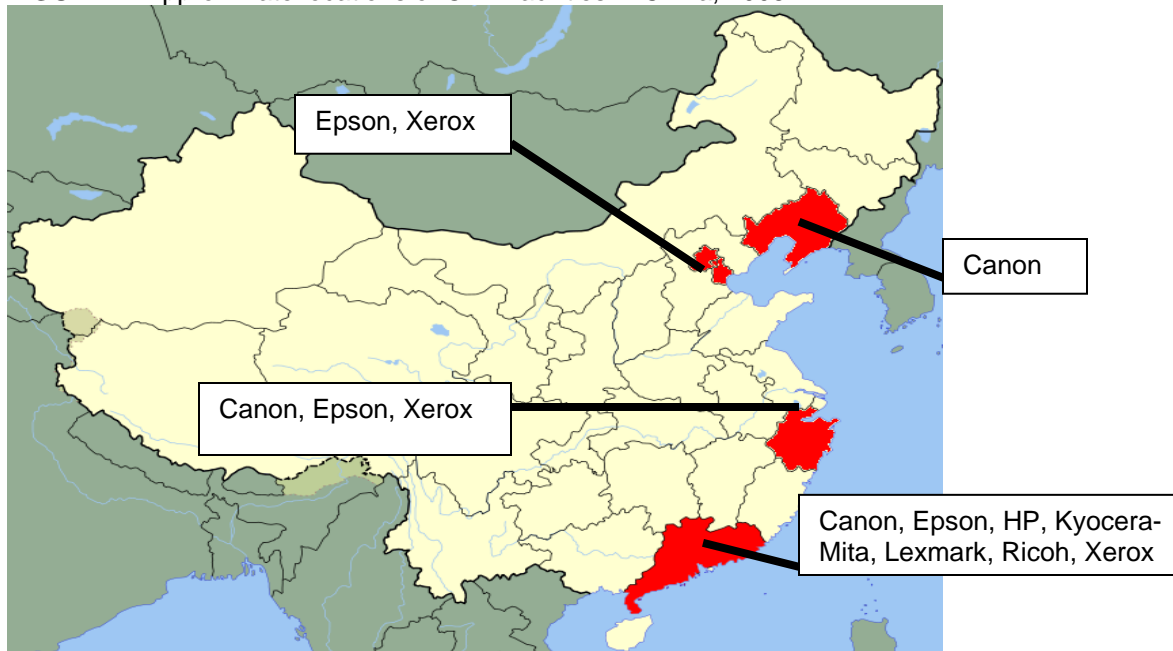
Sources: Compiled by USITC staff; location information courtesy of Bureau van Dijk Orbis Database; map courtesy of DEK Worldwide Web site, http://www.dek.com/web.nsf/us/global_china (accessed August 19, 2009).

GLOBAL MARKET

The global market for MFPs is dominated by the United States and Western Europe. Together, these countries purchased nearly $7 billion worth of MFPs through the second quarter of 2009[77] and remained the world's first and second largest MFP markets, respectively, between 2004 and 2008. These sales were likely driven by purchases of low-end MFPs, which are both relatively inexpensive and widely available to U.S. and European workgroups.[78] The Asia-Pacific region was the world's third leading MFP market over the past five years and was the world's fastest-growing market through the second quarter of 2009.[79] The presence of numerous OEMs in the global MFP market has translated into significant price reductions for low-end MFPs, which is making these devices more affordable to the Asia-Pacific region's burgeoning small-medium sized enterprises (SME) workgroups.[80]

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[77] The total number of MFP sales is unavailable but is believed to be close to $10 billion. Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.

[78] See U.S. Market section for more information.

[79] Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.

[80] Industry official, interview by Commission staff, July 18, 2009.

Marketing

Aggressive marketing is one of the primary determinants of success for OEMs in the global MFP industry. As noted earlier, extensive strategic partnerships between MFP OEMs have translated into "a market of consensus,"[81] to the extent that MFPs are virtually identical across all MFP manufacturers.[82] As a result, OEMs must focus on marketing to convey the quality of their services[83] to attract potential consumers and distinguish themselves from their competitors. Through extensive relationships with numerous local MFP distributors, OEMs are able to advertise the strengths of their products to various workgroups.[84] For example, Xerox relies on dealership networks in over 160 countries, including networks for Fuji Xerox and Xerox Limited, to penetrate markets in Europe, the Middle East, Africa, and the Asia-Pacific regions.[85]

Successful marketing often translates into strong brand recognition in the global MFP market. By virtue of their size and reputation, larger OEMs benefit from strong brand awareness, particularly in developing markets. Xerox, HP, and Canon, for instance, are universally recognized as leaders in the MFP industry, as evidenced by their respective rankings among the top 100 Global Brands of 2007.[86] This reputation has benefited the companies as they seek to expand into overseas markets such as India, where Xerox unveiled eight monochrome MFPs during 2008 alone.[87]

Marketing is also advantageous for OEMs seeking to distinguish their consumables from third-party providers. Because price and quality are two of the most important considerations for users of MFPs and related parts,[88] consumables manufactured by third-party providers that meet these two criteria are often purchased from non-OEMs.[89] Between 2005 and 2008, U.S. consumers replaced one-quarter of their consumables with non-OEM supplies, costing OEMs an estimated loss of $600 million in sales.[90] This trend is largely attributed to cost differences between the third-party consumables, which cost a fraction of the OEM product, and perceived similarities in the quality of the consumables, as third-party consumables are engineered to be compatible with most MFPs and designed to perform similar to the OEM-manufactured consumables. In response, OEMs have redoubled their efforts to market the quality and value of their consumables by advertising the advantages of their proprietary technologies, for instance, which third-party suppliers cannot access.[91]

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[81] A term used to describe the cross-collaboration among MFP manufacturers. Wang, "Dell's New Printers: A Threat to HP Without IP?" May 24, 2004.

[82] Wang, "Dell's New Printers: A Threat to HP Without IP?" May 24, 2004.

[83] Including MPS.

[84] Distribution of MFPs is discussed in the U.S. Market section of this report.

[85] Xerox, *2008 Annual Report.*

[86] The companies were ranked as follows: HP 12th, Canon 36th, and Xerox 56th out of the world's top 100 companies. Business Week, "Top 100 Global Brands Scorecard"; DataMonitor, *Xerox Corporation: Company Profile*, October 26, 2007.

[87] Business Standard, "Xerox India takes lead," May 20, 2008.

[88] Price is also the primary consideration for consumers of MFPs in overseas markets as well. Wang, "Dell's New Printers: A Threat to HP Without IP?" May 24, 2004.

[89] Industry official, interview by Commission staff, March 18, 2009.

[90] Slawetsky, "Use of Non-OEM Parts & Supplies," August 2009.

[91] Industry officials, interviews by Commission staff, March 17–19, 2009.

U.S. MARKET

The United States is the world's largest market for MFPs. Market share information is unavailable for 2008; however, through the first three quarters of 2009, the total value of purchased MFPs exceeded $3 billion.[92] The U.S. market for MFPs is primarily supplied by imports because of the lack of domestic manufacturing of MFPs. U.S. consumers are primarily influenced by the price of MFPs, which can range considerably, depending on the device's speed (ppm), page output, and color capabilities. The drive to reduce costs by workgroups in the United States is contributing to greater domestic demand for A4 MFPs at the expense of A3 devices. Additionally, the U.S. market is being affected by three developments: the declining cost of color technology, which is making color-capable devices the fastest growing segment in the U.S. market; the growing popularity of "smart" MFPs; and heightened demand for managed print services (MPS).[93]

Consumer Characteristics

The leading consumers of MFPs include the government, the education and healthcare sectors, SMEs, and corporations. MFPs are primarily used to create a wide range of documents for end-users such as clients, constituents, and patients. MFPs also facilitate the transmission of important documents within workgroups.

U.S. consumers are most heavily influenced by an MFP's price, followed by its reliability and relative output capabilities.[94] Workgroups acquire various combinations of A3, A4, and low-end MFPs from equipment dealers, directly from the manufacturer, or from office supplies retail stores. In the United States, purchases of MFPs accounted for more than 20 percent of the sales revenues from office supplies stores in 2008.[95] Consumables for low-end MFPs are most often purchased in office supplies retail stores, whereas consumables for A3 and A4 machines are commonly acquired through the equipment dealers or directly from the OEM, depending on which of these vendors the consumer has leased the MFP from. The cost of consumables is generally included in the leasing agreement for the MFP.

Channels of Distribution

Print-centric MFPs and photocopy machines are distributed through different channels. The former are most frequently bought through office supplies retail stores or from value-added resellers (VARs)[96], while the latter are acquired through independent dealers (box 5). As noted earlier, sales of low-end devices generate little profit for OEMs, which makes such MFPs well suited for the high-volume distribution offered by the retail channel; OEMs rely on retail sales of consumables to recover lost profits from the sale of

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[92] Estimate based on reported data from the second quarter of MFP shipments in 2009. The number pertains to print-centric MFPs, as data were not available for the value of shipments of photocopy machines to the United States. Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.

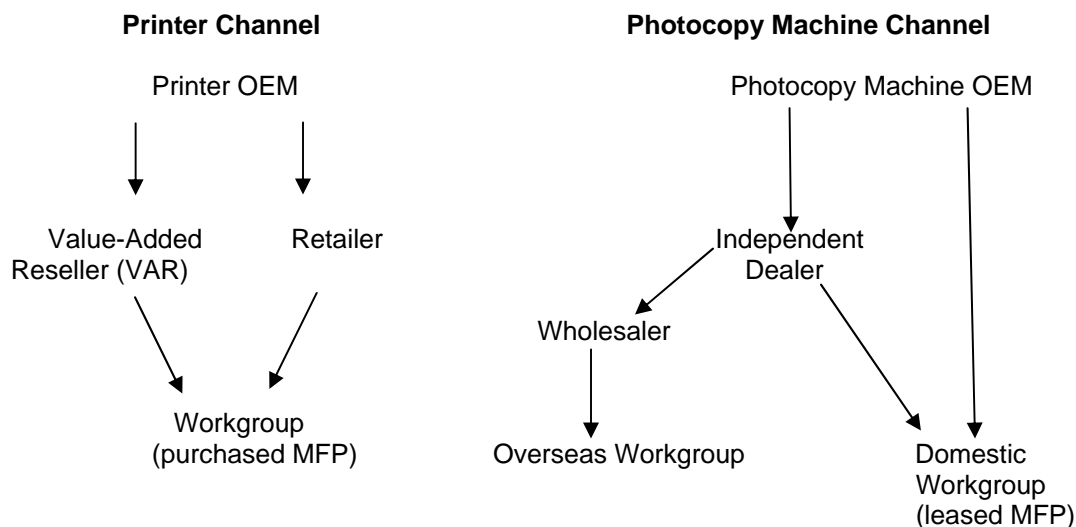[93] See pages 26–8 for a further discussion of these market trends.

[94] Hughes, "The Canadian MFP Market: At the Crossroads," June 13, 2007.

[95] IBISWorld, "Copy Machine & Office Supplies Wholesaling in the US: 42142," March 18, 2008.

[96] See box 5 for a definition and discussion of VARs.

BOX 5 Traditional channels of distribution for printers and photocopy machines

Before the emergence of MFPs, printers were acquired through retailers of office equipment or purchased by the information technology (IT) departments within the workgroup as peripherals to desktop computers. Meanwhile, facilities managers often leased photocopy machines from authorized dealers or directly from the OEM. These patterns of distribution have remained relatively unchanged despite the merger of the printer and photocopy machine industries.

Printer Channel	**Photocopy Machine Channel**

Printer OEM   Photocopy Machine OEM

Value-Added   Retailer   Independent
Reseller (VAR)   Dealer

                                      Wholesaler

        Workgroup   Domestic
        (purchased MFP)   Overseas Workgroup   Workgroup
                                                           (leased MFP)

Printer/Photocopy Machine OEM: the original equipment manufacturers of printers and photocopy machines. The term is used to describe the major companies who manufacture and sell printers and photocopy machines.

Value-Added Resellers (VARs): companies that resell hardware and software with added components. These companies also provide technical support, help to implement of customized computer systems, and sell additional services to various workgroups. In the printing channel, printers were most often sold as peripherals to computers that the VAR sold. VARs sell a variety of IT products.

Retailer: a large chain of stores that sell a variety of office equipment including office furniture, computers, stationary, and low-end printers or MFPs that are typically used by personal or small workgroups. Although the diagram includes retailers in the printer channel, photocopy machine OEMs have increasingly begun to sell low-end MFPs in office supplies retail stores.

Independent Dealer: a distributor of photocopy machines and related equipment. Dealers establish agreements with OEMs to carry a number of different product lines and most often lease photocopy machines due to the high cost of ownership. In recent years, independent dealers have included third-party, non-OEM parts and supplies in their offerings.

Wholesaler: a carrier of used office equipment, including photocopy machines that are no longer being leased by the workgroup. Dealers typically sell the used hardware to a wholesaler who then refurbishes the machine before reselling the equipment domestically or exporting it abroad. The most common destination for U.S. exports of refurbished equipment is Latin America.

Source: Industry officials, numerous interviews by Commission staff, October 2008–July 2009; Brewer, "Printers vs. Copiers," March 2009.

MFPs.[97] By contrast, photocopy machines are most often leased from independent dealers or directly from the OEM due to their high cost of ownership.[98]

Driven by the desire to gain access into previously unexplored markets and challenge competitors, OEMs have acquired independent dealerships over the past four years

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[97] Industry official, telephone interview by Commission staff, March 15, 2009.
[98] See the "Pricing" subsection of the U.S. Markets section.

(table 4).[99] This consolidation of MFP distribution channels is proving significant, because larger OEMs may further increase their influence within the industry at the expense of their smaller competitors. Many dealerships have typically carried a number of products from different OEMs; once these dealerships are acquired, they are likely to replace their many product lines with the acquiring company's equipment.[100] For instance, in the merger of Ricoh and IKON, a leading dealer in MFPs and other office equipment, Ricoh could possibly replace up to 70 percent of IKON's estimated 720,000 MFPs in place in the North American market[101] with Ricoh machines. Additionally, the deal led Canon USA to renegotiate its supply agreement with IKON[102] to phase out Canon MFPs, parts, and consumables by November 2011.[103] Channel consolidation is expected to continue as companies attempt to remain competitive amid an international economic downturn. As a result, the distribution channels for MFPs are likely to become increasingly concentrated in the hands of relatively few players.

TABLE 4 Notable industry acquisitions and mergers, 2005–08

Date	Acquirer	Target company	Type	Implications
10/31/2005	Océ	Imagistics International Inc.	Acquisition	Increases Océ's market presence in the United States
5/11/2005	Xerox	Global Imaging Systems	Acquisition	Xerox gains access to Global's SME market
1/5/2007	Ricoh	IBM's printing division	Joint venture	Established InfoPrint Solutions; Ricoh likely to gain ground in enterprise and SME markets
4/8/2008	Konica-Minolta	Danka Office Imaging Company (DOIC)	Acquisition	HP and Canon USA are likely to reduce or halt sales of their products through Danka
8/27/2008	Ricoh	IKON	Acquisition	Ricoh increases document revenue by acquiring the world's largest independent distributor of hardware, document management services, and software
11/7/2008[a]	Toshiba Business Solutions	55 independent dealers	Acquisition	Strengthens market presence throughout the United States, including Indiana, North Carolina, and San Francisco

Source: Gartner and Lyra Research Inc., 2008.

[a] Date of last recorded deal.

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[99] For instance, Xerox acquired Global Imaging Systems (Global), an independent dealer, in 2007 in large part to gain access to the dealer's SME client base. Industry official, interview by Commission staff, October 2008.

[100] For example, prior to the Xerox-Global deal, Global carried equipment from Konica-Minolta, Canon, Sharp, Ricoh, and Kyocera-Mita. Following the deal, Global is expected to exclusively carry Xerox MFPs and related equipment. Industry official, telephone interview by Commission staff, October 17, 2008.

[101] InfoTrends, "Another Power Deal in the Making," October 15, 2008.

[102] Dixon, "Canon Reworks Distribution Road Map, Signs New Agreement," November 12, 2008.

[103] This development may significantly impact Canon, as IKON sales in 2007 constituted nearly 40 percent of Canon's U.S. office department revenue. Ibid. Additionally, IKON earned more than $1 billion from sales of Canon copiers and MFPs in North America alone in 2007. Dixon, "Ricoh's IKON Buy Will Impact Canon, Overall Market Dynamics," September 2, 2008.

Pricing Model

Price is the chief determinant for U.S. consumers in deciding whether to purchase or lease an MFP. In the United States, MFP prices are determined by the functionality of the device, speed, page output, color capabilities, and sophistication of consumables required in the machine. Low-end print-centric MFPs are typically purchased from office supplies retail stores due to their relatively low ($60–$350) up-front costs (table 5).[104] Profit margins from low-end MFP sales have declined over the past 10 years to the extent that OEMs barely generate a profit on the sales of these MFPs.[105] To compensate for these low margins, OEMs rely on repeated aftermarket sales of consumables such as inkjet cartridges, which generate up to two-thirds of total earnings within this segment.[106] Under this business model, the consumer pays low up-front costs for MFPs, but incurs higher costs over the lifespan of the machine due to repeated purchases of consumables. Print-centric MFPs are especially attractive to personal and small workgroups, as these end users tend to have relatively modest printing requirements.

TABLE 5 Approximate price range of MFPs by segment, 2008

Segment number	Type of MFP	General description	Approximate price range ($)
1	Print-centric	Low-end	60–350
2			
3		Mid-end	2,000–6,000
4	Photocopy machines		
5		High-end	10,000–60,000
6			

Source: Industry officials, telephone interviews by Commission staff between October and December 2008; IDC, *Worldwide Quarterly Hardcopy Peripherals Tracker*; Copiers Refurbished, "The Best Selection of Refurbished Copiers," n.d.; Dixon et al., "Predicts 2008: Smart Print Management," December 21, 2007; Buyers Lab Advisor, "How to Buy a Copier or MFP: 2009," n.d.; Dixon, "The Evolution of Color Will Broaden the Market," September 24, 2007.

Unlike print-centric MFPs, photocopy machines can be very expensive, ranging in price from $2,000 to $60,000 (table 5). Due to the relatively high cost of ownership, U.S. consumers most often lease photocopy machines through independent dealers or directly from the OEM. For these devices, the customer pays a monthly fee that incorporates a price per printed page,[107] which averages around $0.01–$0.02 per page for monochrome pages and between $0.05 and $0.20 per page for a color printout.[108]

The cost per page is directly related to the quality of the consumables (ink cartridges, toner, drum, etc.) used in the machine and the amount of ink used on the page.[109] Lease agreements may also stipulate a minimum number of pages that can be printed each

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[104] AllBusiness, "Basic Differences in Multifunction Printers," undated; State of Montana Buying Guide, "Printer & Multifunction Peripheral (MFP)," June 2007.

[105] Brewer, "Printers vs. Copiers," March 2009.

[106] Industry official, telephone interview by Commission staff, November 20, 2008.

[107] "Pay-per-click" is the term used to describe this process. Once a user prints a page, there is a mechanism within the MFP that tallies the number of pages that have been printed.

[108] Industry official, interview by Commission staff, March 17, 2009.

[109] The price range for monochrome printouts is based on a page with 5 percent coverage, while the color page estimate is based on a page with up to 20 percent coverage. Industry officials, telephone interview by Commission staff, October 17, 2008.

month before customers incur a penalty. Other contracts charge customers a flat monthly rate or asseses a per-click fee, which requires the user to pay for every task that is sent to the MFP.[110] Additionally, lease agreements may also factor in various services, such as maintenance visits, and include the cost of customized solutions.[111]

Workgroups that lease their photocopy machines benefit from being able to upgrade to the latest technology when their lease expires. Upgrading can result in significant cost-per-page reductions as OEMs continue to improve the efficiency of their equipment. Additionally, photocopy machines have a high rate of depreciation, which is another deterrent to purchasing these MFPs.

Market Trends

Evolving User Preferences: A4s versus A3s

The U.S. MFP market is experiencing a consumer-wide shift toward A4 devices, driven primarily by the cost savings generated from leasing an A4 device versus an A3.[112] Another explanation is the shifting of workgroup preferences toward printing at the expense of photocopying in the United States (figure 8). By 2008, 66 percent of MFPs were used primarily to print, compared to just 21 percent for photocopying.[113]

Over the past five years, printer OEMs recognized that few workgroups availed themselves of the robust printing capability of A3 MFPs—which, on average, produces between 20 to 30 percent more output than a comparable A4 machine—[114] and rarely used the 11 x 17 inch capabilities. In response, OEMs began manufacturing and selling A4 devices with finishing options comparable to those found on photocopy machines within the A3 market. By 2010, the share of A4-sized MFP shipments is expected to increase from 18 percent of total MFP shipments in 2006 to 27 percent.[115] The continued growth of A4 devices will likely relegate A3 MFPs to the niche, enterprise workgroup segment in the coming years.

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[110] Drew et al., "Magic Quadrant for Managed Print Services Worldwide," September 24, 2008.

[111] See discussion of "Smart MFPs."

[112] See Pricing section.

[113] Montgomery, "Optimizing Infrastructure with HP MFPs," January 2008.

[114] Although A3 MFPs can generate more than 200,000 pages per month, nearly 90 percent of workgroups print or photocopy less than 20,000 pages per month. Montgomery, "Optimizing Infrastructure with HP MFPs," January 2008.

[115] InfoTrends, "Workgroup 'A4' MFPs Now Growing," June 5, 2007.

FIGURE 8 Estimated U.S printer-photocopy machine page mix, 1997–2006 (billions of pages)
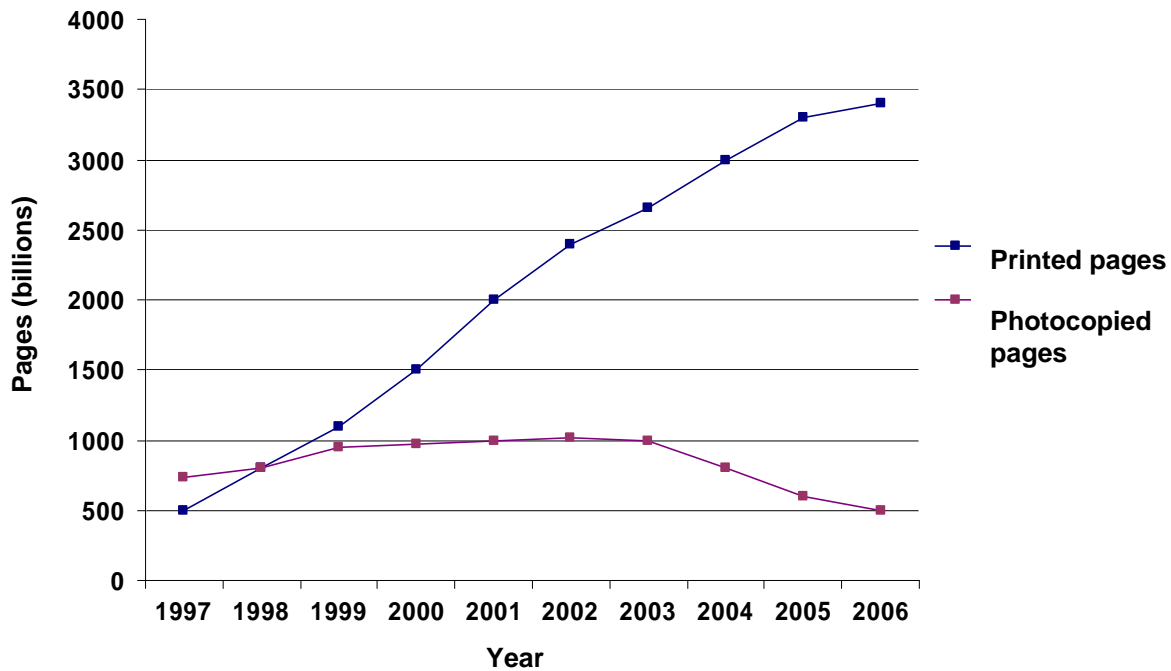
Source: Commission staff estimates based on Montgomery, "Optimizing Infrastructure with HP MFPs," January 2008.

Note: Data for 2007 and 2008 are not available.

Shift to Color

Another major trend in the U.S. MFP market is the shift to color capable devices. Although it has long been popular among U.S. workgroups, high costs once made this capability prohibitively expensive relative to monochrome devices. For example, color printed pages have traditionally cost up to 10 times more than monochrome pages, depending on the amount of page coverage and type of consumable used.[116] Thus, monochrome devices have been the most dominant technology among U.S. workgroups (figure 9), due, in large part, to their lower cost. Even today, color-capable MFPs represent only 20 percent of the market, although they are its fastest-growing segment.[117] Moreover, color adoption is expected to rise over the next five years as the costs of using color technology decreases.

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[116] Industry official, telephone interview by Commission staff, October 17, 2008.
[117] InfoTrends, "Workgroup 'A4' MFPs Now Growing," June 5, 2007.

FIGURE 9 Estimated number of monochrome vs. color pages in the U.S. market, 2003–07 (billions of pages)
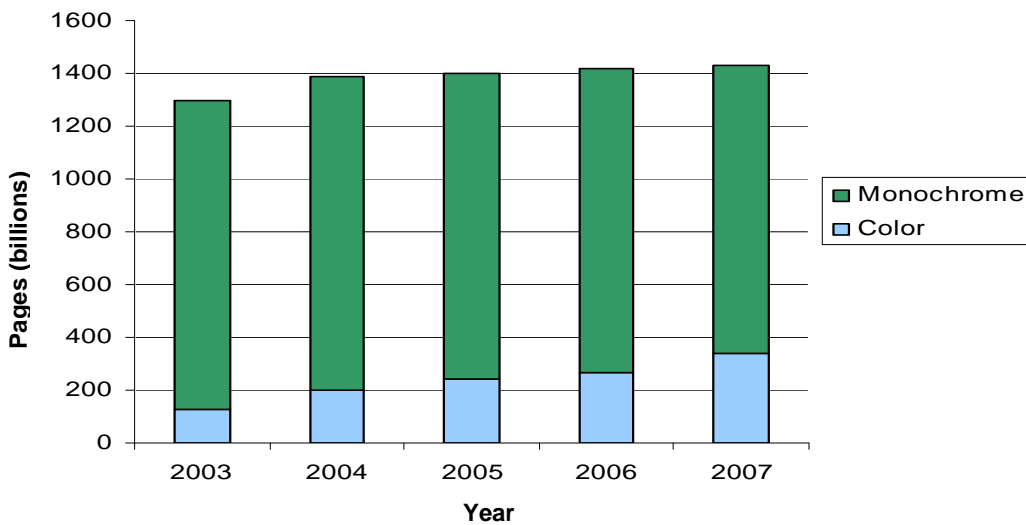
Source: Estimated by Commission staff based on InfoTrends, "Prospectus: The A4 vs. A3 Tipping Point," u.d.

Note: Data are not available for 2008.

In an effort to reduce the cost differential between color and monochrome, several OEMs[118] have introduced ink-based technologies, which cost less than toner, have fewer parts, and deliver quality that is comparable to toner-based output.[119] These inkjet technologies have reduced the droplet size by nearly 90 percent through the use of enhanced printing engines,[120] an advance that has also translated into better image quality. Additionally, the adoption of single-pass engines has also increased the speed of color MFPs. Color MFPs are the only segment forecasted to achieve double-digit growth in the United States for both revenue and shipments in the coming years, with compound annual growth rates expected to reach 16.9 percent by 2012.[121] These forecasts are encouraging OEMs to concentrate their efforts on satisfying the growing demand for color technology.

Smart MFPs

Originally predicted to be a niche market when first introduced in 2003,[122] smart MFPs are now viewed as essential components for large workgroups in the U.S. market to better manage complex printing and faxing demands. U.S. workgroups are especially interested in reducing costs, and smart MFPs generate an estimated savings of between 15 to 30 percent of total company revenues.[123] Moreover, these devices have allowed workgroups to forgo the cost of acquiring a new machine by upgrading and improving their existing MFPs.

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[118] See "Research and Development" section.
[119] InfoTrends, "Opportunities for Ink-Based Marking Technologies in the Office Imaging Market," March 27, 2008.
[120] Industry official, telephone interview by Commission staff, October 17, 2008.
[121] Hoskins, "The Rise of Color: Are you 'on board' for B2C's Ascent?" November 2008.
[122] Dixon and Johnson, "How Smart Does Your MFP Need to Be?" October 3, 2003.
[123] Prema, "Smart MFPs streamline process and reduce costs," July 14, 2005.

Each of the leading MFP machine manufacturers, including Canon, Ricoh, Sharp, Lexmark, HP, and Xerox, offer software development kits that allow independent software vendors[124] to create applications that are integrated into the machine's hardware and connect to a company's network.[125] Most of these solutions are oriented towards securing information stored on smart MFPs, which is especially important for workgroups in the government, healthcare, education, and legal industries.

MPS

The United States is the world's largest market for MPS. Large workgroups (500 or more users) are the most avid consumers of MPS (figure 10). These services have gained in popularity amid the global economic downturn as customers have sought to reduce costs and increase their return on investment on existing MFPs. U.S. customer spending on MPS increased from nearly $5 billion in 2004 to more than $10 billion in 2008[126] as the business model of the MFP manufacturing industry evolved away from hardware-driven sales toward selling MPS and additional services.

MPS is regarded as a way to reduce carbon emissions by encouraging workgroups to dispose of under-used machines and reduce paper consumption.[127] The environmentally friendly aspect of this service should ensure the viability of MPS in the global MFP industry as workgroups become increasingly inclined toward sustainable energy consumption. In 2007, the MPS market was valued at $6.6 billion in North America alone and is projected to expand to $15 billion by 2012.[128]

FIGURE 10 Users of MPS by workgroup type in North America, 2008
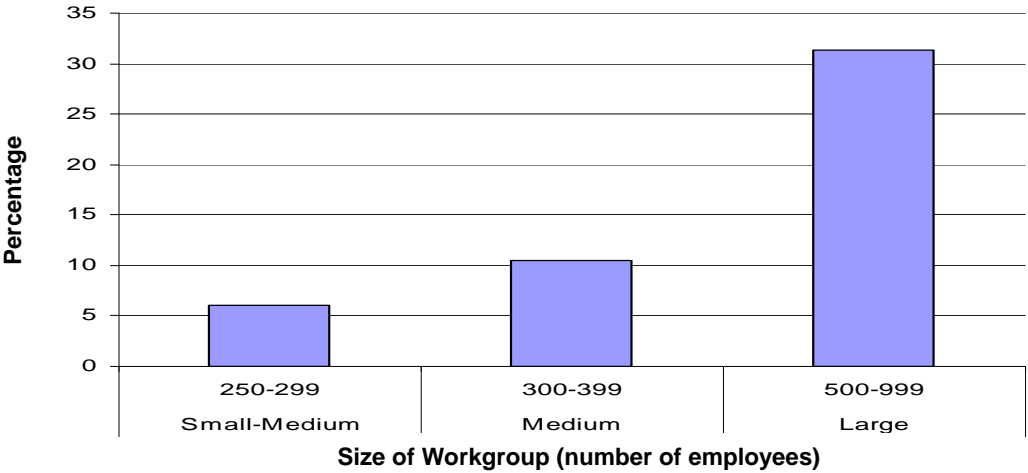
Source: Crowley, "Managed Print Services Corner," April 2009.

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[124] About 18 of these vendors have developed integration with smart MFPs. Drew, "Sharp's Open Systems Architecture Signals Next Evolution of Smart MFPs," March 10, 2006.
[125] Dixon et al., "Predicts 2008: Smart Print Management Underpins Operational Success," u.d.
[126] Commission staff estimates for the years 2004 through 2008 Bulkeley, "Xerox Tries to Go Beyond Copiers," February 24, 2009.
[127] Crowley, "Managed Print Services Corner," April 2009.
[128] Hoskins, "Page-Volume Roundup," March 2009.

FOREIGN MARKET PROFILES

The Asia Pacific region is estimated to be the world's fourth largest market for MFPs.[129] As the workgroups in Japan, Europe, and the United States have become saturated with MFPs, OEMs in these countries have looked to expand sales into developing markets.[130] Regional data provide evidence of the growing popularity of low-end MFPs in Asia;[131] for instance, shipments of low-end MFPs in Asia increased by 46 percent between 2006 and 2007 to 2 million units in 2007.[132] The expansion of Asia's MFP market is being led by China and India's burgeoning SME sectors, respectively.[133] Due to a lack of market data on other countries, the following section will be limited to China and India's markets.

China

China's MFP market is highlighted by increasing demand for laser, print-centric, monochrome MFPs. The country's market for these devices increased from 2.86 million units in 2006 to 4.24 million units in 2007.[134] China's double-digit economic growth over the past decade[135] has led to the emergence of a vibrant SME market[136] in need of office equipment, such as low-end MFPs. As previously mentioned, competition among the numerous OEMs in the global MFP industry has translated into significant price reductions of low-end MFPs, which makes these devices more affordable to the country's SME sector.

Previously, OEMs concentrated on selling to China's larger cities, including Shanghai and Beijing, but are now contending for market share within its less developed cities.[137] China's government has facilitated this development by extending incentives to encourage the country's rural population to purchase IT products, including MFPs.[138] As of 2007, China's MFP market was divided among established global OEMs such as HP, Samsung, and Epson, and regional companies such as Lenovo, Fuji Xerox, and Founder (figure 11). These firms are primarily focused on selling high volumes of low-end, print-centric MFPs throughout the country, which will likely translate into strong gains in aftermarket sales of consumables.[139]

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[129] Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.
[130] Lyra Industry Reports, "China Ink Jet Printer and MFP Forecast," April 14, 2009.
[131] China is believed to be Asia's largest and most rapidly developing market, according to numerous industry analysts interviewed by Commission staff between October 2008 and July 2009. However, very little public market data are available.
[132] Bahrin, "IDC: Lasers Boost Multifunction Printers in Asia," March 20, 2007.
[133] Specific market data on the region are unavailable. According to numerous industry officials interviewed by Commission staff between October 2008 and July 2009, China and India represented two of the largest market opportunities for OEMs.
[134] Lyra Research, Inc., "China Laser Printer and MFP Forecast," April 14, 2009.
[135] Since 2000, China's GDP has averaged 10 percent growth. Financial News, "Graphic Chart Outlining China's GDP Growth since 2000." August 2009.
[136] As of 2004, China's SME market accounted for $5 billion of the $300 billion global SME market. This number has likely increased over the past five years. Small Business Trends, "IBM Pursuing SMB Market in China," October 25, 2004.
[137] Data on market penetration in these cities are unavailable. Lyra Research, Inc., "China Laser Printer and MFP Forecast," April 14, 2009.
[138] China.org.cn Web site, "Dell Targets China's SMB Market."
[139] Wang, "Dell's New Printers: A Threat to HP without IP?" n.d.

FIGURE 11 OEM market share for laser MFPs in China, 2007

Total = 4.2 million units
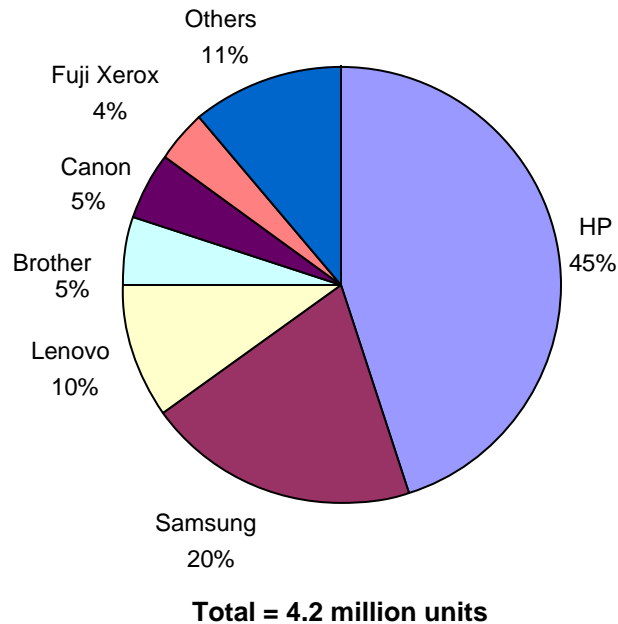
Source: Lyra Research, Inc., "China's Laser Printer and MFP Forecast," April 14, 2009.

Note: The "Others" category includes the following companies: Konica-Minolta, Epson, Lexmark, Founder, and Dell; 2008 data are not available.

India

India's MFP market is dominated by sales of low-cost, monochrome, print-centric devices. Between 2006 and 2007, 96 percent of shipped printers and MFPs were monochrome, versus only 4 percent for color printers.[140] This disparity is mostly attributed to the cost differential of color versus monochrome, which is gradually falling as color becomes more affordable. India, which has the world's fastest-growing SME market,[141] has provided MFP OEMs with new opportunities for expansion.[142] For example, Canon is expected to double its 10 percent market share of the Indian MFP market by the end of 2009 with much of these gains expected to come from increased revenues in their color segments. Similarly, Xerox has directed its efforts towards India's burgeoning SME market, selling mostly A4 monochrome devices.[143] The company currently commands between 50 and 60 percent of the photocopy machine market in India,[144] while HP remains the leading provider of print-centric MFPs.

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[140] Wang, "Dell's New Printers: A Threat to HP Without IP?" Current Analysis, undated.

[141] This segment is buoyed mostly by robust spending by small businesses which represent more than 70 percent of total SMB printing expenditures. IT Facts Web site, December 3, 2005.

[142] Business Standard, "Xerox India Takes Lead in Launch of Mono MFPs, Printers," May 20, 2008.

[143] Treipathi, "Xerox India Product Launch Targets Needs of Emerging Markets," Gartner, May 28, 2008.
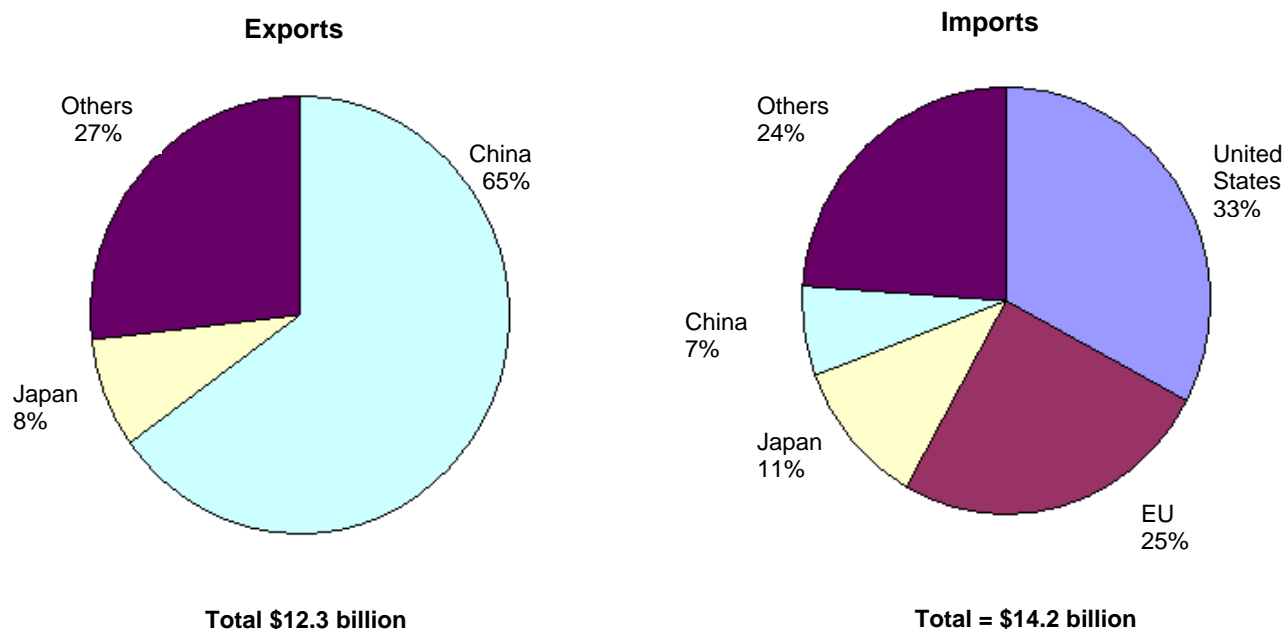
[144] Industry official, telephone interview by Commission staff, October 17, 2008.

GLOBAL TRADE

In 2008, China was the world's leading exporter of MFPs, while the United States and the EU were the world's leading MFP importers (figure 12). Over the past year, China accounted for nearly $8 billion (65 percent) of the world's $12.3 billion worth of MFP exports.[145] Driven, in large part, by China's MFP exports, Asia represented nearly 90 percent of the world's total exports of MFPs.[146] As discussed earlier, Asia has been a leading manufacturing destination for MFP OEMs, primarily due to the region's relatively low labor costs and burgeoning market. The United States and the EU, the world's leading markets for MFPs,[147] accounted for $8.4 billion (58 percent) of the world's $14.2 billion MFP imports in 2008. They are dependent on imports of these products due to the lack of a domestic manufacturing presence.

Since the advent of the Harmonized Tariff Schedule (HTS) in 1988, MFPs and related equipment have been classified under many different categories in three separate chapters: 84, 85, and 90. However, as of January 1, 2007, MFPs and associated parts and consumables were consolidated into HTS heading 8443 (box 6).

FIGURE 12 World's largest exporters and importers of MFPs, 2008

Exports

Others 27%
China 65%
Japan 8%

Total $12.3 billion

Imports

Others 24%
United States 33%
China 7%
Japan 11%
EU 25%

Total = $14.2 billion

Source: GTIS, Global Trade Atlas, accessed September 2009.

Note: Eight of the other 10 leading exporters of MFPs, and their corresponding share of exports were Hong Kong (4.5 percent), EU (4.3 percent), Korea (4.1 percent), United States (3.8 percent), Mexico (3.8 percent), Singapore (2.3 percent), Thailand (2 percent), and Malaysia (2 percent). Along with China and Japan, these countries accounted for 99 percent of the world's total MFP exports.

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[145] GTIS, Global Trade Atlas, accessed September 2009.
[146] Ibid.
[147] Business Wire, "MFPs Continue to Lead the Way," September 2, 2009.

BOX 6	Harmonized Tariff Schedule (HTS) for MFPs and related consumables

HTS Classification	Product Description
8443	Printing machinery used for printing by means of plates, cylinders and other printing components of heading 8442; other printers, copying machines and facsimile machines, whether or not combined; parts and accessories thereof.
8443.31.00	Machines which perform two or more of the functions of printing, copying, or facsimile transmission, capable of connecting to an automatic data processing machine or to a network.
8443.99.50.11	Ink cartridges for the goods of subheading 8443.31
8443.99.50.15	Other ink cartridges for the goods of subheading 8443.31

Source: Harmonized Tariff Schedule, HTS (2009).

Note: Because this report evaluates the MFP industry over a five-year period, Commission staff has calculated trade data between 2004 and 2006 by allocating weights to various classifications that were introduced in 2007. Data for consumables are presented only for 2007 and 2008.

U.S. Trade

The U.S. MFP industry is characterized by extreme import dependence, as reflected in the sizeable trade deficit in MFP transactions between the years 2004 and 2008. The U.S. trade deficit for MFPs increased by 25 percent, from $3.7 billion in 2004 to $4.7 billion in 2008 (table 6). This deficit is largely attributed to the growing proportion of manufacturing that has been relocated to countries such as China, Malaysia, and Japan.

TABLE 6 MFPs, U.S. merchandise trade balance, 2004–08 (thousands $)

Item	2004	2005	2006	2007	2008	% change 2004–08
Total MFPs	−3,724,464	−3,729,984	−3,462,243	−3,942,210	−4,670,867	25

Source: Compiled from official statistics of the U.S. Department of Commerce.

Despite a considerable deficit in the trade of MFPs, the United States maintained a trade surplus in consumables in 2008 of nearly $111 million (table 7). U.S. exports of refurbished MFPs and consumables helped buoy the country's overall exports in the industry between 2004 and 2008, but constituted less than 5 percent of the total value of U.S. MFP imports in 2008.

TABLE 7 Consumables, U.S. merchandise trade balance, 2007–08 (thousands $)

Item	2007	2008	% change 2007–08
Ink-cartridges for MFPs	78,140	27,680	−65
Other MFP consumables	103,890	82,823	−20
Total	**182,030**	**110,503**	**−39**

Source: Compiled from official statistics of the U.S. Department of Commerce.

U.S. Imports

The United States was the world's largest importer of MFPs in 2008, accounting for 33 percent of the world's total MFP imports. Between 2004 and 2008, U.S. imports of MFPs increased by 24 percent, from $3.9 billion to $4.8 billion (table 8). The United States imported the majority of its MFPs from Asia over the past five years. The region accounted for 9 of the top 10 leading suppliers of MFPs to the United States, with China's share of total U.S. imports of MFPs increasing from approximately one-third in 2004 to more than one-half in 2008 (table 8).

TABLE 8 Top 10 sources of MFPs to the United States, 2004–08 (thousand $)

Country	2004	2005	2006	2007	2008	% change 2004–08
China	1,977,659	2,029,665	2,024,137	2,510,188	2,836,835	43.4
Malaysia	559,566	613,524	547,002	713,607	641,550	14.7
Japan	821,004	716,309	628,788	539,344	626,448	−23.7
Thailand	138,675	132,104	144,468	39,554	216,297	56.0
Korea	82,714	78,877	78,313	86,888	187,298	126.4
Indonesia	70,575	62,993	32,308	59,716	109,393	55.0
Vietnam	21,448	50,209	83,465	13,967	102,403	377.4
Philippines	37,043	49,993	24,645	19,994	26,916	−27.3
Singapore	66,371	51,198	37,352	47,717	19,711	−70.3
Mexico	5,587	2,762	7,524	5,163	18,415	229.6
Others	88,930	64,884	42,514	12,108	29,589	−66.7
Total	**3,869,572**	**3,852,518**	**3,650,516**	**4,048,246**	**4,814,855**	**24**

Source: Compiled from official statistics of the U.S. Department of Commerce.

Similarly, over the past two years, total U.S. imports of MFP consumables increased by 202 percent, from $673,000 in 2007 to $2 million in 2008 (table 9). U.S. imports of ink cartridges for MFPs grew by 181 percent, from $161,000 in 2007 to $453,000 in 2008. U.S. imports of other MFP consumables also grew by 208 percent over the past two years, from $512,000 in 2007 to $1.6 million in 2008.

TABLE 9 MFP consumables, U.S. merchandise imports, 2007–08 (thousand $)

Item	2007	2008	% change 2007–08
Ink cartridges for MFPs	161	453	181
Other MFP consumables	512	1,578	208
Total	673	2,032	202

Source: Compiled from official statistics of the U.S. Department of Commerce.

U.S. Exports

Although the United States does not manufacture MFPs domestically, the country has a strong presence in exporting refurbished MFPs abroad, ranking as the world's sixth-largest exporter of MFPs in 2008.[148] U.S. exports of MFPs, which are almost entirely refurbished machines, decreased by 0.8 percent over the past five years, from $145 million in 2004 to $143.9 million in 2008. However, because of the previously stated classification changes to these products, the data for 2007 and 2008 may prove to be a more reliable indicator of the trends in U.S. exports of MFPs. Over the past two years, U.S. exports of MFPs increased by 35 percent, from $106 million in 2007 to $143.9 million in 2008 (table 10).

Over the past five years, Latin American countries accounted for 9 of the top 10 leading recipients of U.S. MFP exports (table 10). The emergence of SMEs in need of MFPs to manage document workflows likely explains these increased exports. Moreover, the majority of domestic wholesalers who export refurbished MFPs are located within the Spanish-speaking border regions of the United States,[149] which may facilitate U.S exports to Latin America.

TABLE 10 Top 10 markets for U.S. MFP exports, 2004–08 (thousand $)

Countries	2004	2005	2006	2007	2008	% change 2004–08
Mexico	18,155	11,715	10,539	50,521	43,279	138
Brazil	5,251	4,791	13,187	13,462	18,720	257
Canada	8,230	5,453	8,266	9,158	14,983	82
Panama	435	2,720	1,051	1,255	5,856	1246
Uruguay	228	686	494	353	4,386	1824
Colombia	1,225	1,860	2,621	2,868	4,214	244
Peru	877	1,366	2,382	1,644	4,133	371
Chile	4,003	2,600	3,465	1,470	4,051	1
Venezuela	1,884	5,097	8,980	2,993	4,040	114
Argentina	850	1,194	1,014	997	3,678	333
Others	103,969	85,051	66,273	21,314	36,588	-65
Total	145,107	122,533	118,272	106,035	143,928	-0.8

Source: Compiled from official statistics of the U.S. Department of Commerce.

Between 2007 and 2008, U.S. exports of MFP consumables decreased by 38 percent, dropping from $182.7 million in 2007 to $112.5 million in 2008 (table 9). This reduction in exports may stem from reduced demand in foreign markets resulting from the global economic recession.

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[148] GTIS, Global Trade Atlas.

[149] The majority of copy and printing machine parts distributors are based in California, Texas, and Florida, and many of these companies advertise the Spanish-speaking capabilities of their staff. Industry officials, interviews by Commission staff, March 17–19, 2009.

TABLE 11 MFP consumables, U.S. merchandise exports, 2004–08 (thousand $)

Item	2007	2008	% change 2007–08
Ink cartridges for MFPs	78,301	28,134	–64
Other MFP consumables	104,402	84,402	–19
Total	182,703	112,536	–38

Source: Compiled from official statistics of the U.S. Department of Commerce.

U.S. and Foreign Trade Measures

The column one rate of duty for U.S. imports of MFPs is free of duty.[150] However, a number of foreign markets apply duties on imported MFPs (table 12). Most notably, the EU's application of duties on some MFPs[151] has raised questions from key trading partners such as the United States,[152] given the EU's participation in the Information Technology Agreement (ITA). Since its inception in 1996, the ITA has mandated duty-free treatment on a number of IT products, including certain photocopy machines.[153] When the agreement was signed, however, photocopy machines were single-function devices that could be easily distinguished from printers, fax machines, and scanners. Additionally, printers were not included in the agreement. However, nearly all photocopy machines that are currently produced and distributed are MFPs, capable of printing. The resulting ambiguity in classifying MFPs as either printers or photocopy machines may explain why ITA signatories such as the EU have assigned duties to MFPs.[154]

TABLE 12 Average ad valorem duties on MFPs for selected U.S. trade partners, by percent, 2008

Country	Tariffs
Brazil	12
Chile	6
Colombia	5
European Union	6

Source: World Trade Organization (WTO) Web site http://www.wto.org (accessed September 2, 2009).

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[150] The column two rate of duty is 35 percent.

[151] Since 2005, the EC has assessed a 6 percent duty on imports of MFPs that print and scan at more than 12 ppm, because the EC claims that printers and scanners are not covered under the original ITA. AeA, "The Information Technology Agreement," June 2008.

[152] The WTO has acceded to complaints from the United States, Japan, and Chinese Taipei, establishing a Dispute Settlement Body (DSB) on September 23, 2008. The complaint is still pending at the WTO. USTR, "USTR's 2009 1277 Report," December 12, 2008.

[153] The ITA's list of signatories has increased from 29 member countries of the WTO in 1996 to 71, most of which are developing countries, as of 2008. AeA, "The Information Technology Agreement," June 2008.

[154] Delegation of the European Commission to Japan, "EU Rejects US Claims over Technology Tariffs," May 28, 2008.

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APPENDIX A
TECHNICAL GLOSSARY

A4 MFP: a multi-function product that only accepts letter sized paper and is typically thought of as a networked printer with additional copying, scanning, and faxing capabilities. These devices are capable of handling up to 8 ½ x 11 inch-sized paper.

A3 MFP: a multi-function product that accepts either letter sized or tabloid sized paper, and is typically thought of as a networked photocopy machine with additional printing, scanning, and faxing capabilities. A3 MFPs tend to cost much more than A4 MFPs and produce a much higher volume of output. These devices are capable of handling up to 11 x 14 inch-sized paper.

Aftermarket: the transactions that occur once the photocopy machine has been sold or leased. Aftermarket sales are driven primarily by the sale of replacement parts for the hardware that has already been sold.

Consumables: replaceable parts for office machinery, including copiers and MFPs. Examples include toner, ink cartridges, and drums.

Drum: replaceable component of a laser printer or MFP that generates static electricity which attracts toner and then transfers the toner onto the paper.

Electronic Manufacturing Services (EMS): companies that are frequently contracted to procure parts and assemble MFPs for the original equipment manufacturers in the MFP industry.

End user: any individual who uses or purchases a photocopy machine.

Finisher: Convenient, time-saving features that are applied in the final stages of a document's creation. Examples include stapling or double-sided printing (duplexing). Most commonly associated with high-end copiers.

Fuser: device that applies heat and pressure to permanently meld the toner onto the page.

Managed Print Services (MPS): services intended to reduce the costs of workgroups by monitoring device usage and determining the most efficient methods to save paper, ink, and energy consumption.

Multifunction Product (MFP): Digital devices that consolidate the functions of single-function printers, copiers, fax machines, and scanners into one unit.

Network Printing/Copying: the ability for multiple users in a network to print or copy through the shared network connection versus a direct cable connection. Networked MFPs and photocopy machines tend to be high-end devices that are associated with medium-sized to large workgroups.

Original Equipment Manufacturers (OEMs): Companies that design, manufacture, and distribute photocopy machines and related equipment.

Photocopy machine: An MFP with a larger copy machine engine capable of outputting more pages at higher speeds than a print-centric MFP. Also distinguished from a print-centric MFP by the number of finishing options, including collated copying, stapling, dual-sided printing, etc.

Restriction, Authorization, and Restriction of Chemicals (REACH): an EU directive requiring companies importing or manufacturing more than one ton of chemicals inside the EU to register the substances with the European Chemicals Agency.

Restriction of Hazardous Substances (RoHS): policy implemented by both the EU and China that prohibits the use of a number of chemicals (including lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether) to assemble MFPs and related equipment.

Toner: a powder-based consumable associated with laser printers and MFPs. The powder is melted onto the paper to produce permanent images on the paper. Toner is most often contained in replaceable cartridges.

Workgroup: Group of end users who are may share a network connection, typically work in close proximity to each other, and can range in size from 5 to 1,000.

Sources: Wikipedia.com and The Ascher Group, LLC. "Copier Central,"
http://www.theaschergroup.com/copier_central.htm.

APPENDIX B

MFPs and Related Consumables: Harmonized Tariff Schedule Subheading, Description, U.S. Col. 1 Rate of Duty as of Jan. 1, 2008

Photocopy machines and related equipment: Harmonized Tariff Schedule subheading, description, U.S. col. 1 rate of duty as of Jan. 1, 2008

2009 HTS subheading	Description	Col. 1 rate of duty as of Jan. 1, 2009. General
		Percent
8443.31.00	Multifunction units (machines which perform two or more of the functions of printing, copying, or facsimile transmission, capable of connecting to an automatic data processing machine or to a network)	Free
8443.99.50.11	Ink cartridges for subheading 8443.31	Free
8443.99.50.15	Other (unspecified MFP consumables)	Free

Source: U.S. exports and imports compiled from official statistics of the U.S. Department of Commerce.