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A Research Monograph of the Printing Industry Center at RIT

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R·I·T Printing Industry Center
An Alfred P. Sloan Foundation Center

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Abstract

Print buyers are asking printers to have their printing processes certified in order to become preferred suppliers. Comprehensive process certification is something new to printers in the US. A successful certification program requires that the certification body is independent and is technically capable, as well as a market that demands the certification.

A number of printing industry influencers approached RIT in December 2008 and asked RIT to offer a process certification program to the U.S. printing industry. In 2009, a committee was formed of faculty and staff from the School of Print Media and the Printing Applications Laboratory to investigate this proposal. The committee submitted a research project proposal to the Printing Industry Center in November 2009 with the goal of conducting a printing standards survey in order to capture the view of printing companies regarding the role of printing standards applicable to workflow from data reception to printing.

A questionnaire was designed to assess the role of standards that impact five areas of workflow: file creation and data reception, contract proof, CTP/press calibration, process control, and workflow efficiency. An Internet-based survey tool was used to implement the survey worldwide. A total of 117 companies (including 90 printers) from North America, Europe, Asia, and Mexico participated in the survey. This report provides the complete results of that survey.

Introduction

A survey is a method for collecting data to investigate subject matters of interest. When U.S. printing industry influencers asked RIT to offer an independent assessment of printing process conformance according to ISO 12647 in 2008, the RIT Printing Outreach Group, represented by faculty and staff from the School of Print Media and the Printing Applications Laboratory, began to contemplate the possibility of a Printing Standards Audit (PSA) initiative.

RIT has a reputation as a premier university for print media education and as a technical center that provides testing and technical training to the printing industry. It has neither experience in process certification, nor awareness of the market demands. Thus, a printing standards survey was chosen to be the first phase of the PSA initiative. Consequently, a proposal was submitted to the RIT Printing Industry Center in November 2009. The proposal was accepted and funded by the Center in January 2010.

This report documents the entire process of conducting the printing standards survey in the following sections: (1) survey objectives, (2) overview of international printing standards, (3) questionnaire design, (4) survey implementation and data analysis, (5) results, and (6) conclusions.

Survey Objectives

A good survey begins with well-stated objectives which are clear and succinct. In this case, the primary objective was to determine the view of printing companies regarding the role of printing standards in production workflow. A secondary objective was to ascertain the issues and problems that arise when communicating with customers and when implementing color control. An additional objective was to determine the percentage of participants who wish to seek process certification in the near future.

Printing companies were also offered an opportunity to download test forms with instructions for printing and then submit their printed sheets to RIT for printing conformance analyses according to ISO 12647-2 at no cost (see Appendix A). Press sheet measurement and conformance reporting are ongoing. A summary of press sheet check-up results will be documented in a separate report.

Overview of International Printing Standards

Modern printing and publishing workflow can be depicted in the form of a block diagram as shown in Figure 1. The process begins with the color conversion of an input file (denoted as Data_1) to a reference printing condition. Once converted, the data file is then further processed (denoted as Data_2) for proofing. The data file defined in the reference printing may be adjusted (denoted as Data_3) for platemaking and printing. If the platemaking and printing are calibrated, and the inks and paper conform to standards, the resulting print will visually match the proof.

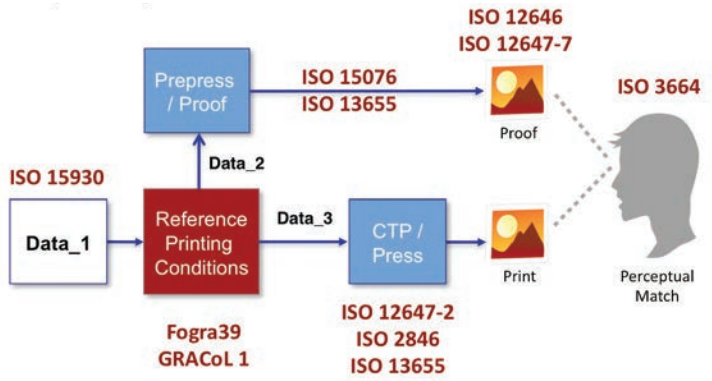

Figure 1. ISO standards applicable to digital printing workflow

ISO 12647-2 is the standard that specifies process control aims and tolerances in offset printing, but ISO 12647-2 is not the only standard that governs color quality printing from customer-supplied files. ISO standards that are closely aligned with ISO 12647-2 include ISO 2846, which specifies color and transparency of process inks and ISO 13655, which specifies color measurement and computational procedures.

A number of relevant ISO standards are essential to standardize the workflow in order to maximize efficiency, repeatability, and predictability of the color image reproduction process. In terms of file creation and exchange, ISO 15930 specifies the use of PDF for data exchange between content creation and print production. Currently, PDF/X-1 is used for blind CMYK data exchange; PDF/X-3 and PDF/X-4 are used for blind data exchange with color management.

In terms of color management, ISO 15076 specifies a profile standard including the registration of tag signatures and descriptions. Based on the aim values of ISO 12647-2, Fogra created the Fogra39 characterization data set; IDEAlliance created the GRACoL1 (or CGATS/TR2206) data set, and so on. These data sets are also known as Reference Printing Conditions. Both the data set and ICC profile of these Reference Printing Conditions can be downloaded from **www.color.org** free of charge.

A premise of modern color management is that when two dissimilar output devices closely match the same Reference Printing Condition, then device-to-device color match will result. Achieving this result requires additional standards, such as ISO 12646, which specifies the display requirements for soft proofing; ISO 12647-7, which specifies hard copy requirements for contract proof; and ISO 3664, which specifies viewing conditions for critical color appraisal.

Methodology

Questionnaire Design

The questionnaire consisted of three sections. The first section covered participant background, i.e., geographic locations, ISO 9001 registration status, and printing certification status. The group theorized that much of the survey data could be stratified by region, ISO 9001 status, or printing certification status.

The second section of the questionnaire addressed five areas of a print production workflow: file creation and data reception, contract proof, CTP/press calibration, process control, and workflow efficiency. Graphic icons were used to guide the participants through the survey (see Figure 2).

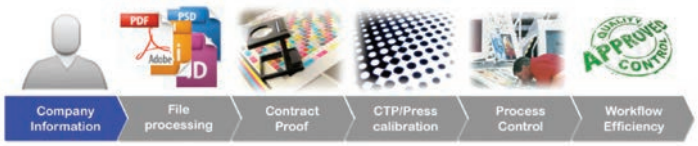

Figure 2. Workflow icons used in the survey

The third section of the questionnaire asked if the company would consider printing process certification within the next year and if it wished to submit a press sheet for a free check-up.

Survey Implementation and Data Analysis

A survey may be implemented in many ways, e.g., through face-to-face meetings, by phone calls, and through the use of printed questionnaires. In the Internet age, it is likely that most printing companies are avid users of computers and e-mail. Thus, e-mail was chosen as the delivery method for the link to the survey, which was hosted online using SurveyMonkey, an Internet-based survey tool.

It was also necessary to design a database for participant registration prior to survey distribution. This was administered through a web page dedicated to the survey project. Through the registration process (see Appendix B), the team was able to track the progress of participants and guide them through (1) registration, (2) completing the survey, (3) downloading the test form, and (4) submitting the press sheets. The database was also used as a tool to inform participants about upcoming deadlines.

Due to the use of two different systems, there was a need to link the information gathered from both processes. By capturing the IP address of the computer used during both registration and the survey, the team was able to link the information and thereby achieve a good view of the demography of all the participants. The IP address was also used to ensure that participants only completed the survey once.

Prior to the official launch of the survey, a number of printing companies were asked to critique such areas as clarity of the content, time taken to complete the survey, and survey accessibility. The team then made significant improvements to the questionnaire as a result of the pilot effort. The final questionnaire can be viewed in Appendix C.

The survey took place from May 1 to June 30, 2010—a total of eight weeks. The initial news release, followed by an e-mail broadcast and the support of industry associations like IDEAlliance and Gent Working Group, were instrumental in soliciting printing companies to take part in the survey. As shown in Figure 3, the database generated weekly reports of the total number of participants registered, the number of surveys completed, the number of test forms downloaded, and the number of press sheets received.

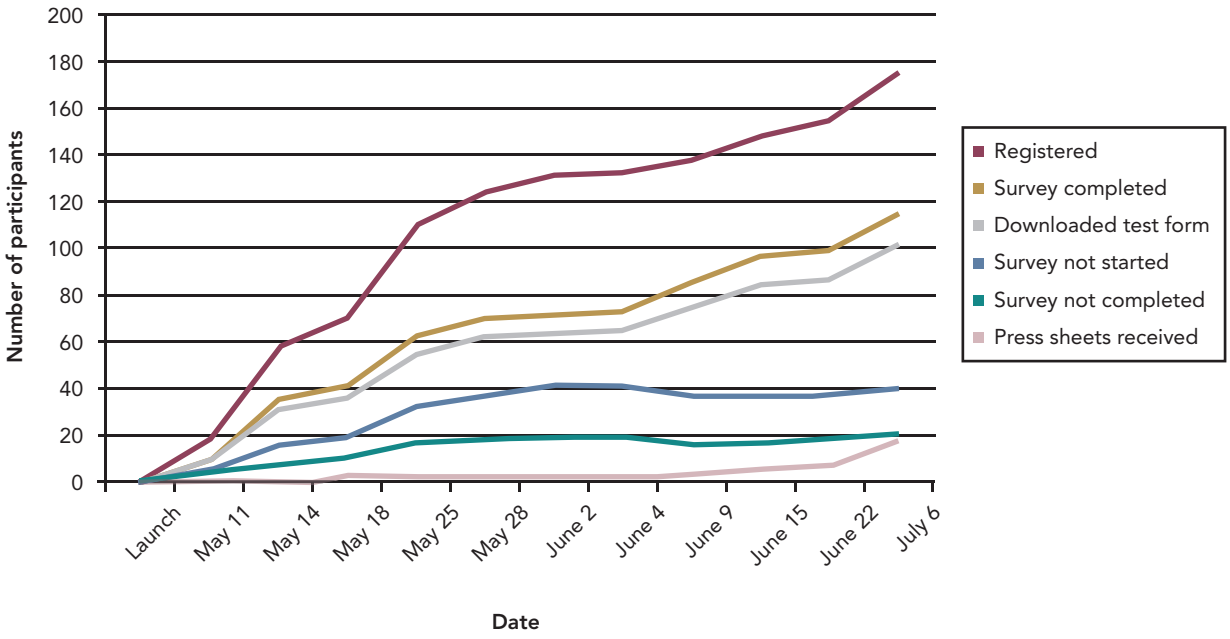

Figure 3. Weekly progress of survey participants

Survey data were exported from SurveyMonkey as a text file that could then be imported into Microsoft Excel. Descriptive statistics were prepared using Microsoft Excel. Split-group analyses were carried out using SAS 9.2.

Findings

A total of 117 respondents completed the survey (see Figure 4). Ninety (77%) of respondents were printers. The remaining 27 respondents consisted of 5 consultants, 2 manufacturers, 2 print buyers, and 18 other (associations, schools, and students). Among the 90 printers who completed the survey, 71 were from North America, 15 were from Europe, 3 were from Asia, and one was from Mexico. The ratio between the number of U.S. printers and the number of European printers is close to 5-to-1.

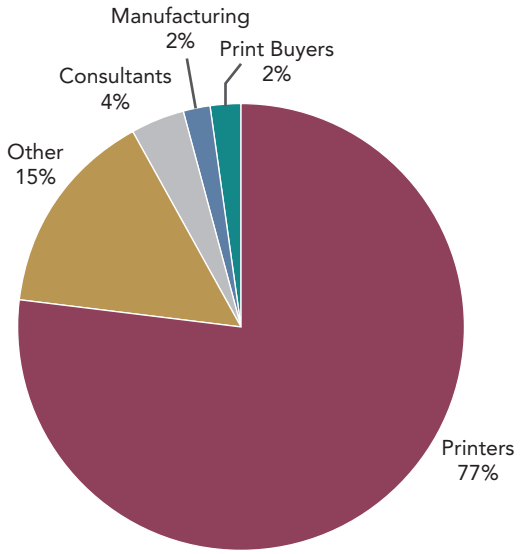

Figure 4. Participant profiles

An analysis of the descriptive statistics between all respondents (N = 117) and printers (n = 90) found them to be similar. Since the goal of the survey was to capture the view of printing companies, only printing companies' responses were used in the data analysis and report.

Company Profiles

Thirty percent of respondents have received ISO 9001 quality system certification, while the remaining 70% have not. In terms of companies that have received other printing process certifications/qualifications, 20% have received G7 qualification; 10% have received PSO certification; and 60% have not received any printing process certification.

Use of Color Space in File Creation

From a digital color management point of view, the first use of standards is the color space used in content creation and file preparation. The survey asked how customers use standard CMYK color space as the common space for file creation. The results show that 13% use ISO ECI color space, 24% use the GRACoL space, 26% use SWOP space, 24% of customers do not use common CMYK color space, and the remaining 4% don't know which is used (see Figure 5).

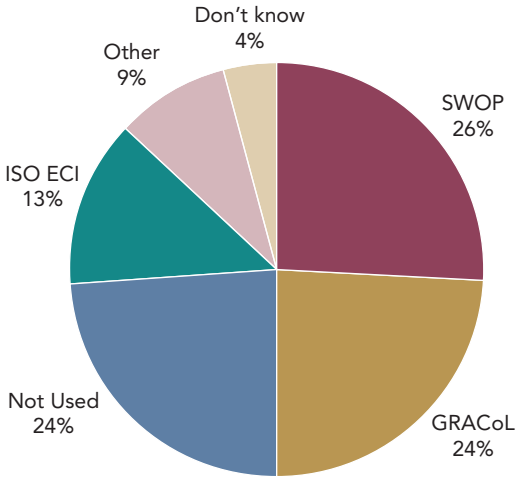

Figure 5. Use of color space in file creation

The team believes that the above finding is proportional to the participant profiles; i.e., European printers use the ISO/ECI color space and U.S. printers use the GRACoL and SWOP color spaces. In other words, there is no single CMYK color space that is used as a global standard for file creation.

File Type and Preflighting

ISO specifies PDF as the file format for data exchange. In order to find out how frequently certain file types are received by printers, the survey asked participants to rank the frequency with which they receive a given file format. The data in Table 1 shows that Adobe InDesign files are used most frequently, followed by PDF/X-1. Quark and PDF/X-3 files are used least frequently.

Table 1. File formats used in data exchange

File format	Weight				Rating average
	Most frequently used			Least frequently used	
	4	3	2	1	
InDesign	**48**	13	13	4	**3.35**
PDF/X-1	**25**	19	20	10	2.80
PDF/X-3	3	18	18	**26**	1.97
Quark XPress	4	15	19	**31**	1.88

"Garbage in, garbage out" is a well-known concept in data processing. Translating this concept into file reception means that customer-submitted files are not necessarily prepared correctly and, if not corrected, will compromise the results achieved in the rest of the workflow. Therefore, the survey asked if the correctness of the files are verified by means of using preflighting software. The results show that 83% of printers use a preflight check to ensure the correctness of a customer's file, while 15% do not preflight a customer's file.

Proofing/Color Management

Color management concepts and associated practices can vary widely from company to company and from region to region. The survey asked participants about their degree of agreement with a number of color management statements concerning digital proofing.

Table 2 summarizes the results and may be interpreted as follow: (1) most printers (92%) agree that they have adopted color management in their digital proofing workflow with good results; (2) a majority of the printers (77%) use standard CMYK profiles as source color space; and (3) many printers (70%) build their own proofer profiles as the destination color space in their digital proofing workflow. Consequently, 87% can produce hardcopy color proofs that match OK sheets better than their customers' proofs. In addition, only 47% of participants use a display-based soft proofing system.

Table 2. Color management practices

Statement	Agree	Disagree	Don't know	N/A
We implement color management in our digital proofing workflow.	**92%**	3%	0%	4%
There is a good match between our contract proof and OK sheet.	**87%**	7%	1%	6%
We use standard profiles, e.g., ISOcoated V2 (ECI), Coated GRACoL 2006, in our digital proofing workflow.	**77%**	14%	4%	4%
We build our own proofer color profiles.	**70%**	23%	1%	6%
We use display-based soft proofing.	**47%**	41%	2%	10%
There is a good match between the customer-submitted proof and our contract proof.	36%	**44%**	9%	11%

To ensure high color management performance in color proofing, industry associations (e.g., Fogra in Europe and IDEAlliance in the US), offer proofing system certification to proofing vendors. The survey asked if participants used a certified proofing system. The results (Figure 6) show that 31% of printers use IDEAlliance-certified proofing systems; 13% use Fogra-certified proofing systems; and 44% of printers either do not use any certified proofing system or don't know if they do.

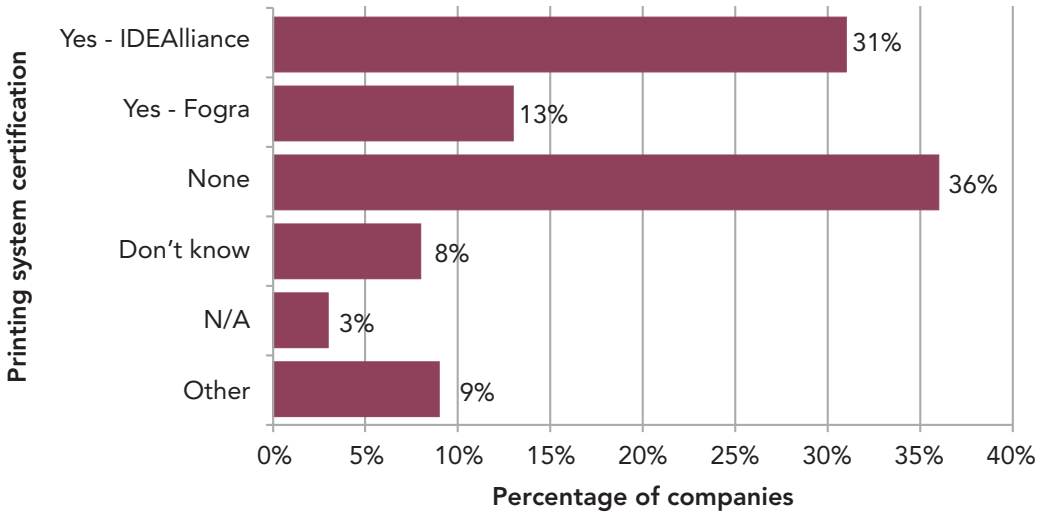

Figure 6. Use of proofing system certification

Using a certified proofing system is one aspect. Verifying the accuracy of individual proofs is another. Figure 7 shows that 39% of participants use a proofing verification system, 30% do not verify proofs, and 23% use manual methods to verify proofs.

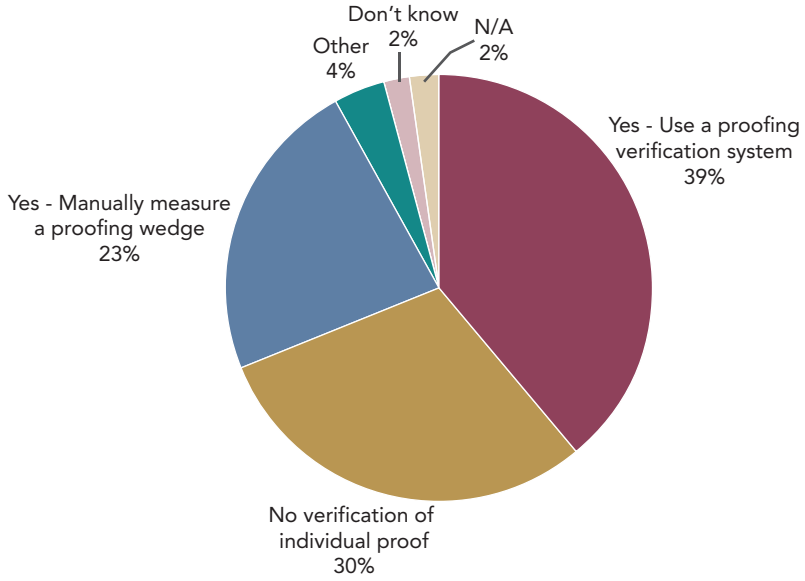

Figure 7. Verification of the accuracy of individual proofs

CTP/Press Calibration

ISO 12467-2 specifies process control requirements, but it does not dictate what press calibration must be used. Instead, ISO/TS 10128 states that there are three press calibration methods: TVI, gray balance, and device link. Thus, the survey asked, "Which CTP/Press calibration method does your company use to conform to a printing standard?"

The results indicate that 47% of printers use the gray balance method, 32% use the TVI method, and 11% use the device link method (see Figure 8). The fact that more printers use the gray balance method than TVI and device link combined is a result of the following factors: 71 out of the total of 90 printers are from the US, and IDEAlliance has been very successful in communicating the benefits of using G7, a gray balance press calibration method.

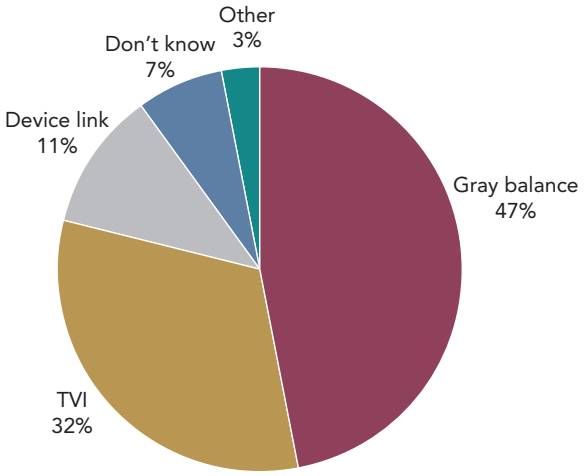

Figure 8. Press calibration by different methods

A typical press calibration procedure involves two steps: (1) adjusting ink film thicknesses and printing solid colors of black, cyan, magenta, and yellow ink to ISO 12647-2 conformance with a set of linear plates, and (2) repeating the printing conditions, but with a set of curved plates according to the TVI or gray balance method during the computer-to-plate (CTP) step. In other words, the performance of the curved plate is based on the accuracy of platemaking and the repeatability of the printing process. Therefore, the survey asked how common certain CTP operations are.

Table 3 provides the statements and participants' responses. Most printers (70%) agree that a plate reader is useful to verify plate processing. Most printers (66%) also agree that both the linear wedge target and the curved wedge target are useful to verify CTP/press calibration. On the other hand, most printers (66%) disagree that only linear plates are used for printing. A majority (56%) also disagree that a screen ruling indicator is necessary to verify the screen ruling of the processed plate. This is likely due to the fact that screening rulings have been well developed by RIP manufacturers and do not cause problems in routine CTP production.

Table 3. CTP practices as a part of press calibration

Statement	Agree	Disagree	Don't know	N/A
We use a plate reader to verify plate exposure and processing.	**70%**	20%	1%	9%
We include both the linear wedge target and the curved wedge target to verify CTP/press calibration.	**66%**	22%	4%	8%
We generate only linear plates.	28%	**66%**	2%	4%
We use a screen ruling indicator to verify plates.	31%	**56%**	3%	10%

Printing Process Control

There are a number of issues concerning printing process control. From a data collection point of view, the survey asked about the prevalence of the use of certain color measurement instruments to control the printing process. The results indicate that color measurement devices—densitometers and spectrophotometers, process control, and reporting tools—are prevalent in pressrooms.

The survey asked, "What is the most critical factor that determines color OK?" The results (see Table 4) show that visual match to proof is viewed as the most critical factor (70%) in determining the color OK sheet. This is followed by print to density that conforms to ISO aim points (24%) and print to ISO CIELAB aim points (6%).

Table 4. Critical factors in determining color OK sheet

Factor	% Response
Visual match to proof	**70%**
Print to density that conforms to ISO CIELAB aim points	24%
Print to ISO CIELAB aim points	6%
Other	5%

Some participants pointed out that these factors are not necessarily exclusive from one another. For example, the ISO colorimetric aim points and tolerances can be translated into density aims and tolerances. Visual match between print and proof can be optimized if these tolerances are used effectively.

An interesting question in printing process control is, "How do you characterize your printing process control practice?" The choices (from simple to complex) are visual inspection, measure density/color, save data, data charted and reported, press run analyzed/results shared, and analyzed data is used for continuous improvement. Participants were allowed to choose as many responses as they used. The results, as expected, show that (1) there are more printers characterizing printing process control as visual inspection and defect detection-based, and (2) fewer printers characterize their printing process control as data-driven and continuous improvement-based (Figure 9).

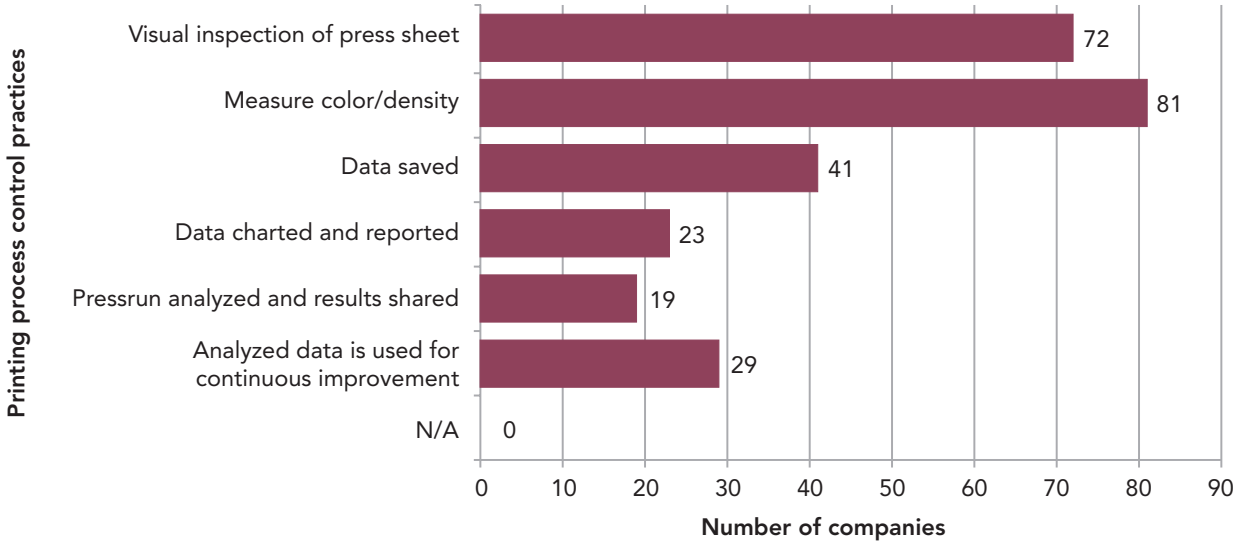

Figure 9. Printing process control practices/characteristics

Operational Efficiency

Printing companies must embrace quality printing while reducing waste and cycle time. In other words, printing companies are challenged to optimize their quality and operational efficiency. To find out how printing companies address their operational efficiencies, the survey asked printers to rank the importance of certain daily production procedures (see Table 5). Having standard operating procedures (SOP) in color-critical areas of the workflow was ranked as the most important in routine production. Having efficient press make-ready in achieving OK print also ranked as highly important. Compared to these two issues, having customers' PDF files and proofs certified to a known standard, having an OK sheet as a production reference, and having a right measurement and reporting system in order to verify printing consistency were ranked as less important.

Table 5. Importance of daily production procedures

Statement	Weight					Rating average
	Most important				Least important	
	5	4	3	2	1	
Having standard operating procedures (SOP) in color-critical areas of the workflow	**35**	17	18	14	6	**3.68**
Having efficient press make-ready in achieving OK print	**31**	18	18	17	6	3.57
Having customers' PDF files and proofs certified to a known standard	5	15	**25**	21	24	2.51
Having an OK sheet as a production reference	12	16	16	17	**29**	2.61
Having a right measurement and reporting system in order to verify printing consistency	7	24	13	21	**25**	2.63

Printing by numbers and process conformance are based on data. Data come from color measurement instruments. The survey asked printers to rank the importance of certain color measurement procedures. As shown in Table 6, printers ranked having certified reference material to verify measurement accuracy more highly than having good inter-instrument agreement or having color measuring instruments re-calibrated. Indeed, when two instruments agree with each other, it is merely an indication of reproducibility, not accuracy that is traceable to higher order standards.

Table 6. Importance of color measurement procedures

Statement	Weight			Rating average
	Most important		Least important	
	3	2	1	
Having certified reference material (e.g. T-Ref or Lab-Ref) to verify measurement accuracy	**44**	28	18	**2.29**
Having good intra-instrument agreement	**34**	29	27	2.08
Having our color measurement instrument sent back to the vendor for re-certification	12	33	**45**	1.63

Technical Issues

Standards are developed to address the common needs of the industry. As the needs of the industry change, standards must be revised accordingly. ISO 12647-2 was developed in 2004. It is therefore appropriate to ask printing companies how they rank the problems they encounter in applying standards in their operations. According to Table 7, printers ranked "Press sheet and proof do not match each other visually" and "Paper containing OBA does not conform to the paper white point specified in ISO 12647-2" as the most problematic. However, "Inks do not conform to ISO 2846" and "ISO 12647-2 only addresses a small part of my customers' needs" were ranked as less problematic.

Table 7. The problematics of technical issues

Issue	Weight				Rating average
	Most problematic			Least problematic	
	4	3	2	1	
Press sheet and proof do not match each other visually	44	18	12	15	**3.02**
Paper containing OBA does not conform to the paper white point specified in ISO 12467-2	28	26	17	18	2.72
Inks do not conform to ISO 2846	6	22	48	13	2.24
ISO 12467-2 only addresses a small part of my customers' needs	12	24	11	43	2.06

The survey also asked how frequently certain technical issues occur. Table 8 indicates that agreeing on the color matching tolerance with the customer and controlling color on press occur more frequently. Agreeing on how color ought to be specified with the customer and achieving contract proof to press match occur less frequently.

Table 8. Frequency of technical issues

Issue	Weight				Rating average
	Most frequently occurs			Least frequently occurs	
	4	3	2	1	
Agreeing on the color matching tolerance with the customer	25	28	31	6	**2.80**
Controlling color on the press	31	18	24	17	2.70
Agreeing on how color ought to be specified with the customer	21	20	13	36	2.29
Achieving contract proof to press match	13	24	22	31	2.21

Press Sheet Check-up

The survey asked, "Do you intend to submit press sheets to RIT for a free 'printing conformance' check-up?" Figure 10 shows that 62 out of 90 printers planned to do so. However, RIT received 40 submissions.

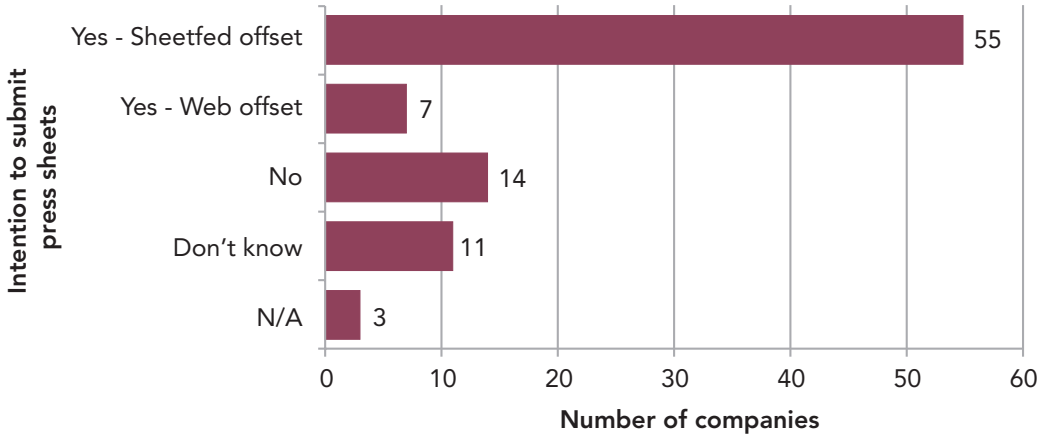

Figure 10. Intention of submitting press sheets

Certification Plan

The team also used the survey as a marketing tool, asking participants if they would consider printing process certification within the next year. Out of a total of 90 printers, 23 indicated they will consider RIT's PSA certification; 6 will consider PSO certification; 22 will consider G7 Master Printer qualification; and the rest were either already certified, not interested, or did not answer (see Figure 11).

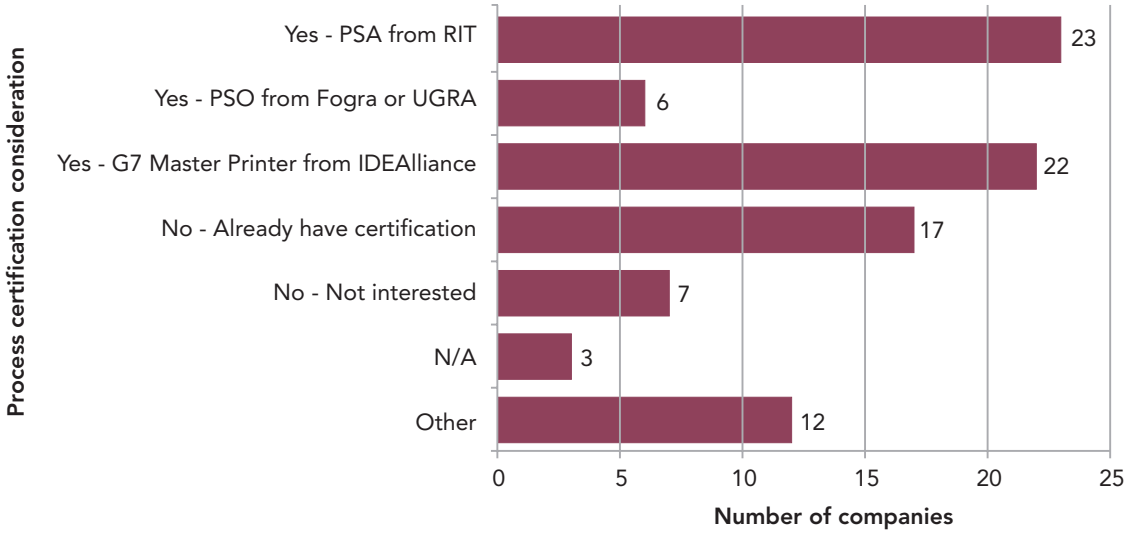

Figure 11. Process certification consideration

When seeking process certification, senior management know that they must also invest in employee training. The survey asked if printers were interested in taking certain seminars from RIT. Figure 12 shows the findings.

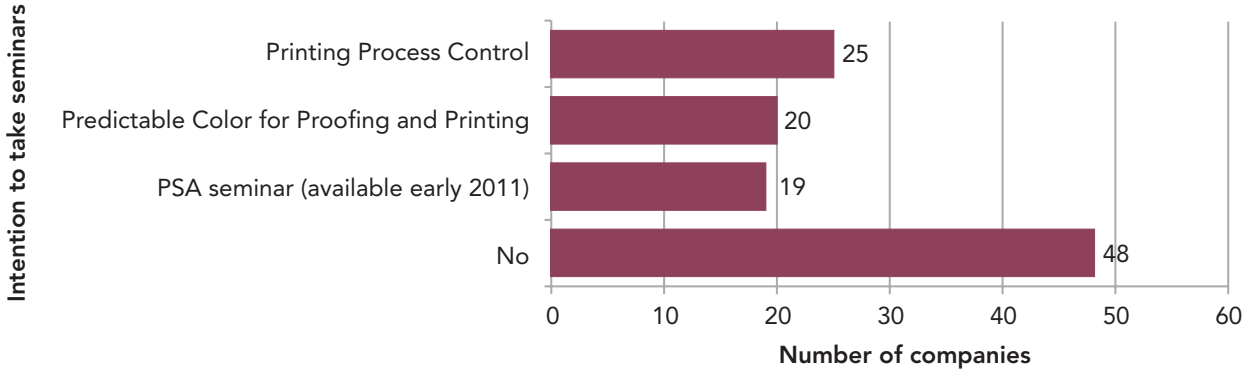

Figure 12. Intention to take seminars

Discussion

Additional statistical testing was conducted to see if significant differences occurred between two factors or sub-groups. The major findings are summarized below. Appendix D documents the details of the statistical analyses used.

Company Location and ISO 9001 Status

When comparing the relation between company location and ISO 9001 registration, a Fisher's Exact Test showed a highly significant difference between the proportions of ISO-registered companies in North America and in other parts of the world ($p < .0001$). The proportion of ISO certification in other parts of the world (89.47%) is much higher than in North America (14.08%).

Company Location and Printing Process Certification

When comparing the relation between company location and printing process certification, a Pearson's Chi-squared Test showed no significant difference between the proportions of printing certified companies in North America and in other parts of the world ($p = .30$).

Printing Process Certification and Ranking of Technical Issues

Cochran-Mantel-Haenszel Tests showed that companies with process certification are not significantly different than companies without process certification in ranking (1) paper non-conformance due to OBA ($p = .10$); (2) proof and print not matching ($p = .60$); (3) inks not conforming to ISO 2846 ($p = .16$); and (4) scope of ISO 12647-2 being too narrow ($p = .60$).

ISO 9001 Status and Continuous Process Improvement

A Pearson's Chi-Squared Test showed significant differences between the two groups. Companies with ISO 9001 certification tend to be more aligned with continuous process improvement ($p = .05$).

Company Location and Process Certification

A Fisher's Exact Test showed extremely significant differences between the U.S. and European companies in seeking process certification ($p < 10^{-4}$). Among U.S. printers who are considering process certification, 50% of them were interested in seeking PSA certification, while the other 50% were interested in seeking G7 qualification. None were interested in PSO certification. Among European printers who are considering process certification, 75% of them were interested in seeking PSO certification, and the rest were interested in seeking either PSA or G7 qualification.

Conclusions

The printing standards survey accomplished its primary objectives:

- The group found that the majority of printers use printing standards at many points within their daily production workflows. Printing standards are therefore important to the printing industry.
- Nevertheless, the team found issues with today's printing standards which, if addressed, could increase their value to the industry. Two themes unify these issues. The first is relevance. For standards to be valuable, they must be relevant to producing the goods demanded by the printer's customers. As an example of this type of problem, the survey showed that printers encounter serious problems when they attempt to use standards with papers containing high levels of optical brighteners (the most common papers found in the industry today). The second is global applicability. In today's world of increasingly global supply chains, truly global standards facilitate efficiency by allowing all members of the supply chain to embrace common goals. Once again, the survey found significant opportunities for improvement in this regard.
- Three quarters of the printers surveyed indicated that certification of their printing processes to a well-recognized standard was a goal that the printer had already achieved (19%) or was planning to achieve in the near future (57%).

RIT's response to the survey findings was a call to action. The team conducted research aimed at improving the utility of printing standards when used with optically brightened papers and presented the results to ISO/TC 130 in October 2010. As a result, the Technical Committee endorsed implementing the solution proposed by RIT in future standards and future revisions of current standards. In a second presentation, RIT—as a representative of the U.S. delegation—made the case for harmonizing printing standards to ISO/TC 130. In response, the international standards community embraced the U.S. position and formed a new working group, WG13, with RIT as the convener. WG13 will address this important issue. Finally, RIT will launch a rigorous, objective process for certifying conformance to printing standards—PSA certification—in early 2011.

Proposed Research Agenda for the Coming Year

The printing standards survey confirmed the importance of international standards in achieving customer's expectations and increasing operational efficiencies. It also confirms the level of interest among printers in seeking process certification.

As RIT continues its certification preparation, one of the critical decisions is the press sheet conformance analysis. There are many scoring criteria, e.g., deviation conformance of solid colors, TVI, and registration of CMYK, variation conformance of solid colors, TVI, and registration, etc. Should the certification be granted only when all of these criteria are met or most of the criteria are met? If so, where is the threshold for making the pass/fail decision? Thus, the proposed research agenda for 2011 is "Data-based Determination of Pass/Fail Criteria for Printing Conformance."

An approach to answer the research question, "How should pass/fail criteria of printing certification be defined?" is to study the variation and conformance of existing press sheet databases. There are two databases available to the researchers: (a) PSO database, courtesy of FOGRA PSO (Print Standard Offset), which contains 88 Excel files with a common file structure; and (b) G7 database, courtesy of IDEAlliance, which contains close to 100 files. Other databases (e.g., PSA database), may be included in the future.

Acknowledgments

We thank Professor Patricia Sorce and the Printing Industry Center for their financial support of the project.

We want to thank Mr. Joe Fazzi, IDEAlliance, for partnering with RIT and promoting the survey to printing companies in North America. We also want to thank the printing companies who participated in the survey worldwide.

We want to recognize Mr. Fred Hsu, Color Specialist and a member of the PSA Team, for his support in the preparation of the test form for printing conformance check-up.

We want to thank Mr. Robert Eller, Visiting Scholar at RIT, for his encouragement, constructive comments, and review of the manuscript.

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References

ISO 12646, Graphic technology - Displays for colour proofing - Characteristics and viewing conditions.

ISO 12647-2, Graphic technology - Process control for the production of half-tone colour separations, proof and production prints - Part 2: Offset lithographic processes.

ISO 12647-7, Graphic technology - Process control for the production of half-tone colour separations, proof and production prints - Part 7: Proofing processes working directly from digital data.

ISO 13655, Graphic technology - Spectral measurement and colorimetric computation for graphic arts images.

ISO 15076, Image technology colour management - Architecture, profile format and data structure - Part 1: Based on ICC.1:2004-10.

ISO 15930, Graphic technology - Prepress digital data exchange using PDF.

ISO 2846, Graphic technology - Colour and transparency of printing ink sets for four-colour printing.

ISO 3664, Graphic technology and photography - Viewing conditions.

Appendix A: Printing Conformance Check-up

Printing Standards Survey

Printing Conformance Check-up

Printing conformance check-up only applies to sheet-fed and web offset printed samples of ISO 12647-2 Type 1 (gloss coated) and Type 2 (matte coated).

Your task is to print to the ISO 12647-2 on the solids. RIT will evaluate if your printing conforms to ISO 12647-2 specifications as well as how close your printing compared to the published data set of your choice, i.e., Fogra39 or GRACoL1.

Instructions

1. Place the PDF Test Forms A & B (Figures 1 & 2) in your InDesign or QuarkXPress press form. Fill in the following data in the participant info section of Test Form A:

   a. Company name

   b. Location (city, country)

   c. Date of production

   d. Production Note (paper, ink, etc.)

Figure 1. Test Form A.

Figure 2. Test Form B.

2. Add your custom targets, such as color control bar, test images, and press calibration targets. Do not scale the test forms. An example of the sheet-fed signature is shown in Figure 3.

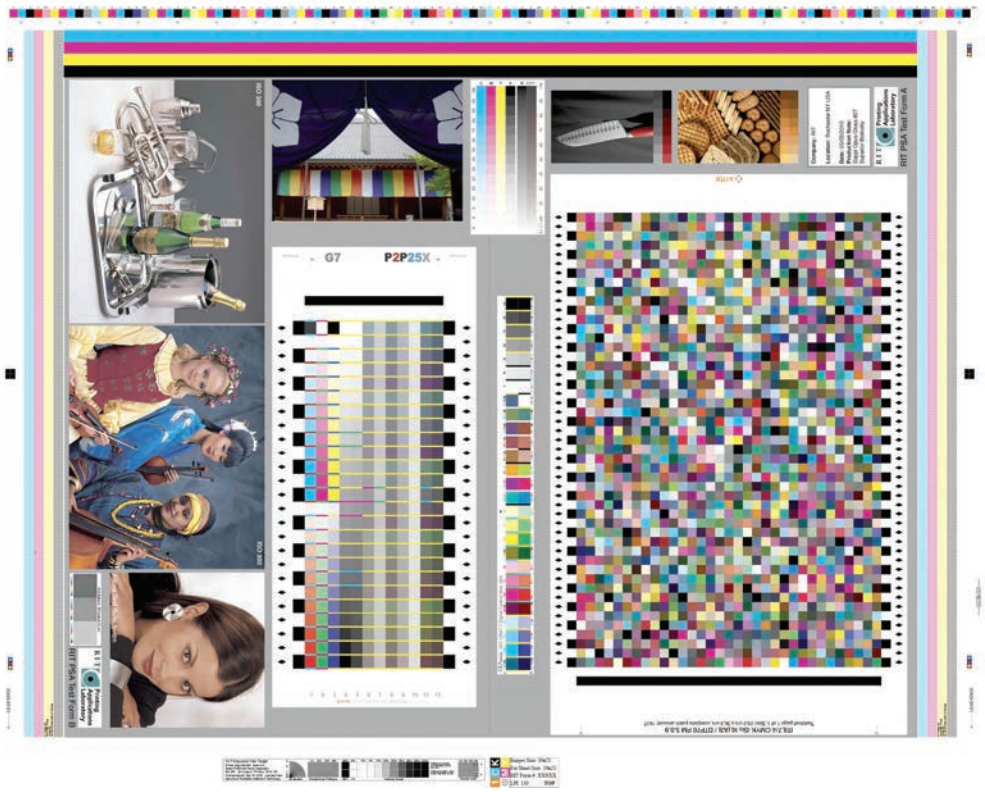


Figure 3. An example of the sheet-fed signature.

3. Print the press form under a calibrated printing condition.

4. After the ink is dried, collect 5 OK print samples and they don't have to be consecutive sheets. Cover them with a blank sheet. Do not tape or cut the print samples. If folding is necessary, do not fold across targets.

5. Fill out the print production data sheet in Appendix A.

6. Mail the print samples and Appendix A to RIT using a mailing tube or stay-flat envelope.

Print Production Data Sheet

Please fill out the following information using PDF or by hand, and attach it with the print samples.

Company:
Name:
Phone no./e-mail:
CTP/Press Calibration: (check one)

☐ ISO (TVI)

☐ G7 (gray balance)

☐ Device link

Data set aim: (check one)

☐ GRACoL1

☐ Fogra39

Press: (check one)

☐ Sheet-fed ☐ Web ☐ Other

Press model: _____

Color measurement device: _____

Time taken to achieve color OK (min.) _____

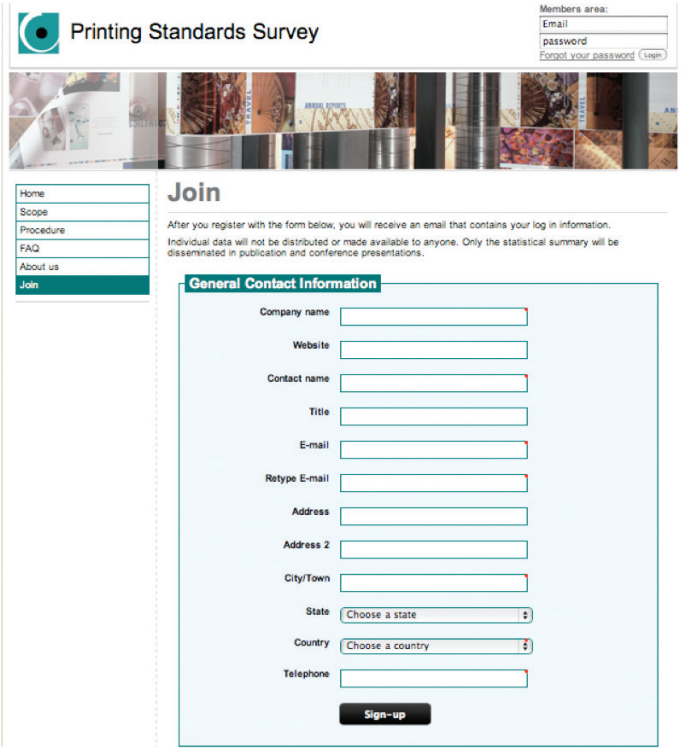
Ink:

Paper:

Type 1:

Type 2:

Appendix B: Website Registration



Appendix C: Questionnaire

Printing Standards Survey 2010

Introduction

Thank you for your interest in the printing standards survey. The goal of the survey is to capture the view of printing companies regarding (1) the role of printing standards, (2) standard operating procedures from data reception to printing, and (3) workflow efficiency in terms of pain points felt when communicating with customers, implementing color control, and encountering technical roadblocks.

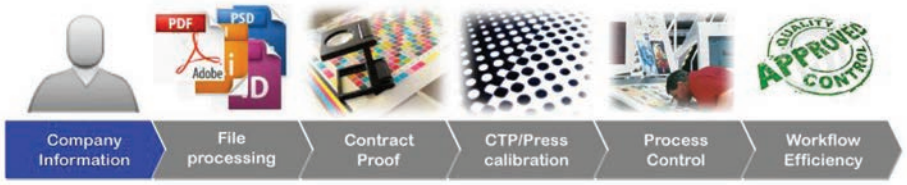
Individual data will not be shared. Only the statistical summary will be disseminated in publication and conference presentations.

Please take the next 15 minutes to complete the questionnaire.

Thank you for your participation.

Printing Standards Survey 2010

Company Status Regarding Certification / Qualification



*** 1. Please enter the region of your company headquarters**

- ◯ North America
- ◯ Europe
- ◯ Asia
- ◯ Other (please specify)

*** 2. Has your company received ISO 9001 quality system certification?**

- ◯ Yes
- ◯ No
- ◯ Don't know
- ◯ N/A

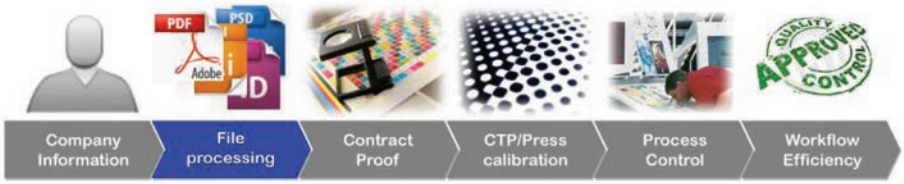
Printing Standards Survey 2010

*** 3. Has your company received printing process certification/qualification?**

- ◯ Yes - G7 Master Printer
- ◯ Yes - PSO
- ◯ No
- ◯ Don't know
- ◯ N/A

Printing Standards Survey 2010

File Reception & Verification



*** 4. Do your customers use standard color space, e.g., ISO ECI, GRACoL, SWOP, as the common CMYK space for file creation?**

- ☐ Yes - ISO ECI
- ☐ Yes - GRACoL
- ☐ Yes - SWOP
- ☐ No
- ☐ Don't know
- ☐ N/A
- ☐ Other (please specify)

*** 5. Please rank how often your company receive a given file format.**

	Most frequently - 4	3	2	1 - Least frequently	N/A
PDF/X-1	◯	◯	◯	◯	◯
PDF/X-3	◯	◯	◯	◯	◯
InDesign	◯	◯	◯	◯	◯
QuarkXPress	◯	◯	◯	◯	◯

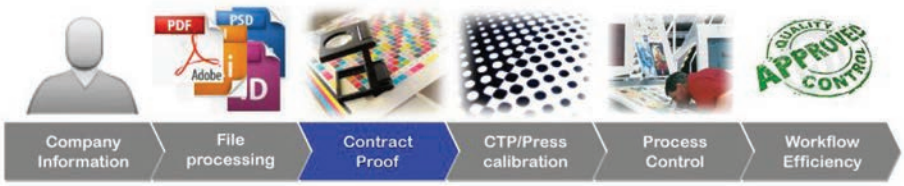
Printing Standards Survey 2010

*** 6. Do you use preflight check tools to ensure the correctness of the files?**

- ◯ Yes
- ◯ No
- ◯ Don't know
- ◯ N/A

Printing Standards Survey 2010

Proofing



*** 7. Please respond to the following statements by selecting agree, disagree, don't know, or Not Applicable (N/A).**

	Agree	Disagree	Don't know	N/A
We implement color management in our digital proofing workflow.	◯	◯	◯	◯
We use standard profiles, e.g., ISOcoated v2 (ECI), Coated GRACoL 2006, in our digital proofing workflow.	◯	◯	◯	◯
We build our own proofer color profiles.	◯	◯	◯	◯
There is a good match between customer submitted proof and our contract proof.	◯	◯	◯	◯
There is a good match between our contract proof and OK sheet.	◯	◯	◯	◯
We use display-based soft proofing.	◯	◯	◯	◯

Printing Standards Survey 2010

* 8. Do you use a certified proofing system?

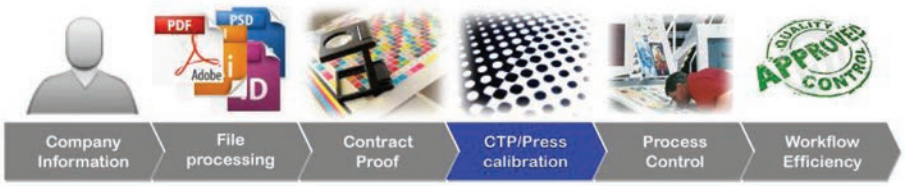
- ◯ Yes - IDEAlliance
- ◯ Yes - Fogra
- ◯ No
- ◯ Don't know
- ◯ N/A
- ◯ Other (please specify)

* 9. Do you verify the accuracy of the individual proof?

- ◯ Yes - Manually measure a proofing wedge
- ◯ Yes - Handled by a proofing verification system
- ◯ No
- ◯ Don't know
- ◯ N/A
- ◯ Other (please specify)

Printing Standards Survey 2010

CTP



* 10. Which of the following CTP/Press calibration method does your company use to conform to a printing standard? (choose those that apply)

- ☐ TVI
- ☐ Gray balance
- ☐ Device link
- ☐ Don't know
- ☐ Other (please specify)

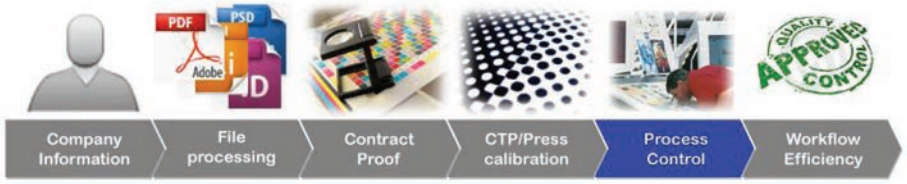
Printing Standards Survey 2010

*** 11. Please respond to the following statements by selecting agree, disagree, don't know, or Not Applicable (N/A)**

	Agree	Disagree	Don't know	N/A
We generate only linear plates.	○	○	○	○
We include both linear wedge target and curved wedge target to verify CTP/Press calibration.	○	○	○	○
We use a plate reader to verify plate exposure and processing.	○	○	○	○
We use a screen ruling indicator to verify plates.	○	○	○	○

Printing Standards Survey 2010

Process Control



*** 12. What color measurement device is used in your pressroom? (choose those that apply)**

- ☐ Close-loop color control system
- ☐ Auto scanning spectrophotometer
- ☐ Hand-held colorimeter or spectrophotometer
- ☐ Hand-held densitometer
- ☐ We do not have color measurement, control, and reporting system

*** 13. What is the most critical factor that determines your color OK sheet?**

- ○ Visual match to proof
- ○ Print to ISO CIELAB aim points
- ○ Print to density that conform to ISO CIELAB aim points
- ○ Other (please specify)

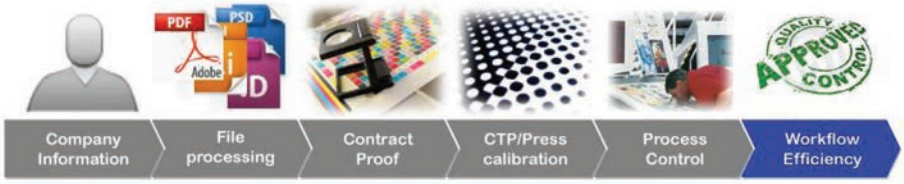
Printing Standards Survey 2010

*** 14. How do you characterize your printing process control practice? (choose those that apply)**

- [ ] Visual inspection of press sheet
- [ ] Measure color/density
- [ ] Data saved
- [ ] Data charted and reported
- [ ] Pressrun analyzed and results shared
- [ ] Analyzed data is used for continuous improvement
- [ ] N/A

Printing Standards Survey 2010

Workflow Efficiency



The next four sections of questions focuses on pain points in your daily production and in the industry in general.
The following statements may all be very important to you, but they are structured so you can only select an answer once. Like being a judge in a beauty contest, all contestants are beautiful, but you must rank.

Printing Standards Survey 2010

*** 15. Please rank the importance of the following issues in your daily production.**

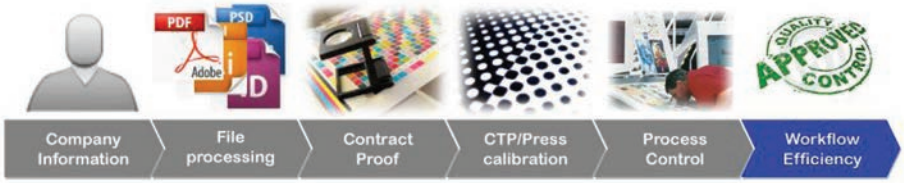
	Most important - 5	4	3	2	1- Least important
Having standard operating procedure (SOP) in color critical areas of the workflow	○	○	○	○	○
Having customers' PDF files and proofs certified to a known standard	○	○	○	○	○
Having efficient press make-ready in achieving OK print	○	○	○	○	○
Having an OK sheet as a production reference	○	○	○	○	○
Having a right measurement and reporting system in order to verify printing consistency	○	○	○	○	○

*** 16. Please Rank the importance of the following issues regarding your color-measuring instruments.**

	Most important - 3	2	1 - Least important
Having good inter-instrument agreement	○	○	○
Having certified reference material (e.g. T-Ref or Lab-Ref) to verify measurement accuracy	○	○	○
Having our color measuring instrument sent back to the vendor for re-certification	○	○	○

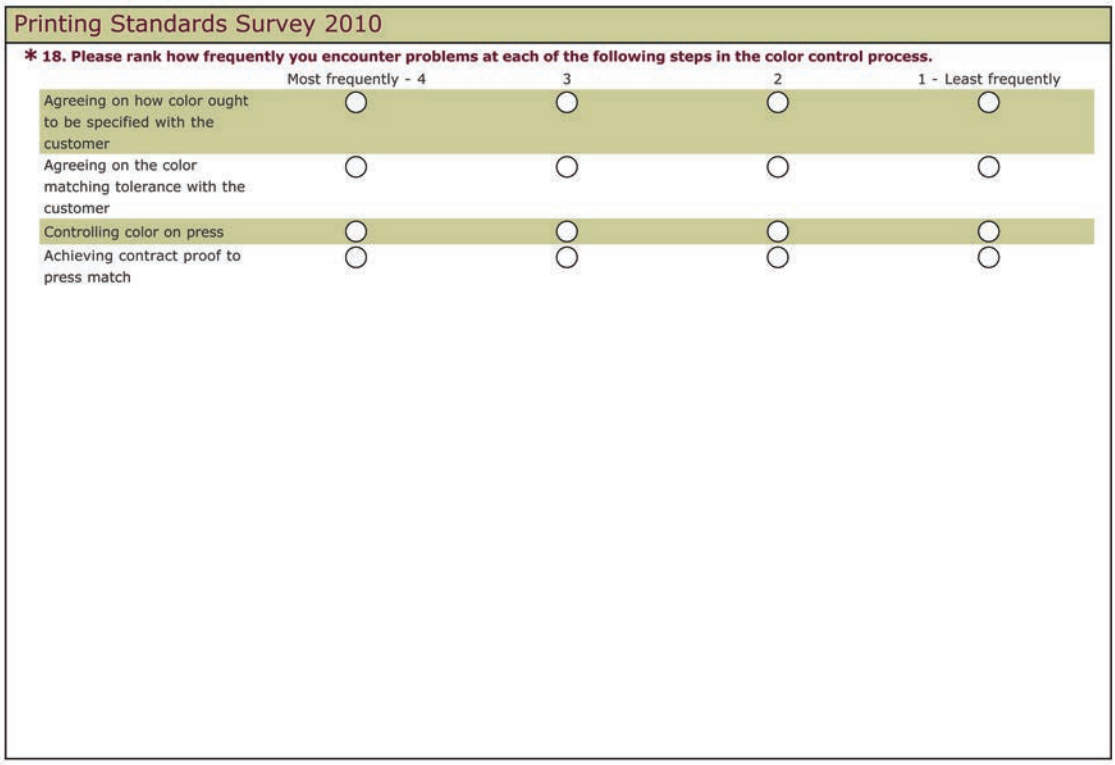
Printing Standards Survey 2010

Workflow Efficiency



*** 17. Please rank how problematic the following technical issues are to you.**

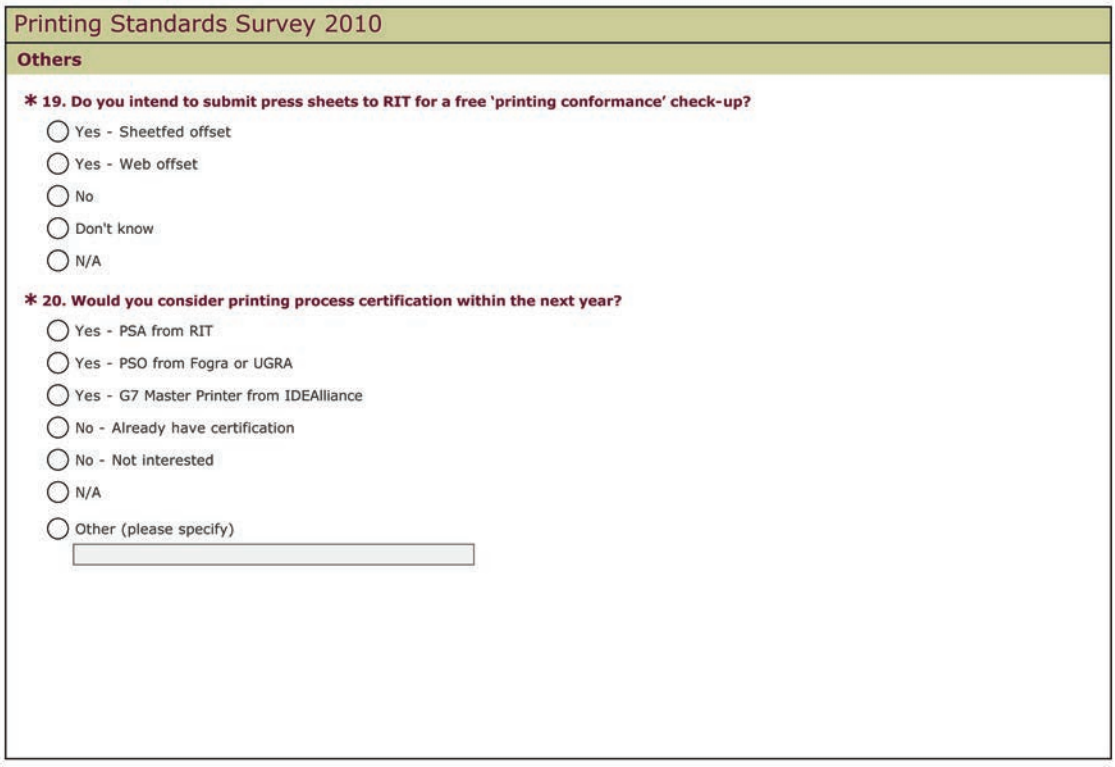
	Most problematic - 4	3	2	1 - Least problematic
Paper containing OBA does not conform to the paper white point specified in ISO 12647-2	○	○	○	○
Inks do not conform to ISO 2846	○	○	○	○
Press sheet and proof do not match each other visually	○	○	○	○
ISO 12647-2 only addresses a small part of my customers' needs	○	○	○	○



Printing Standards Survey 2010

* 18. Please rank how frequently you encounter problems at each of the following steps in the color control process.

	Most frequently - 4	3	2	1 - Least frequently
Agreeing on how color ought to be specified with the customer	○	○	○	○
Agreeing on the color matching tolerance with the customer	○	○	○	○
Controlling color on press	○	○	○	○
Achieving contract proof to press match	○	○	○	○



Printing Standards Survey 2010

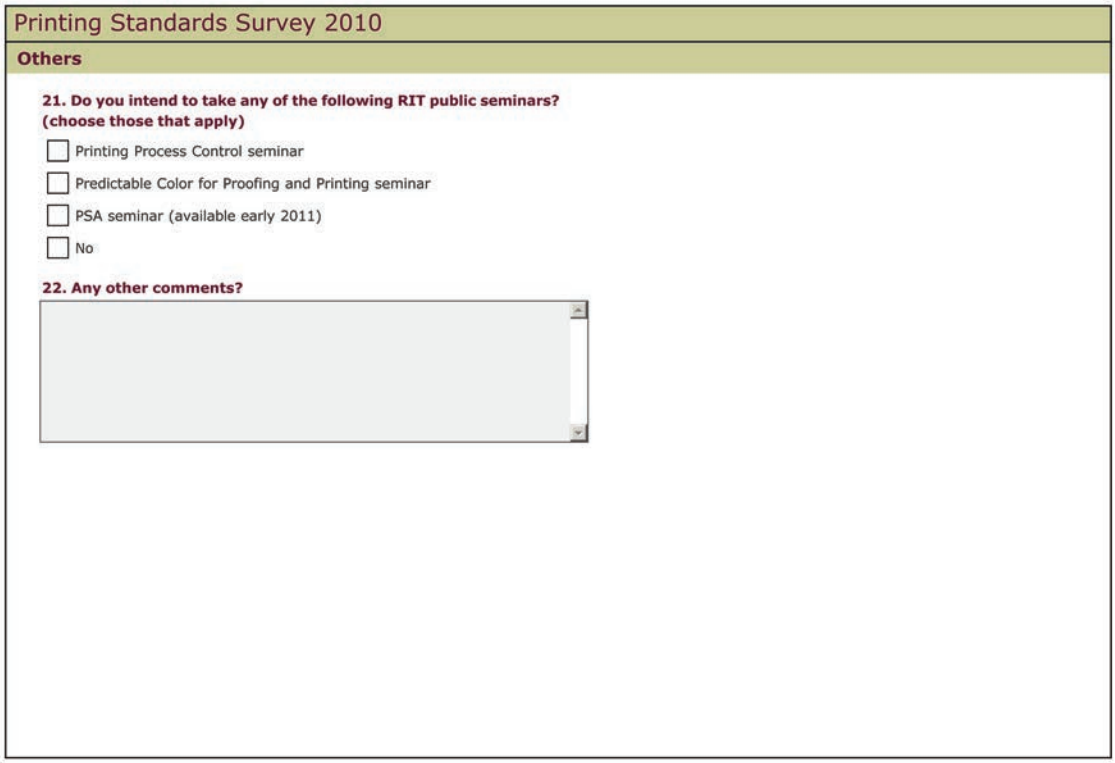
Others

* 19. Do you intend to submit press sheets to RIT for a free 'printing conformance' check-up?

- ○ Yes - Sheetfed offset
- ○ Yes - Web offset
- ○ No
- ○ Don't know
- ○ N/A

* 20. Would you consider printing process certification within the next year?

- ○ Yes - PSA from RIT
- ○ Yes - PSO from Fogra or UGRA
- ○ Yes - G7 Master Printer from IDEAlliance
- ○ No - Already have certification
- ○ No - Not interested
- ○ N/A
- ○ Other (please specify)



Printing Standards Survey 2010

Others

21. Do you intend to take any of the following RIT public seminars? (choose those that apply)

- [ ] Printing Process Control seminar
- [ ] Predictable Color for Proofing and Printing seminar
- [ ] PSA seminar (available early 2011)
- [ ] No

22. Any other comments?

Appendix D. Split-group Analysis

With the help of Professor ChangYong Feng, University of Rochester, additional statistical testing was conducted to see if there were significant differences between two factors or sub-groups through the use of SAS 9.2 (SAS Institute Inc., Cary, NC).

1. Location and ISO 9001 certification

We compared the relation between the location of companies and whether or not they had ISO 9001 registration.

Location	ISO 9001 certification		Total
	Yes	No	
North America	10 (14.08%)	61 (85.92%)	71
Other	17 (89.47%)	2 (10.53%)	19
Total	27	63	90

The Fisher's Exact Test shows a highly significant difference between the proportions of ISO-registered companies in North America and in other parts of the world ($p < .0001$). In fact, the proportion of ISO certification in other parts of the world (89.47%) is much higher than in North America (14.08%).

2. Location and printing process certification

We compared the relation between the location of companies and whether or not they had printing process certification.

Location	Printing certification		Total
	Yes	No	
North America	21 (29.58%)	50 (70.42%)	71
Other	8 (42.11%)	11 (57.89%)	19
Total	29	61	90

The Pearson's Chi-squared Test shows no significant difference between the proportions of printing certifications of companies in North America and in other parts of the world ($p = .30$).

3. The relation between process certification and results from Question 17

Process certification	Paper containing OBA does not conform to the paper white point specified in ISO 12647-2				Total
	Least problematic			Most problematic	
	1	2	3	4	
No	14 (23.33%)	13 (21.67%)	17 (28.33%)	16 (26.67%)	60
Yes	4 (13.79%)	4 (13.79%)	9 (31.03%)	12 (41.38%)	29
Total	18	17	26	28	89

The Cochran-Mantel-Haenszel Statistics show that the companies with process certification are not significantly different than companies without process certification regarding paper non-conformance due to OBA (p = .10).

Process certification	Inks do not conform to ISO 2846				Total
	Least problematic			Most problematic	
	1	2	3	4	
No	8 (13.33%)	29 (48.33%)	19 (31.67%)	4 (6.67%)	60
Yes	5 (17.24%)	19 (65.52%)	3 (10.34%)	2 (6.90%)	29
Total	13	48	22	6	89

The Cochran-Mantel-Haenszel Statistics show no significant difference between companies with/without process certification regarding inks that do not conform to ISO 2846 (p = .16).

Process certification	Press sheet and proof do not match each other visually				Total
	Least problematic			Most problematic	
	1	2	3	4	
No	10 (16.39%)	9 (14.75%)	9 (14.75%)	33 (54.10%)	61
Yes	5 (17.86%)	3 (10.71%)	9 (32.14%)	11 (39.29%)	28
Total	15	12	18	44	89

The Cochran-Mantel-Haenszel Statistics show no significant difference between companies with/without process certification regarding proof and print that do not match each other (p = .60).

Process certification	ISO 12647-2 only addresses a small part of my customers' needs				Total
	Least problematic			Most problematic	
	1	2	3	4	
No	28 (42.55%)	9 (14.89%)	16 (28.72%)	8 (13.83%)	61
Yes	15 (51.35%)	2 (10.81%)	8 (21.62%)	4 (16.22%)	29
Total	43	11	24	12	90

The Cochran-Mantel-Haenszel Statistics show no significant difference between companies with/without process certification regarding the scope of ISO 12647-2 being too narrow ($p = .60$).

4. The relation between ISO 9001 status and continuous process improvement

ISO 9001 certification	Continuous improvement		Total
	Yes	No	
Yes	12 (44.44%)	15 (55.56%)	27
No	15 (23.81%)	48 (76.19%)	63
Total	27	63	90

The Pearson's Chi-Squared Test shows significant differences between the two groups (with and without ISO 9001 certification). Companies with ISO 9001 registration tend to be more aligned with continuous process improvement ($p = .05$).

5. The relation between company location and process certification

Company location	Type of process certification sought			Total
	PSA	PSO	G7	
USA	30 (50.85%)	0 (0.00%)	29 (49.15%)	59
Europe	2 (16.67%)	9 (75.00%)	1 (8.33%)	12
Total	32	9	30	71

The Fisher's exact shows extremely significant differences between the U.S. and European companies in seeking process certification ($p < 10^{-4}$).

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