



**American
Forest & Paper
Association**

Documenting the Value of Paper: Literature Review

Prepared by AF&PA
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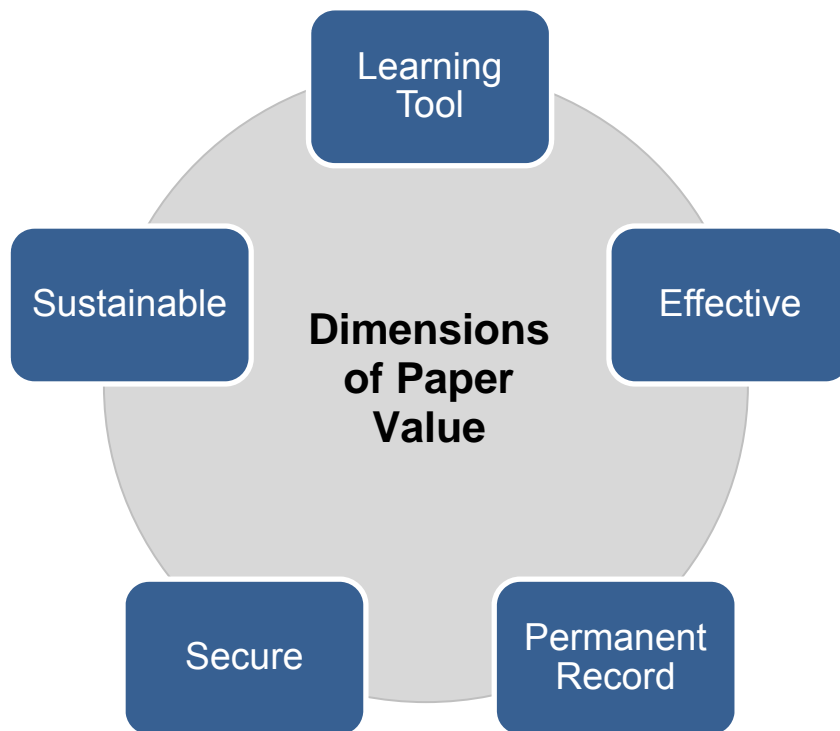
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The Value of Paper

Executive Summary

While the roots of paper use trace back to the beginning of the first millennium, paper remains a relevant part of our modern everyday lives. As demographics tip toward a new generation of digital natives, paper-based media is still an important and essential component of multi-channel communications.

So that the strong value proposition that paper offers does not get forgotten or confused, we compiled this literature review to document for our members and their customers the valuable contribution that paper makes to enriching and improving many dimensions of our lives. Paper informs, reaches customers, creates a permanent record of the milestones in life, provides secure documentation, and offers a sustainable option that no other medium can match.



The message is clear -- paper has value, and the following pages demonstrate some of the finest examples.

■ Paper as a Learning Tool

Reading and learning from reading are complex processes. From our initial experiences learning to read, to getting a college education and engaging in work at our jobs, we rely on our ability to comprehend, remember and make use of what we read. The skills and strategies we are taught to employ while reading have developed over centuries of interaction with print on paper. As a result, our reading skills and strategies are not simply tied to the written word, but are also intimately tied to the medium of paper. Over the years, paper has proven to be a particularly potent learning tool and continues to be the most effective medium for reading.

Paper-based materials promote reading comprehension, information retention, and learning for students.

- In a study of 6th graders reading e-books and paper-based books, researchers found that the students who read print books had “better reading comprehension of the text, performed better on quizzes about the content of the material, and suffered less eye fatigue. Students expressed a preference for paper-based books.” (Jeong, 2012)
- “When eighth-grade students were asked to extrapolate information from science and social studies texts read in either paper or electronic format, it was found that students reading digitally performed worse than those reading traditional texts when recalling and identifying specific details, main ideas, and supporting details from their text.” (Fisher, Lapp, and Wood, 2011, cited in Schugar, Schugar, and Penny, 2011)

Students commonly employ 5 different reading strategies, and frequently switch between them, while engaging with a text academically. Paper is superior to electronic text in supporting these strategies.

- In the University of Washington’s Amazon Kindle Pilot Study, researchers testing the Kindle e-reader “found it difficult to switch between reading techniques, such as skimming an article’s illustrations or references just before reading the complete text. Students frequently made such switches as they read course material in print.” (Hickey, 2011).
- In fact, the Kindle was found to hinder readers’ abilities to utilize 4 of the 5 common reading strategies -- skimming, scanning, search reading and responsive reading. (Thayer et al., 2011, cited in Olsen, Kleivset and Langseth, 2012, p. 4)
- In Princeton University’s Amazon Kindle Pilot Study, it was concluded that retention of information was decreased when using a Kindle e-reader due to its lack of flipping and skimming functionality. These functional limitations of the e-reader also made it more difficult to review material later in semester. (The Trustees of Princeton University, 2010, p. 3)

- Students felt that "flipping through the pages" in print would continue to be important in order to get a general sense of a text's content and organization prior to reading it more fully. (Marmarelli and Ringle, 2010a, p. 4-5)
- Several studies cited the lack of skimming functionality in e-texts and e-readers as problematic for students. (Clark et al., 2008; Foasberg, 2011; Mallett, 2010)

College students prefer paper-based reading materials to electronic for academic work.

- Students prefer to study using print texts rather than study on screen. (Ackerman and Goldsmith, 2011)
- In a study of undergraduate students at the College of Mount Saint Joseph, 66% of respondents preferred using a book in print format over electronic (Gregory, 2008)
- A study of 91 undergraduate students found that they do not prefer e-texts over print textbooks "regardless of their gender, computer use or comfort with computers." (Woody, Daniel and Baker, 2010).
- In a 2009 Student Public Interest Research Group survey, 70% of students preferred print textbooks to e-texts "when cost was not a factor." (Weinman, 2009)
- Two surveys of first year dental students conducted at Louisiana State University Health Sciences Center School of Dentistry found that 66% and 57% of students preferred reading print textbooks over e-textbooks. They preferred print textbooks for reading large amounts of text. (Brunet et al, 2011)
- In a study conducted at Oxford University, undergraduate students preferred print over electronic for reading lengthy text. (Keller, 2012)
- Research at the University of Agder revealed that 54% of students preferred print on paper for academic study. 28% preferred a combination of print and e-reader and 11% preferred using an e-reader. (Olsen, Kleivset and Langseth, 2012)
- In online interviews with 600 Millennials conducted by TRU research, 78% of interviewees preferred print over electronic books. (TRU, 2011)

Some of the most effective tools in a student's arsenal are "active reading" strategies such as bookmarking, highlighting, note-taking and annotating text. Print-based texts are superior to e-texts and e-readers in facilitating the use of these strategies.

- Active reading strategies help students identify what information is important, think about and assimilate information, and facilitates review of materials during activities like studying, organizing a term paper, discussing readings in class, and reviewing for exams.
- Print-based texts are "well suited to student needs" because highlighting and annotating can be performed right on the paper. (Demski, 2010, p. 3; Fisher and Harris, 1973; Wesley, 2012)

- A researcher at the University of Washington has shown that writing by hand, as in note-taking, activates a much larger area of the brain than keyboarding --including regions used for thinking, language, and working memory. (Bounds, 2010)
- Active reading skills are less effective with e-text than with print-based materials. (Hoseth and McLure, 2012; Schugar, Schugar, and Penny, 2011, p. 174)
- In the University of Washington's Amazon Kindle Pilot Study, researchers found that three quarters of students marked up print texts as they read. "This included highlighting key passages, underlining, drawing pictures and writing notes in margins." (Hickey, 2011)
- Participants in the Ohio State University Kindle Pilot Study rated the e-reader poor for annotating e-text. (Noble, 2010)
- Participants in the Princeton University Kindle Pilot Study rated print-based texts more highly than e-texts for their ease of highlighting, annotating, and navigation within and between documents. (The Trustees of Princeton University, 2010, p. 3)
- The Reed College Kindle Pilot Study revealed, "the use of PDFs renders many of the functions of e-readers unusable, such as annotation, highlighting, text-resizing, and text-to-speech." (Marmarelli and Ringle, 2010, p. 4)
- Researchers for the Princeton University Kindle Pilot Study noted that "students want to 'skim' or 'flip' rapidly through a reading to see highlights and notes" and that print textbooks facilitate these review behaviors better than the Kindle e-reader. (The Trustees of Princeton University, 2010, p. 5)
- A survey of students using e-texts in engineering courses revealed user dissatisfaction with highlighting, note-taking, and note sharing. (Carter et al., 2012)

The classroom experience is enhanced by print-based textbooks, which allow students to easily follow along with lectures and participate in class discussions.

- Students can more effectively follow along with a classroom lecture or participate in a class discussion when they can quickly flip to the correct page or passage being discussed. With e-readers students find it difficult to navigate between sections.
- "When reading traditional books, it's easy to take the act of flipping pages for granted; it's an inherent part of the process. In academic reading, it's also essential. Whether students are studying for exams, comparing passages in separate texts, or following along in class, they need to be able to thumb quickly through their books so they can access the information they need." (Demski, 2010, p. 4)
- Students frequently need to view more than one text at a time, both in class discussion and when studying (The Trustees of Princeton University, 2010, p. 5). This is difficult to do with e-texts, because e-reading devices often do not allow more than one reading to be viewed on the screen at a time.
- In the Reid College Kindle Pilot Study, "three courses in the study were upper-division seminars centered around careful reading and discussion of the assigned texts; in such courses, students typically are expected to support their claims with specific textual evidence, and everyone in the class needs to be able to quickly locate the same passages in the texts in order to keep the discussion moving. The Kindle DX did not

facilitate either of these needs because of the difficulty of navigating from one point in a text to another.” (Marmarelli and Ringle, 2010, p. 5)

- In the Arizona State University Kindle Pilot Study, students found page-flipping difficult with the e-reader and remarked that it was a problem in the classroom, where they need to be able to quickly locate text passages being referenced by their professor (Demski, 2010, p. 5). Similar results were found in the Princeton Kindle Pilot Study. (The Trustees of Princeton University, 2010, p. 3)
- A Kindle Pilot Study at the Ohio State University noted that the lack of page numbers in e-texts accessed on the e-reader made it difficult for students to follow class discussion. (Noble, 2010)

College students engage deeply with texts – they read, study, assess, discuss, critique and create their own written products from them – so it is important that they have access to the format that delivers the best learning outcomes. Paper-based books and readings are more conducive to success in an academic setting than their electronic counterparts.

- In a comprehensive study of students at 5 major universities (Cornell University, Indiana University, University of Minnesota, University of Virginia and University of Wisconsin), most students expressed a preference for print textbooks, and generally had a negative experience with e-texts.
 - 54% of Wisconsin students reported print textbooks provided a better learning outcome than e-texts. (Internet2.edu, 2012, p. 23)
 - Negative aspects of e-texts included “poor readability, eyestrain, insufficient resolution for graphics, zooming and scrolling difficulties, difficulty annotating, not readable on some mobile devices, and a dislike of reading on a computer or other device.” (Internet2.edu, 2012)
 - Minnesota students reported they would only purchase an e-text in the future if it were the cheapest option. Some would not buy an e-text regardless of cost (Internet2.edu, 2012)
 - Minnesota faculty expressed the belief that e-texts did not enhance student outcomes. Some professors reported that their students actually read less than their counterparts reading a print textbook. As a result, faculty preferred printed texts for class instruction. (Internet2.edu, 2012,p. 24)
- The results from the Kindle Pilot Studies at Reed College, Princeton and UVA “found the device unsuitable for the rigors and expectations for college-level teaching and learning. Researchers cited issues with text formatting (PDFs), highlighting and annotating, as well as text skimming and previewing as issues and reasons why these devices could not meet academic demands.” (Schugar, Schugar, and Penny, 2011 p. 178)
- A professor in the Reed College Kindle Pilot Study “felt that his students’ comprehension of the reading materials suffered from use of the Kindle DX. He speculated that the difficulty students encountered with highlighting and taking notes on the device eventually caused them to read passively, thereby reducing their ability to reflect on and retain complex information. He saw evidence of this in assignments as well as in class discussion.” (Marmarelli and Ringle, 2010, p. 6)

- In the UC Library’s Springer E-book pilot study, “Many undergraduate respondents commented on the difficulty they have learning, retaining, and concentrating while in front of a computer.” (Li, 2011)
- In a pilot study conducted with students from Cranfield University and The Open University, students reported that e-readers “were limited by their functionality and did not fit in with their current study practices.” (Mallett, 2010)
- Research at Gettysburg College found that students find e-readers awkward for classroom use. (Foster and Remy, 2009)

Reading on screen is fundamentally different than reading on paper. When people read on screen, they spend less time actually reading, and more time browsing and scanning text, which leads to less comprehension and recall.

- “The average times that users spend on e–book and e–journal sites are very short: typically four and eight minutes respectively. It is clear that users are not reading online in the traditional sense, indeed there are signs that new forms of ‘reading’ are emerging as users ‘*power browse*’ horizontally through titles, contents pages and abstracts going for quick wins. It almost seems that they go online to avoid reading in the traditional sense.” (Rowlands, *et al.*, 2008, cited in Cull, 2011).
- “A typical ‘*screen–based reading behaviour*’ is emerging, characterized by more time spent on ‘browsing and scanning, keyword spotting, one–time reading, non–linear reading, and reading more selectively’, while less time is spent on in–depth reading, and concentrated reading.” (Z. Liu, 2005, cited in Cull, 2011)
- “It has been suggested that speed reading and browsing —typical online reading behaviour — results in an overall decline in the level of comprehension.” (Dyson and Haselgrove, 2000, cited in Cull 2011)
- “When online, people switch between two poor kinds of reading — ‘*tunnel vision reading*’ in which one reads a single bit of text without a sense of the context, and ‘*marginal distraction*’, which happens, for example, when a person reads textual feeds on the sidebar of a Web site such as a blog.” (A. Liu, *et al.*, 2009, cited in Cull, 2011)
- “When working with digital information people also switch activities every three to 10 minutes, pointing to an obvious conclusion: ‘It is just not possible to engage in deep thought about a topic when we’re switching so rapidly.’” (A. Liu, *et al.*, 2009, cited in Cull 2011)
- A study of college students at Oxford University found: “All participants agreed that reading on screen was different than reading in print. The general opinion was that reading on screen was conducive to a more *superficial reading style*. Students used terms like ‘skimming’, ‘browsing around’ or ‘reading quickly’ when talking about reading on screen. Attention span and reading sessions were shorter. Someone described them as ‘short bursts’; texts were often not read linearly or to the end.” (Keller, 2012)
- These students reported that with e-texts they generally read short passages only, and usually in a non-linear fashion. (Keller, 2012)
- They also reported it required more effort to concentrate when reading on screen. (Keller, 2012)
- Mark Bauerlein, author of *The Dumbest Generation*, notes that onscreen reading impedes intellectual processes: “We need to recognize that screen scanning is but one

kind of reading, a lesser one, and that it conspires against certain intellectual habits requisite to liberal-arts learning. The inclination to read a huge Victorian novel, the capacity to untangle a metaphor in a line of verse, the desire to study and emulate a distant historical figure, the urge to ponder a concept such as Heidegger's ontic-ontological difference over and over and around and around until it breaks through as a transformative insight — those dispositions melt away with every 100 hours of browsing, blogging, IMing, Twittering, and Facebooking.” (Bauerlein, 2008)

Readers “information graze” on screen, rather than actively engage in reading as they do when reading from paper.

- A study by Rowlands et al. (2008) found that “although young people demonstrate an apparent ease and familiarity with computers, they rely heavily on search engines, view rather than read and do not possess the critical and analytical skills to assess the information that they find on the web.”
- “Several studies of college student use of e-books indicates they use text search features to focus in on brief passages, tend to skim e-book content, and generally do not read an entire e-book cover to cover unless it is for a literature course.” All of these practices can limit recall. (Hoseth and McLure, 2012)
- In a review of the scholarly literature on e-books, Staiger found “academic users typically search e-books for discrete bits of information, a behavior summed up by the formula ‘use rather than read’.” (Staiger, 2012)
- People who read on screen “tend to skim, bounce from source to source, and hunt and peck for information.” (Wexelbaum, Miltenoff, and Parault, 2011)
- In the CIBER survey, 55% of students indicated they “dipped in and out of several chapters” while only 6% indicated they read the entire book. (Wexelbaum, Miltenoff, and Parault, 2011)
- “Web site users tend to browse pages rapidly, and read only about 20 percent of the text on an average page.” (Nielsen, 2008; Weinreich, *et al.*, 2008; both cited in Cull, 2011).
- According to the CIBER study, on average, readers only spend about four minutes on a particular e-book site. (Wexelbaum, Miltenoff, and Parault, 2011)

Print resources are perceived as more authoritative than electronic resources.

- Students at Oxford University generally believed that there was something “a bit more authoritative about print” than electronic text. “Printed media were more likely to get the facts right; electronic texts were perceived as more ephemeral or disposable, containing ‘so much trivial stuff’.” (Keller, 2012)
- In online interviews with 600 Millennials conducted by TRU research, interviewees considered print documents more official and more trusted than electronic documents. (TRU, 2011)

Technical limitations of e-readers and certain features of e-books have a negative impact on reading comprehension and recall.

- The screen size of e-readers, poor zoom capabilities, difficult to read graphics, and the use of continuous scrolling to navigate texts (particularly in PDF format) make it difficult for students to make use of text features and cognitive mapping to retain information.
 - Text features (such as chapter and section headings, captions, illustrations, charts, tables, and graphs) help readers comprehend and remember what they've read. (Fisher and Frey, 2008; Morrison and Nunnery, 2011; Yang, Chen and Li, 2011).
 - "Cognitive mapping" is a technique in which readers use text features and physical cues such as the location of information on the page and the position in the book to go back and find a section of text or even to help retain and recall the information they had read. Cognitive mapping is more difficult with e-texts. (Hickey, 2011)
- Some of the common features and content of electronic storybooks are distracting to young readers, may lead to passive participation in reading, and may reduce reading comprehension when compared to paper-based materials. (Zucker, Moody, and McKenna, 2009; Moody, 2010).

Print newspapers remain more popular with readers than digital newspapers and promote greater recall.

- The World Association of Newspapers and News Publishers (WAN-IFRA) reports that over 2.5 billion people read print newspapers at least once a week, versus 100 million who read digital newspapers exclusively. 500 million read both print and digital newspapers. (RIT, 1/1/2013)
- In a study of 45 consumers reading a newspaper either in print or on the web, it was found that the group reading the print version remembered significantly more of the topics presented and more of the main points contained within the stories. (Santana, Livingstone and Cho, 2011)

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■ Paper as an Effective Medium for Reaching Customers

In an era when many businesses are pouring resources into Internet marketing plans, paper continues to be a very effective medium for reaching customers. Surveys show that consumers of all ages still prefer paper-based advertising to electronic formats. Print advertising continues to have a greater influence on buyer behavior than electronic, even among Millennials. Consumers look forward to receiving and reading print advertising while they find email and Internet targeted advertising unappealing.

Consumers use print more often than electronic advertising to become aware of, and become familiar with, products prior to purchase decisions.

- In a Shopper Sciences national study commissioned by Google, 5 of the top 6 marketing types consumers reported as increasing their awareness and familiarity with a product or service were paper-based (TV commercial: 37%; Direct mail or catalog from brand/manufacturer: 31%; Newspaper ad/newspaper insert: 29%; Newspaper article/review/information: 28%; Magazine article/review/information: 27%; Magazine advertisement: 24%). (RIT, July 2011).

Direct Mail is effective for businesses communicating with customers - for customer contact, retention, and acquisition.

- According to Target Marketing Sixth Annual Media Usage Forecast which surveyed 350+ marketers, direct mail is the channel cited most by B2C direct response marketers as delivering the strongest ROI for customer contact and retention (37%) and acquisition (34%), followed by email. (RIT, 3/1/2012)

Consumers prefer print advertising to electronic advertising.

- A Dunham+Company survey reveals that print solicitations are driving online giving, not online solicitations. Donors are 3 times more likely to donate to a non-profit online after receiving a direct mail letter than after receiving an email request. (RIT, 5/27/2012)
- A study of over 2,500 Internet users conducted by the Newspaper Association of America (NAA) found that 73% of respondents had used newspaper printed circulars within the previous month. Respondents especially preferred print circulars over electronic marketing because of the greater portability and ease of scanning of print coupons. (RIT, 4/12/2012)

Direct mail marketing is effective and popular with consumers.

- A Marketing-GAP survey of 1,140 UK consumers revealed 80% of respondents open direct mail. (RIT, 10/3/2012)
- 74% of consumers surveyed by Pitney Bowes in the US, UK, Germany, and France “welcome a monthly offer sent to them via postal mail.” (RIT, March 2012)
- According to the *DMA 2011 Statistical Fact Book*, over 50 % of U.S. consumers report they read direct mail received from retailers and find it useful. Sales driven by direct mail other than catalogs increased \$20 billion from 2010 to 2011. (RIT, 2011)
- Nielsen research reveals that 67% of surveyed consumers read direct mail at least once a week to spot sales and promotions. (RIT, 7/5/2011)
- When these same Nielsen respondents were asked how they preferred to receive advertisements in the future, the top 3 categories were all paper-based: direct mail (87%), newspapers (86%), and in-store print advertising (86%). (RIT, 7/5/2011)

Those who receive print catalogs in the mail spend more money on online purchases than those who do not.

- A 2009 USPS commissioned study, found a \$21 million difference in online sales per million site visitors between those who had received a catalog at their home address and those that had not. Households receiving print catalogs shop online more often, spend more meaningful time at retail websites, and were found to be twice as likely to make an online purchase. (RIT, 2009).

Paper catalogs have more influence on what consumers buy, both online and in stores, than social media or mobile advertising.

- A survey of 1,000 holiday shoppers who own smartphones revealed that paper catalogs had a greater influence on shoppers’ purchase decisions --both in-store and online -- than mobile advertising, facebook, twitter and pinterest. Print catalogs were also more influential than promotional e-mails for in-store shoppers. (RIT, 1/8/2013)

Consumers do not like online behavioral marketing.

- TRUSTe’s 2012 *U.S. Online and Mobile Privacy Perceptions* report shows that consumers are uncomfortable with online behavioral advertising (RIT, 7/16/2012):
 - 58% report they 'do not like' online behavioral advertising.
 - 40% report at least one targeted advertisement has made them feel uncomfortable.

- 50% plan to opt out of online behavioral advertising to protect and manage their privacy, up 23% from 2011.
- 53% believe personally identifiable information is attached to browsing behavior.

Newspaper advertising (including circulars) is the leading advertising medium cited by consumers in planning, shopping and making purchasing decisions.

- Data from “How America Shops and Spends 2011,” a Newspaper Association of America survey of 2,500 U.S. adults showed 79% of respondents “took action” as a result of newspaper advertising in the previous month, including: clipping a coupon (54%); making a purchase (46%); going online to learn more (37%); and trying a new product or service for the first time (20%). (RIT, April 2011)
- In a BrandSpark/BH&G survey of over 75,000 U.S. consumers focused on which sources they rely upon to get shopping ideas, 66.9% of respondents listed circulars and flyers; 29.2% listed newspapers; 25.1% listed websites. (RIT, 1/24/2013)
- Nielsen research reveals that 69% of surveyed consumers read newspapers at least once a week to spot sales and promotions. (RIT, 7/5/2011)

90% of grocery retailers consider weekly circulars their top promotion vehicle of choice.

- In addition, print takes the top three spots in ratings of effectiveness, with retailers listing circulars (newspaper and mail-delivered) and direct mail as the leading drivers of sales. 75% of grocery retailers get increased results from print circulars, with 50% reporting increased sales and 25% reporting increased customer retention. (RIT, 7/9/2012)

Print sources are more effective than electronic sources at driving QR code traffic.

- In a Pitney Bowes survey of 5,000 smartphone users, respondents indicated they have accessed QR codes from magazines (15%), mail (13%), product packaging (13%), and posters (10%). Websites, email, and television were used to access QR codes by 8%, 5%, and 4% of respondents, respectively. (RIT, 1/15/2013)

Online advertising has less impact on Millennials than advertising in “offline” media such as print, TV and radio.

- In a survey of nearly 2,500 young adults (aged 12-17) in the U.S. and Europe conducted by Research Now, respondents were asked to rate online versus offline advertising (including print, TV, and radio). Respondents were twice as likely to:
 - discuss offline ads with friends;
 - be introduced to a product they later purchased by offline advertising;
 - be annoyed by online ads;
 - try to ignore online ads. (RIT, 2/26/2013)
- In the Research Now survey, Millennials were four times more likely to remember offline ads for a long time than online ads (50% vs. 12%). (RIT, 2/26/2013)

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■ Paper as a Permanent Record for Milestones in Life

Paper plays a vital role in documenting our lives, both on an official level and a personal one. Most official documents are paper-based and serve as proof of who we are, what we have achieved and what we own. Examples include birth certificates, identification cards, social security cards, high school and college diplomas, transcripts of courses we have taken, professional licenses, the deeds to our homes, and the titles to our cars. On a personal level, paper captures, documents and preserves the milestones we achieve and the memories that matter to us: a child's baby book; report cards from school; our children's artwork proudly displayed on the fridge; a personal diary; handwritten letters and cards we have received; an album full of photographs of families, friends, holidays and celebrations. With such intimate ties to the things that matter so much in our lives, it's no wonder that we have a strong emotional attachment to paper.

Paper is used for official documents.

- Traditional certificates are designed to establish and document characteristics belonging to a specific individual, be it an identification number (i.e., social security number, driver's license number), a level of achievement (i.e., college degree, license to practice a profession), or membership status (i.e., company ID, trade union card).
- Official documents, issued by federal, state and local governments are almost entirely in paper. That is because paper is considered to be secure, particularly if it contains watermarks, official seals, or other marks that verify they have not been altered or faked.
- The same is the case with those documents provided by schools and colleges, such as official transcripts.
- In 600 online interviews with US Millennials (aged 16-26) conducted by TRU research, 82.7% of interviewees believe that digital is easier to modify than print and therefore they consider paper more official and more trusted. (TRU, 2011)

Millennials prefer paper over digital for official documents.

- In 600 online interviews with US Millennials (aged 16-26) conducted by TRU research, data revealed that paper is the preferred format for official documents by a majority of respondents: 83% preferred paper for diplomas; 75% for business cards; 75% for contracts or documents requiring a signature; 71% for confidential documents (TRU, 2011).
- In a survey of 4,500 European consumers conducted by IPSOS, 63% of 18-24 year olds prefer paper for official documents (RIT, 11/2011)

Many of life's meaningful personal moments are recorded on paper.

- People tend to save the papers that serve as mementos of their lives.
- Photographs are particularly tied to personal moments, memories, and emotional connections.
- Personal communications, such as handwritten letters, postcards, and greeting cards let us know how someone is doing and that they are thinking of us.
- In a survey conducted for the Greeting Card Association, nearly a third of respondents reported that they keep special cards they receive forever. (PAPERbecause)
- A survey on US consumer attitudes towards envelopes found:
 - Americans believe envelopes are “engines of emotion” that touch us, connect us and move us.
 - 84% believe the “envelope is a trusted way to leave a memorable impression”;
 - 83% believe they “keep friends and family connected wherever they may be”;
 - 82% believe “envelopes touch our lives every day, everywhere”.
 - 62% percent who prefer to send greeting cards in an envelope say the top reason is because they’re “more personal” than electronic and “It’s an expression of how much I care” as the next reason. (EMA, 2006)

People associate paper with achievement.

- In a reader response to an article appearing in the *Chronicle of Higher Education* (“For many students, print is still king”), online respondent Professor Keith Williams points out that accumulating a personal library represents intellectual accomplishment for students and professors: “...The truly valuable books are traditionally treasured and displayed on a shelf, where they represent real accomplishment to anyone who sees them in [a] collection. We dust them off every now and then...and we share them many years after they are out of print. At some point in our studies, it starts to make sense to accumulate the really important books and build a library. I like to have an office full of books.” (*online response to Howard, 2013*)
- Our achievements are documented on paper and are such important symbols that we hold on to them for a long time, including report cards, diplomas, certificates of achievement, and letters of commendation.

People have a strong emotional attachment to paper.

- In online interviews with 600 Millennials, interviewees expressed a strong emotional attachment to paper.
 - 92% feel paper is more sentimental than electronic
 - If forced to choose a print versus an electronic version, they prefer print:
 - 55% prefer a handwritten letter over an email;

- 57% prefer a mailed invitation over an evite;
- 78% prefer a handwritten love note over a text message;
- 87% prefer a birthday card received through the mail over an email. (TRU, 2011)
- In a study of college students at Oxford, a great love of books on paper was reported by respondents. “Childhood memories and family traditions led to a *desire to read and own printed books and build collections*. Bookshelves were an important part of people’s lives, to the point of becoming part of their identity.” (Keller, 2012, p. 9)
- In a survey of 4,500 European consumers conducted by IPSOS,
 - 80% of respondents find “reading from paper is nicer than reading off a screen.” Among 18-24 year olds, the rate rises to 83%.
 - 74% find paper is more pleasant to handle and touch than other media (78% of 18-24 year olds). (RIT, 11/2011)
- Research shows our mood can increase by up to 29% when touching something tactilely pleasant like paper, and by up to 46% when viewing something visually pleasing, such as a photograph. (Mail Media Center, 2008)
- Julie K. Bartley, chair of the geology department at Gustavus Adolphus College, notes: “Our students don't really want to have e-books. What I hear from them a lot of times is that they feel some sort of comfort in being able to hold the thing in their hands.” (Howard, 2013).

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■ Paper as a Secure Form of Documentation & Communication

Paper is a secure form of documentation and communication in more than one sense. First, it is a secure format for storing information for the long term. It does not easily break down or fall apart over time and can last for centuries. The only equipment you need to retrieve the information stored on paper is your eyes – no source of electricity, computer or internet connection required. Second, personal and business information is generally more secure on paper, where it is safe from hackers and computer viruses. Consumers are concerned about the increasing number of data breaches at organizations that store personal information electronically that can lead to identity theft and fraud. Businesses, too, are concerned about data breaches and theft of their information assets. It is no wonder that many people prefer to receive financial materials in print rather than electronically. Third, electronic copies of important financial records supplied by banks and credit card companies may only be available for a finite time versus paper copies of these records, which can be kept safe and accessible in home filing systems.

Information stored on paper is easily accessible and does not need extensive ongoing monitoring. With digital storage media, however, the need for machinery and software to access the data requires ongoing maintenance.

- Digital storage media needs to be monitored for physical degradation over time.
- The equipment needed to access the information stored on digital media needs to be kept in working order.
- As software, operating systems and hardware change over time, the data stored on digital media needs to be updated or migrated to other media formats to ensure it can continue to be accessed.
- Other concerns with digital storage media include: the loss of functionality of access drives; the need for both analog and digital backups; the obsolescence of data formats, storage media, and the equipment necessary to access the data; media and hardware failures; software failures; communication channel errors; and network service failures. (Gladney, 2007; Ross, 2012)

Nearly two thirds of all Americans and three quarters of Millennials have fallen victim to some type of cybercrime.

- According to research conducted by computer security giant Norton, in 2011, 431 million adults in 24 countries were victims of cybercrime, and over 1 million people become victims each day. (Norton, 2012)
- 54% of survey respondents have had their computers infected by malware and/or viruses; 11% have been victims of online scams; 10% have been victims of phishing schemes; and 10% have experienced cybercrime on their smartphones. (Norton, 2012)
- 44% of Norton survey respondents were victims of a cybercrime in the previous 12 months, while only 15% reported being victims of an offline crime. (Norton, 2012)
- 35% of adult respondents are fearful of being a victim of cybercrime while online. (Norton, 2012)
- Norton estimates global consumer losses of \$388 billion to cybercrime (\$114 billion in financial loss and \$274 billion worth of their time to deal with the fall out of cybercrime) in 2011 (Norton, 2012)

Online privacy is an ongoing concern for consumers.

- The *2012 U.S. Online and Mobile Privacy Perceptions Report* produced by privacy management solutions provider, TRUSTe shows that:
 - 94% of respondents consider privacy an important issue.
 - 55% of respondents often think about online privacy.
 - 60% are more concerned about their online privacy now than a year ago.
 - 69% say that they trust themselves most when it comes to protecting their own personal information online (up from 45% in 2011).
 - 76% do not allow companies to share their personal information with a third party (up from 67% in 2011).
 - 35% say they have stopped doing business with a company or using their website because of privacy concerns. (RIT, 7/16/2012).

Electronic forms of communication, document sharing and document storage are less secure than their paper counterparts – leading to widespread hacking, data breaches, identity theft and fraud.

- Electronic documents and forms of communication are susceptible to attack by hackers and viruses.
 - In a survey of nearly 600 U.S companies conducted by Ponemon Research, 90% of respondents reported their organizations' computers had been breached by hackers at least once in the previous 12 months.” (Ponemon Institute, 2011)
 - Close to 60% of these companies reported more than one breach during the 12-month period. (Ponemon Institute, 2011)

- Survey respondents cited serious consequences of these attacks: theft of information assets (59%); business disruption (36%); cost of data breach (21%); regulatory and legal action (19%); productivity decline (15%). (Ponemon Institute, 2011)
- Companies' intellectual property is frequently stored electronically, where it is susceptible to being misplaced or lost through poor data management, stolen by current employees, sabotaged by former employees or stolen by cyberthieves. (McAfee, Inc., 2009)
- 50% of computer users choose a single common word or keystroke combination for a password that is easy to hack. Hacker software can test for random patterns and break a password code quickly – a 6 letter, lower case password in as little as 10 minutes. (Bloomberg, 2011)
- Computer viruses can “result in the loss of information and destruction of data.” (Harris, 2002)
- Hackers often datamine organization's electronic records for individuals' private information in order to commit fraud.
 - For 2012, the following statistics on data breaches for different online segments in the US were reported: 17 data breaches, with 470,048 individual records exposed in the banking/credit/financial sector; 165 breaches, with 4,615,893 records exposed in the business sector; 61 breaches with 2,304,663 records exposed in the education sector; 50 breaches with 7,688,707 records exposed in the government/military sector; 154 breaches with 2,237,873 records exposed in the medical/healthcare sector; for a grand total of 447 data breaches and 17,317,184 records exposed. (ITRC, 2012)
 - There were 12.6 million victims of identity fraud in the US in 2012, up more than 1 million from the previous year. Online fraud and data breaches account for the majority of cases. (Javelin, 2013)
 - Some types of personal information commonly obtained by data breaches are: credit card numbers, online banking login name and password, and social security numbers. (Javelin, 2013)
- 608,958 cases of consumer fraud were reported to the Consumer Sentinel Network in 2012. Victims of fraud were most frequently targeted electronically (38% through email, 12% via websites or other internet resources) while only 9% of victims were targeted through the mail. (FTC, 2013).
- In addition to targeted hacking, electronic files can be “Google hacked”
 - Search engines and spiders scour the Internet for materials that are then indexed for searching and even archived. “For a variety of reasons -- improperly configured servers, holes in security systems, human error in where an electronic document is stored on a network -- a wide assortment of material not intended to be viewed by the public is, in fact, publicly available. Once Google or another search engine finds it, it is nearly impossible to draw back into secrecy.” (Noguchi, 2004)
- Electronic filing of federal tax returns and electronic payment of refunds has led to a skyrocketing number of identity theft tax refund fraud cases.
 - According to the Government Accountability Office, the IRS identified 1,078,000 fraudulent returns in 2012 (642,000 cases plus an additional 436,000 fraudulent returns for citizens of Puerto Rico). It is estimated that 1,500,000 fraudulent returns make it through the system undetected annually. (Novack, 2013).

- The Consumer Sentinel Network received over 2 million complaints in 2012; the largest single category for 5 years running has been identity theft complaints. 43% of reported identity theft cases involved Federal tax or wage related fraud. (FTC, 2013).

People prefer to receive financial statements and bills in paper format.

- A survey of more than 5,000 US households conducted by Phoenix Marketing International found that:
 - 71% of consumers open print financial statements and bills mailed to them
 - 65% prefer a print copy of their bill or statement
 - about 25% of households don't make electronic payments of any kind
 - Identity theft is making people cautious about switching to electronic payments. "The more security breaches there are the more people prefer paper," said PMI President Leon Majors.
 - 37% of respondents use mail as their primary method of paying bills. (RIT, January 2012)
- Research on the use of paper by Millennials found that even though 79% of interviewees receive bank statements electronically, 63% print out paper copies of these and other electronic records for their files (TRU, 2011).
- The IRS can audit personal tax returns for up to 3 years and cautions consumers to keep financial records and copies of previous returns for at least that long. Those who bank online may not have access to 3 years worth of previous monthly electronic statements or to images of cancelled checks. (Laise, 2007).
- In a poll of 1,000 registered voters, 72% of respondents want the federal government to continue to issue paper copies of important personal documents, including Social Security checks, annual earning statements and federal tax forms. (Consumers for Paper Options, 2011).
- A survey of UK consumers conducted by Royal Mail revealed that consumers prefer paper banking and billing statements over electronic statements:
 - 73% would feel "inconvenienced and annoyed" if paper statements were discontinued
 - when given a choice, 75% of respondents elect to receive paper statements or a combination of paper and electronic.
 - 65% of respondents who prefer paper statements would consider taking their business elsewhere if a bank or company discontinued the option for print statements (Post & Parcel, 2010)

People trust paper.

- Online interviews with 600 Millennials (TRU, 2011) found:
 - 88% consider paper more official;
 - 82% consider paper more trusted;
 - 78% consider it easier to keep paper confidential;

- 74% consider paper safer / more secure;
- 77% believe digital is less trustworthy because it can be altered without your knowledge.

People prefer to keep important documents on paper.

- In a survey of 4,500 European consumers commissioned by Two Sides and Print Power, 63% of 18-24 year old respondents, and 58% of all consumers, prefer to keep important documents on paper. (RIT, 11/2011).
- Online interviews with 600 US Millennials conducted by TRU research revealed that 90% prefer paper copies of important documents (TRU, 2011).
- In a survey of 5,000 consumers conducted by Two Sides, 70% of US respondents prefer to keep important documents on paper. (Two Sides, 2011)

Paper is a stable format with a long shelf life, which makes it ideal for archiving or warehousing information and official documents. Digital storage media, on the other hand, generally have relatively short shelf lives.

- According to a recent survey commissioned by Two Sides, a non-profit organization, 68% of those surveyed believe that paper records are more sustainable than electronic record storage. (RIT, 1/18/2012)
- In a review of multiple studies on storage media, Lunt provides the following life expectancies for data stored in different digital storage formats: magnetic tape, 10-50 years; magnetic hard disk drives, 1-7 years; flash drives and solid state drives, 10-12 years; recordable optical discs [CD, DVD, Blue Ray], 1-25 years. (Lunt, 2011)
- Certain laws require the keeping of records and documents in print.
 - A number of states in the US and foreign government agencies do not recognize scanned images of a document as an original. (Jedd, 2006)
 - Human resources departments hold on to paper records due to recordkeeping requirements stated by federal employment laws and many state laws. (Thelen, 2009)

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■ Paper as a Sustainable Choice

Consumers are subject to a barrage of negative messaging about the sustainability of paper-based communications, with many believing that using paper causes deforestation and is bad for the environment. The truth is that paper comes from an infinitely renewable resource and is a sustainable choice. Paper originates from trees, which are sustainably grown and harvested to make products that are recyclable, made with carbon neutral biofuels, and often contain materials recovered from other manufacturing operations. In addition to incredibly efficient manufacturing methods, the paper industry is further committed to sustainability through the establishment of one of the most extensive, quantifiable set of sustainability goals, put forth by a U.S. manufacturing industry-- *Better Practices, Better Planet 2020*.

Paper has the characteristics consumers use to determine if a product is environmentally friendly and responsible.

- “The results of a 2008 survey commissioned by SCA and conducted by Harris Interactive show the top four characteristics consumers believe make a product green or environmentally friendly are: biodegradable (81%), reusable/recyclable (81%), percent of recycled materials used to make the product (66 %) or organic (60%).” (PR Newswire, 2008)
- In a survey of 5,000 consumers conducted by Two Sides, 96% of US respondents think recyclability is an indicator that a product is environmentally responsible. (Two Sides, 2011)
- A poll by Call2Recycle indicates that “92% of respondents feel recycling is important for the Earth and 86% report feeling good about themselves for recycling.” (IPSOS, 10/12/2012)

The paper industry promotes sustainable forestry practices.

Despite public opinion, the paper industry is not the big driver of tropical deforestation.

- In a multinational survey of 5,000 consumers, 71% of US respondents believe there is a connection between paper manufacturing and loss of tropical forestland. For 18-24 year olds, this figure rises to 85%. (Two Sides, 2011)
- But the truth is the lowest rates of deforestation occur in regions with the highest rates of industrial wood harvest and forest products production, according to researchers at the USDA Forest Service Products Laboratory. (Wallace, 2011)
- Most tropical deforestation “is now driven by the expansion of large cattle ranches, commercial soybean production, oil palm plantations, and in some cases timber cutting.” (Union of Concerned Scientists, 2010)

- In the Amazon, “cattle ranching is responsible for the majority of deforestation, with the growth of large-scale soybean farming (mostly for livestock feed) running second....In Indonesia and Malaysia, rain forests are being replaced by oil palm plantations that produce a vegetable oil used in thousands of processed foods as well as biodiesel production.” (Union of Concerned Scientists, 2010)
- “The businesses clearing tropical forests today are attracted less by the available timber—in fact, they often burn the wood or leave it to rot, producing carbon emissions—than by the low cost of land that deforestation makes available”. (Union of Concerned Scientists, 2010)

While many believe the paper industry causes forest loss, the amount of forestland in the US is similar to what it was 100 years ago.

- 65% of US respondents in a multinational survey mistakenly believe that forests have decreased in size over the last 50 years. 69% are concerned about paper’s effects on forests, with 18% believing the paper industry has the largest impact on the perceived reduction of forest area. (Two Sides, 2011)
- The US Forest Service reported that as of 2007, there are over 751 million acres of forestland, roughly the same amount recorded for 1907. (Smith et al., 2011)
- The US grows more trees than it harvests. (Smith et al., 2011)
- 4 million trees are planted in the US every day. Sustainable Forestry Initiative participants alone plant 1.7 million trees a day in North America. (PAPERbecause, 2007)
- According to the USDA, “Forest-use land increased 20 million acres (3 percent) from 2002 to 2007, continuing a trend that became evident in 2002 and reversing an almost 50-year downward trend. The 14-percent decline in forest-use land between 1949 and 2002 was largely due to forest-use land reclassified to special-use areas.” (USDA, 2011)

The paper industry is committed to sourcing virgin fiber responsibly, from certified forestlands that promote and practice sustainable wood production.

- The paper industry supports and utilizes multiple certification programs including: Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC) program, the American Tree Farm System and the Programme for the Endorsement of Forest Certification (PEFC)-endorsed programs. (AF&PA)
- These certification programs provide seals of approval for wood and wood products, which guarantee that they have been procured and produced responsibly and in adherence to specific environmental principles and criteria.
- “As of 2010, about 323 million ha (8%) of the world’s 3.9 billion ha of forests were certified. Of this, the PEFC had enrolled about 63% (225 million ha) in forest management certification through participating programs, including 152 million ha in the United States and Canada. SFI had 22.8 million ha certified in the United States and 55.4 million ha in Canada. FSC had certified about 13.1 million ha in the United States and 35.4 million ha in Canada.” (Moore, Cabbage and Eicheldinger, 2012)
- In 2010, AF&PA members increased the amount of fiber they procure from certified forestlands to 24% and the fiber procured through certified fiber sourcing programs to 96%. (AF&PA)

- All AF&PA members that own forestland are required to conform to a credible sustainable forest management program. 100% of AF&PA members that source wood fiber from forests owned by others participate in credible forest certification systems. (AF&PA)
- 56% of all US forestland is privately owned. Managed forest lands utilized by the paper industry offer some major environmental advantages:
 - they are harvested sustainably and replanted, not clear cut, so there continues to be plentiful oxygen-producing, carbon-sequestering trees on the land
 - the income owners of private forestlands receive for their trees “encourages them to maintain, renew and manage this valuable resource sustainably.” If the paper industry was not creating demand for the trees land owners might find other uses for their land – such as selling it to real estate developers or converting it to agricultural use, both of which would involve permanently removing the trees and destroying the forest. (WBCSD, 2007)
 - they provide wildlife habitat.

Additionally, the paper industry opposes illegal logging and is doing its part to reduce it.

- AF&PA members support and promote efforts to reduce illegal logging in a number of ways, including: working with governments and other stakeholders to promote policies that reduce illegal logging around the world; and through participation in the Forest Legality Alliance, an international, multi-stakeholder initiative working to reduce demand for illegally harvested forest products. (AF&PA)
- Thanks to the efforts of AF&PA, its strategic partners, and stricter laws, imports of illegally harvested wood products to the United States have decreased by 24% since 2007. (Environmental Paper Network, 2011, p. 6)

The paper industry continues to increase its recovery of paper and use of recycled fiber, reducing the amount of paper that ends up in landfills.

The paper industry strives to increase the recovery rate of paper, and has been very successful in this endeavor.

- In 2010, 62.5% of paper and paperboard entering the municipal waste stream was recovered for recycling, far outpacing the rates of recovery for glass (27.1%), metals (35.1%) and plastics (8.2%). (EPA, 2011, Table 2)
- In 2011, nearly 53 million tons or 66.8 percent of the paper used in the United States was recovered for recycling, up from 33.5 percent in 1990. That’s about 338 pounds for every adult and child in the country.
- As a result, the amount of paper disposed of in landfills fell 9% in 2011, reaching 18.4 million tons, the lowest level in decades.
- Through time, the rate of recovery for paper and paperboard has not only consistently increased but also outpaced other material types. From 2000 to 2010, the rate of recovery of paper and paperboard increased by 19.7% while the increase in recovery

rate was 4.5% for glass, 0.3% for metals and 2.1 percent for plastics. (EPA, 2011, calculated from data in Table 2)

The paper industry is focused on increasing products incorporating recycled fiber.

- 42% of the material used to manufacture paper comes from recovered fiber and wood residues – wood chips and scraps left behind from forest and sawmill operations, not from the harvesting of new trees. (AF&PA, 4/2012)
- Nearly 80% of US paper mills are designed to use paper collected in recycling programs (EPA website)
- In 2010, 77% of paper and paperboard mills used some recovered paper to make new products, and 115 mills used only recovered paper. (EPA, 2011)

The paper industry provides hundreds of paper options for consumers that are certified environmentally friendly.

- As of 2011, there were more than 770 papers available in North America that are FSC-certified.” (Environmental Paper Network, 2011, p. 6)
- “As of January 2011, the EPN/Canopy Eco-Paper database shows that there are 121 different printing and writing papers available in North America rated “Environmentally Superior” by the Paper Steps, a rating system that designates leading environmental papers across multiple features. This represents approximately twice the number of similar products available in 2007.” (Environmental Paper Network, 2011, p. 6)

The paper industry is committed to reducing its impact on the environment by improving the energy efficiency of its manufacturing plants, reducing green house gas emissions, and using water responsibly in the manufacturing process.

The paper industry is decreasing its reliance on fossil fuel and purchased energy.

- AF&PA member pulp and paper mills reduced their *purchased energy* use per ton of production by 25.3 percent since 1990, and by 14.5 percent since 2000.
- They decreased their *on-site fossil fuel* use, per ton of product, by 30 percent between 1990 and 2010.

The paper industry is generating more of its own energy and focusing on carbon-neutral energy.

- About two-thirds of the energy used for production at AF&PA member pulp and paper mills comes from using carbon-neutral biomass onsite, including spent pulping liquors, bark, wood, wood scraps, wood by-products, and process residuals.
- “Biomass energy is fundamentally different from fossil fuel energy because biomass recycles carbon to the atmosphere, whereas fossil fuels introduce ‘new’ carbon. This is why biomass is called ‘carbon-neutral’”. (WBCSD, 2007)
- An additional small, but significant, amount of energy is produced by other renewable

sources such as hydropower.

- In 2010, 97.2 percent of electricity produced by the industry was generated by combined heat and power (CHP) energy – using the exhaust steam from electricity-generating turbines.
- This achieves fuel-use efficiencies of 50 to 80 percent, compared to average fossil-fueled power plant efficiencies of 33 percent in the U.S.

The paper industry is reducing its GHG emissions.

- Life cycle studies reveal that most greenhouse gas emissions from the global forest products value chain come from four sources: fossil fuel combustion at production facilities; fossil fuel combustion by electricity plants that the industry buys energy from; fossil fuel combustion associated with the transport of the industry's raw materials and products; and methane emissions attributable to the anaerobic decomposition of forest products in landfills. (Two Sides, date unknown)
- By focusing on improving energy efficiency, the paper industry is reducing its GHG emissions. Between 2005 and 2010, AF&PA members reduced their GHG emissions by 10.5 percent.

AF&PA continues to seek ways to reduce water use during manufacturing, increase water reuse and recycling, and spread information about the role of water in the paper industry.

- Ongoing technology and innovation enable water to be reused and recycled at least ten times throughout the paper mill process.
- After water is used inside the mill, it is treated in a wastewater system and then returned to the environment.
- The forest products industry directly returns to the environment about 88 percent of the surface water it withdraws and uses in its manufacturing processes, with qualities that meet, and usually exceed, that required by law in the US. (Wiegand et al., 2011).
- AF&PA participates in global water sustainability initiatives to help advance understanding of mill water use impacts, including positive economic impacts, a key component of water sustainability. (AF&PA)

Recent lifecycle assessment studies show that the difference in environmental impact between paper and electronic text is small.

- A study by Moberg et al. compared emissions for producing and reading a print newspaper, an e-paper accessed on an e-reader and a web-based paper accessed on a pc. The power grid used to power the electronic devices was found to be a major factor in overall emissions. Depending on type of environmental impact assessed, the web-based paper had the larger carbon footprint overall, although differences were small. (Moberg et al., 2007)
- A 2012 study by Gattiker, Lowe and Terpend compared the GHG emissions associated with a semester's use of a print text book of 500 pages and its equivalent electronic version. Among their findings:

- The magnitude of conventional textbook GHG emissions is largely due to the resources that go into manufacturing and transportation. These emissions can be offset by consumer behavior. Selling a textbook back to the campus bookstore or giving it away leads to reuse. A text could conceivably be bought and sold numerous times – until a new edition of the text comes out. Recycling a textbook can also offset production emissions.
- Relevant e-text GHG emissions come from reading the e-text online, printing, and disposing of printouts. More emissions are created the longer a person spends online reading; the energy source used to power the text reading device also has a large impact on emissions. The dirtier the energy grid, the bigger the impact.
- Shortcomings of this study include: 1) it did not take into account the resources that went into producing and distributing the reading device; 2) it did not take into account end of life scenarios for the reading device even though toxic e-waste disposal/dumping in 3rd world countries has a significant impact on global emissions.
- Taking into account consumer behaviors, the difference in GHG emissions between the two formats was not great - the GHG footprint of an average hard-copy text for a semester is approximately 9.0 pounds CO₂e (the sum of the manufacturing/distribution node and the disposal node [resell, recycle or landfill]) while the GHG footprint of an average e-text for a semester is approximately 7.8 pounds CO₂e [the sum of energy to read online, to print out selections of text and disposal of print outs]. (Gattiker, Lowe and Terpend, 2012, p. 602)
- Researchers computed that a student printing out 128 pages from the electronic version of the book (roughly 25% of the book) under typical conditions (using virgin paper, printing on only 1 side of the page) would have had a lower GHG emissions impact by purchasing the print textbook instead. (Gattiker, Lowe and Terpend, 2012, p. 605)

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