

# An Investigation into Papers for Digital Printing

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## ABSTRACT

A survey of digital print providers in the U.S was conducted to identify constraints and potential solutions for improved performance and quality of digitally printed papers. The key factors in printers' decisions about which paper to purchase were identified as runnability and print quality. The leading paper characteristics considered when making a purchase were found to be toner/ink adhesion, accurate sheet dimensions, dimensional stability, and moisture level. Performance- and runnability-related factors were found to be more important than appearance-related factors. Overall, the price of papers charged by manufacturers to print producers was not a leading factor in the paper selection process. Digital print providers are most interested in an improvement in the extent of the available product range, with more sizes, finishes, and basis weights available for their digital presses.

## INTRODUCTION

A survey of U.S. print providers currently using digital printing technology has been conducted to assess the relative importance of the different properties of digital papers. The survey explored the reasons why certain grades are selected by print providers, and assessed gaps in currently-available digital grades.

Specific research objectives included:

- *identifying the paper grades commonly used for the market segment of production digital printing,*
- *identifying the number of brands used and the nature of printing companies' relationships to suppliers,*
- *determining the factors that affect brand and purchase decisions,*
- *discovering the relative importance of different paper properties and characteristics,*
- *assessing the deficiencies in currently-available paper grades, and*
- *determining what improvements are required by digital printers, and what limitations are currently imposed by press design.*

This study is directed towards the production segment of electrophotographic digital printing, and does not include the SOHO (small office and home office) and graphic arts inkjet markets. Direct-to-press and direct imaging (DI) equipment is not included in the scope of this phase of the research. A full analysis of the survey results is published in a Printing Industry Center Report [1].

## **The Market for Digital Paper**

2004 was a year of significant digital press acquisitions [2]. Mirroring the growth of digital presses is the concomitant development of papers that have been manufactured specifically to meet digital press requirements, and digital paper is now the fastest growing category in paper manufacturing [3]. In response to these market dynamics, paper manufacturers have been launching new digital paper lines and expanding existing lines. Both printers and print specifiers are increasingly demanding a wider and more diverse selection of papers qualified for digital presses and an expansion of other media for use with these technologies (for example, self-adhesive labels, envelopes, identity cards, synthetic substrates, etc.).

In order to produce high quality images and good on-press runnability, electrophotographic papers require good dimensional stability and surface smoothness, small, evenly distributed additives and fillers, more tightly controlled uniform moisture levels, controlled conductivity levels, and uniform charging characteristics for toner transfer efficiency. The chemical composition, spatial distribution of components, and thickness uniformity of paper are therefore more critical than in traditional printing papers. Thus, the design and production of high quality digital papers requires significant expertise. In addition to these technical factors, to fully exploit the fast turnaround capabilities of Print on Demand, printers may need to carry a significant inventory of papers. This poses challenges in an environment in which space and cash flow are at a premium. Where several print technologies are functioning within one print operation, a universal paper has significant economic advantages. In general, however, robust runnability and image quality require papers designed specifically for electrophotographic applications [4].

## **RESEARCH METHODOLOGY**

A telephone survey of digital print providers elicited 103 responses from print companies in the U.S. and Canada. Following an exploration of company demographics, questions were asked to understand how and why different papers are selected for digital printing jobs. The following categories were explored:

- Paper grades commonly used for digital printing jobs
- Number of brands used and companies' relationships with suppliers
- Factors which affect brand decisions
- Relative importance of different paper properties and characteristics
- Paper characteristics needing improvement
- Limitations imposed by digital press design, and
- Paper cost changes in recent years

## **RESPONDENT COMPANY DEMOGRAPHICS**

The 103 respondent print companies have been in business from 3 to 197 years, with a median of 28 years; more than 30% have been in business for over 50 years. More than 50% of companies had fewer than 20 employees in 2004, with only 14% above 100. The median annual revenue for 2004 was approximately \$1M, with 68% below \$3M. This confirms the predominance of small- and medium-sized enterprises (SMEs) in the printing industry [5]. The majority of respondents (66%) experienced an increase in annual revenue in 2004 compared with 2003, while 11% decreased in revenue and 23% reported no change over this time period. By the end of 2004, 28% of respondents owned one digital press, 19% had two presses and 16% had three presses. Only 20% own only digital printing technology; 72 have sheetfed offset presses, 14 have web offset presses, 13 have inkjet equipment, and 3 have flexographic presses.

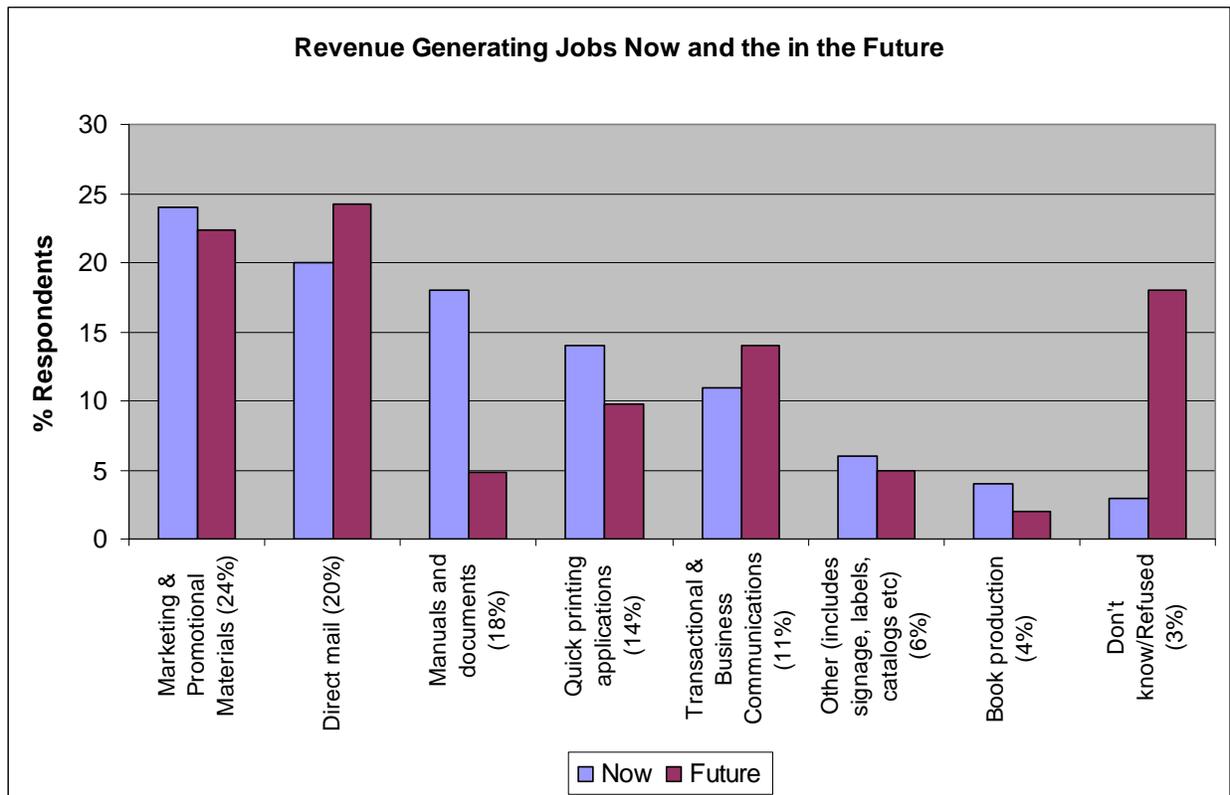
## **DIGITAL PRINTING APPLICATIONS**

Respondents identified the types of jobs produced with digital printing; the leading categories ranked as a "major portion" of the business were Marketing and Promotional Materials, Quick Printing Applications, and Direct Mail. When asked to indicate only one predominant job type, the leading application is again Marketing and Promotional

Materials (24%), followed by Direct Mail (21%), Manuals and Documents (19%), and Quick Printing Applications (14%).

The approximate percentage of revenue growth in 2004 indicated by each respondent was linked with various job types, and was found to be greatest for Transactional/Financial and Signage (19% each), followed by Marketing and Promotional Materials (16%), Book Production (16%), Business Communications (14%), and Direct Mail (12%).

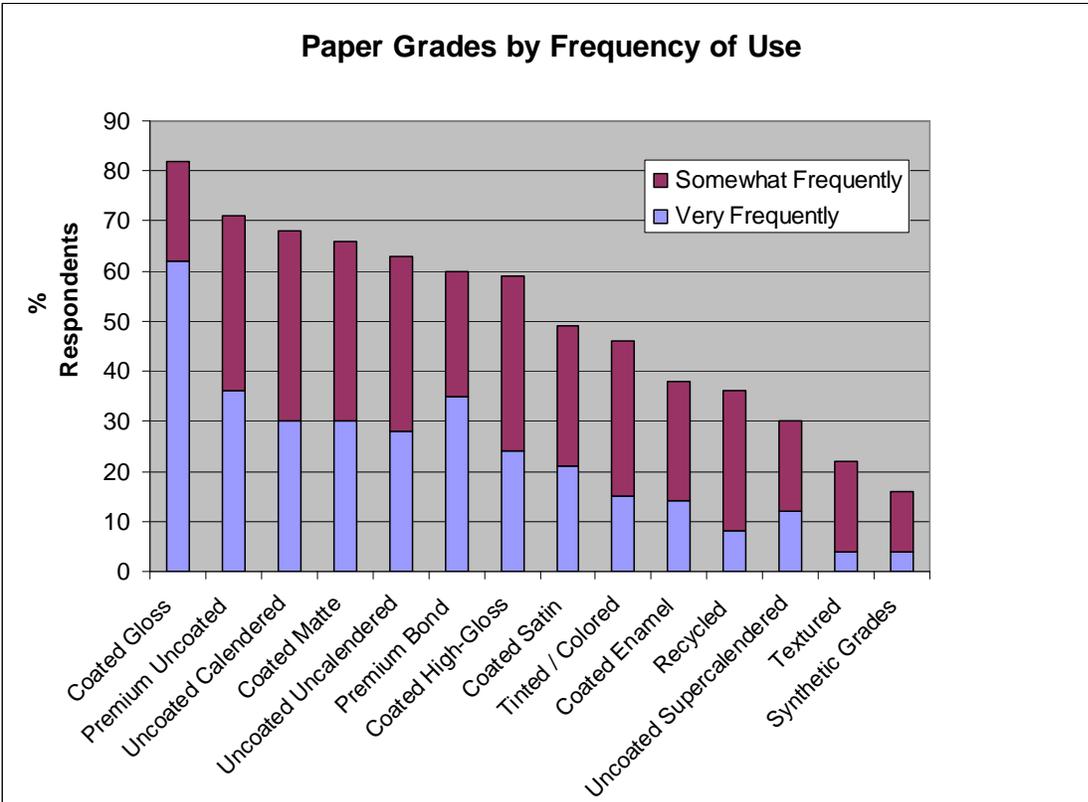
Figure 1 shows respondents' predictions of revenue growth by job types at the present time and in the future. The categories of Manuals and Documents, and Quick Printing Applications are outlooked to diminish in revenue generation, which may be due to the growing proportion of competing electronic document forms. Direct Mail and Transactional and Business Communications jobs are projected to show a revenue increase. The lead job type, Marketing and Promotional Materials, shows little projected change with this data set.



**Figure 1** Predicted revenue generating jobs now and in the future.

## PAPER GRADES FOR DIGITAL PRINTING APPLICATIONS

Paper grade categories that respondents used for digital printing and their frequency of use were explored using grade descriptions designed to avoid resemblance to brand names or product ranges. Figure 2 shows that coated gloss is the leading grade, followed by premium uncoated, uncoated calendered, coated matte, uncoated uncalendered, and premium bond.



**Figure 2** Frequency of use of paper grades for digital printing

When asked to select only one grade used most often, the leader was coated gloss (32%), followed by premium bond (15%), and uncoated uncalendered (12%). The combination of gloss grades (coated and coated high-gloss) accounted for about 38% of grades used most frequently and ranked as very or somewhat frequently used by 82% and 59% respectively. This heavy usage correlates with the identification of marketing and promotional materials as a leading job type in this sample. Recycled paper is used most often by only 2% of respondents, although 36% stated that they used recycled paper very or somewhat frequently. A follow-up question asked for the percentage of recycled content: the distribution has a median of 25%, and only 2% use 90–100% recycled content papers. Most of the digital presses used by respondents in this survey are sheetfed. Eighty-five percent of survey respondents do not use webfed media at all, and 5% use webfed media only.

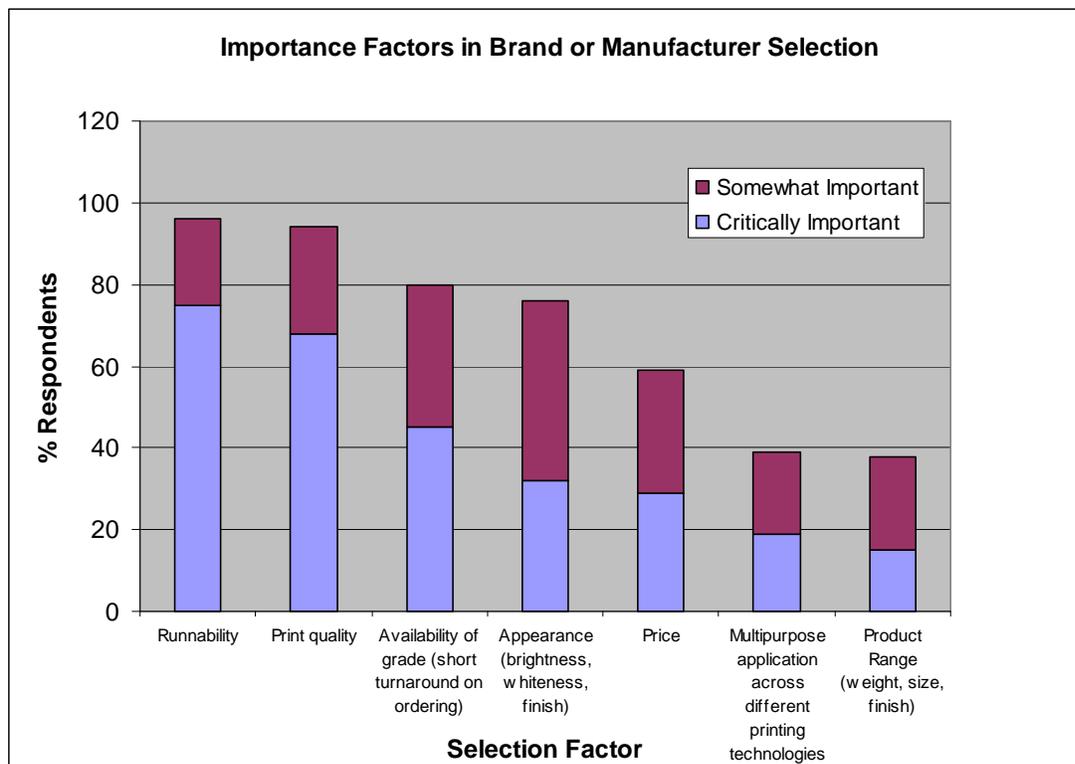
## THE PAPER PURCHASE AND SELECTION DECISION

It is important for paper producers to understand the factors and personnel involved in the paper purchase decision, as it affects advertising and marketing strategies for paper brands. There seems to be a tendency for collaboration between the print provider and the print purchaser on the selection of paper grades (46%), and in 22% of the cases, all paper selection decisions were made jointly. However, the distribution of responses indicates mixed selection practices.

Within the print company, in nearly 15% of cases, the owner/manager was responsible for making the paper grade selection, correlating with the observation that this sample holds a significant proportion of small enterprises (25% have fewer than 10 employees). The sales function accounts for 13% and combined customer service functions 17%. Only 5% use the purchasing department or a paper buyer. The combined technical production functions showed 12% compared with a 51% “front office” grouping. It is interesting to consider whether front office personnel are generally as aware of the technical differences between papers designed for traditional and electrophotographic printing technologies.

A degree of brand loyalty was evident, with the median number of brands at 5. 28% of respondents are limited to one brand of paper, with 3% of these reporting that they are obligated by a contractual relationship.

Respondents were asked to rank factors relating to the paper purchase decision on an importance scale. “Runnability” was used in the context of no misfeeds or web breaks during a press run; “appearance characteristics” included brightness, whiteness, finish type, etc.; “product range” included weight, size, finish, etc; “availability of grade” referred to acceptable turnaround on ordering; and “multipurpose application across different printing technologies” refers to papers qualified for electrophotography as well as offset lithography or other technologies. This factor was introduced based on recommendations from the pilot survey.

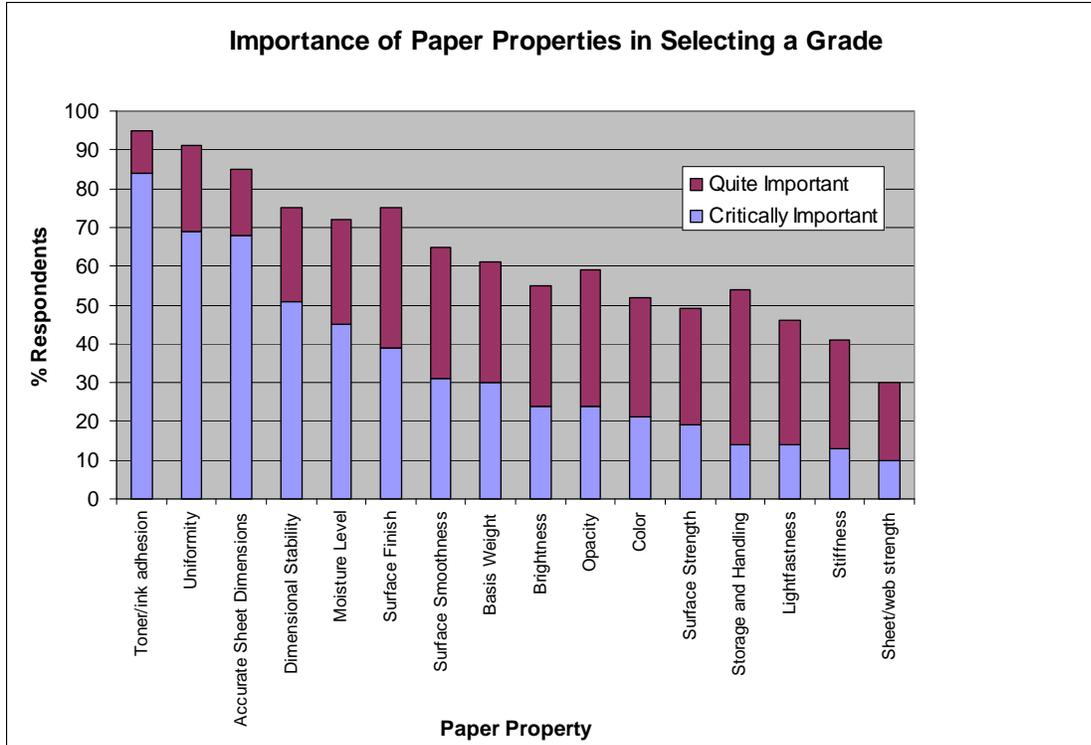


**Figure 3** The relative importance of factors used to determine brand or type of paper.

Runnability and print quality were ranked as having the most importance and were statistically equivalent (Figure 3). Overall, the grouped factors relating to grade availability (availability of grade, multipurpose application, and product range) were ranked lower in importance than the grouped visual appearance-related factors (print quality and appearance). Price was found not to be a leading factor in the purchase decision for these digital grades with this sample. The difference between brands on the basis of these factors was investigated; about one third of respondents indicated that different brands showed a major difference in runnability, availability, and print quality. Only 27% indicated a major difference in price, with 62% indicating only a minor difference.

## PAPER CHARACTERISTICS

The properties and characteristics of papers that may be considered when selecting a grade were investigated for relative importance (Figure 4). When asked to identify the relative importance of all characteristics in a provided list, the leading characteristics were identified as toner/ink adhesion, uniformity, accurate sheet dimensions, dimensional stability, moisture level, and surface finish.



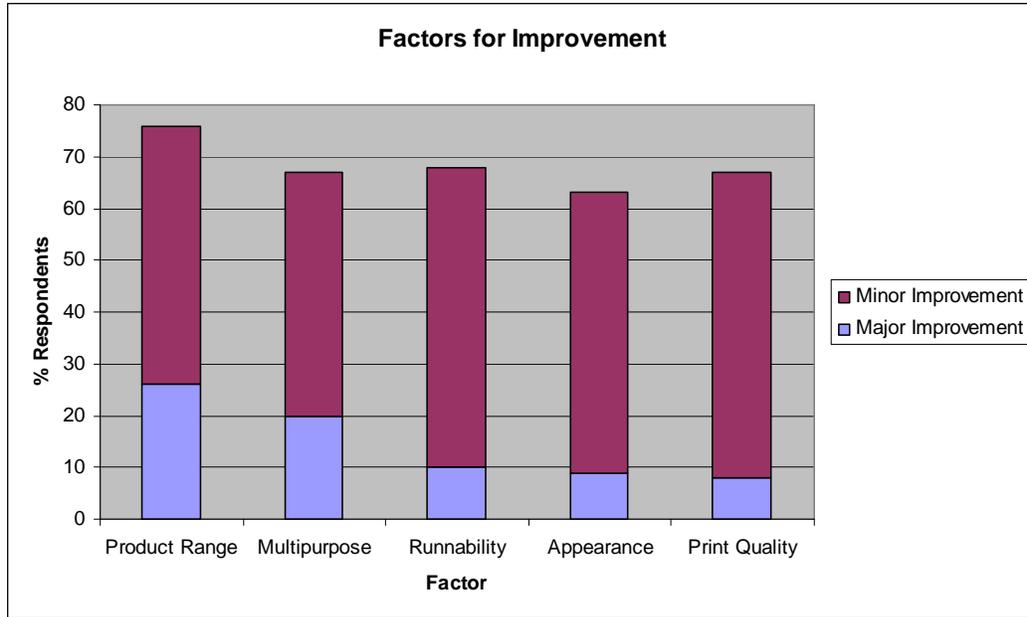
**Figure 4** The relative importance of paper characteristics and properties in selecting a grade.

When asked to identify only one characteristic as most important, the top three are the same, but with different weightings; 58 % of respondents identified toner/ink adhesion as most important, followed by accurate sheet dimensions (10%) and uniformity (7%). No respondents identified brightness as the most important characteristic, and the overall relative ranking of brightness is not among the leaders. Greater importance is attached to performance-related factors than appearance-related factors: when uniformity, accurate sheet dimensions, dimensional stability, moisture level, basis weight, storage and handling, stiffness, and sheet/web strength are grouped the “critical” rating is 33% compared with 22% for appearance-related factors such as color, opacity, and brightness.

Relating paper characteristics to the job type identified as generating the most revenues, seventeen out of nineteen respondents who had identified direct mail as a leading job type also identified toner/ink adhesion as either critically or quite important. Across a wide range of applications, and for all the most important job types in terms of revenue generation, ink/toner adhesion was found to be the most important factor for this sample of print providers. Thirty seven percent of those identifying gloss as the most commonly-used grade also identified adhesion as a primary concern; for uncoated calendered this was 17% and for premium bond, 9%.

## ACCEPTABILITY OF CURRENT PAPER GRADES

Respondents were asked to rank the extent of improvement they would like to see in the factors described above. Although the responses were statistically close, the need for product range improvement ranked higher than runnability, appearance and print quality, but was not significantly different to the need for multipurpose brands (Figure 5). Runnability, found to be a key factor in brand selection, was ranked less in need of improvement than product range, but was not otherwise significantly different than other factors. Overall, the greatest need for improvement is in product range and the availability of multipurpose brands.



**Figure 5** Factors needing improvement in digital papers.

## DESIRED IMPROVEMENTS

Of the 103 respondents, seven stated that no improvements to digital papers were necessary. Only eight indicated that they would like to see a lowering of paper price, suggesting that profit on a specific digital job may not be governed primarily by the paper price, but by other factors such as finishing, distribution, value-added services, etc. This is consistent with the observation that price is not a leading driver in the brand selection and purchase decision.

In an open question, forty four respondents reported that current product ranges are not sufficient at this time to meet all needs for digital document production, with specific comments calling for a wider range of sizes (10), more colors, a wider range of caliper/thickness and basis weights, and the ability to print on the same stock across different technologies. A range of comments related to the adhesion of toner or ink onto the substrate. Details of the comments on desired improvements are reported elsewhere [1].

When asked about limitations imposed by the digital press design, the leading limiting factors relate to product range: twenty respondents felt that they are limited in basis weight due to press limitations, but only one at the low end: fifteen are limited to sizes imposed by the press, and ten are limited by thickness. Adhesion and substrate pre-treatment was called out by fifteen respondents.

## PAPER COST CHANGES

Seventy percent of respondents stated that paper costs have increased either significantly or somewhat over the last two years (2002–2004), seven percent reported that paper costs had decreased somewhat, and eighteen percent reported no change in paper costs. Of those seventy percent reporting cost increases, forty nine percent passed the increase onto their customers, twenty five percent in its entirety, and ten percent passed on only half of the cost increase.

## CONCLUSION

Within the paradigm of On-demand Printing in the digital production segment, there is a lower tolerance for waste (both of time and materials) and an increased need for productivity, which puts pressure onto paper manufacturers to produce more uniform products to higher specifications. The results of this study indicate that paper characteristics

and purchasing factors relating to efficiency of production predominate over considerations relating to appearance and price. The fact that price is not a leading factor in the paper purchase decision suggests that digital printing paper is a differentiated product as opposed to a homogeneous product. In many cases the entire economic viability of a print job depends on the quality of the substrate; poor runnability and low image quality can differentiate between profit and loss in an industry with tight profit margins. The data from this study suggests that production digital printing is not a commodity segment, but is performance- and value-based.

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