

# Increasing Prepress Productivity and Quality by Early Image Processing

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Keywords: Digital, Image, Quality, Productivity, Workflow

**Abstract:** Digitalization and preparation of images is a bottleneck in the prepress workflow. This influences the entire production of a print product. The productivity of the production workflow and the quality of the final product may be increased by restructuring the prepress workflow. The reconstruction proposed is that image scanning and preparation is carried out at a very early stage, possibly even before the production has been initiated by the customer.

This paper discusses the possibilities and problems of such workflows from the points of view of different types of customers and graphic arts service providers. The hypothesis is tested using both qualitative and quantitative data collected primarily from the Swedish graphic arts industry.

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## Introduction

Production technology in the graphic arts industry are rapidly moving from proprietary systems to a standard computer platform in an open production environment with standardized computer peripherals. This means that actors in the graphic arts industry can no longer direct a business around hardware investments and a static customer base. The actors have had a clear definition of their complements which have been closely related to their hardware investments. Examples of those definitions are photographic laboratories, prepress houses, image bureaus, print houses and so on. Today we call them collectively GASP's, Graphic Arts Service Providers [Behoriam 1997]. Services they offer today depend on their customers' demands and these demands change with the customers' marketplace. This makes it crucial for the GASP of today, and of tomorrow, to be able to alter their services. Production tools are becoming more similar for all of the GASP's. Intelligent tools are developed at a fast pace making it possible to automate the processes. The factors of success for the actors of today and tomorrow are the ability to change and understand the customers' market. The market demands shorter delivery times and lower costs. The total number of printed editions is diminishing, with an increasing number of pages and images [Romano 1997]. At the same time, the customers require higher quality, with the ability to predict and control the end result. If the customers are satisfied and loyal they will be a major factor in the long-term success of an organization. Therefore, it is important to know your customer, listen to what they say and act on that information [Prescott, 1995].

The coordination of content providers, producers and distributors has therefore become increasingly important in the graphic art industry, especially when working with short life-cycle products. Despite the rapid development of technology, which has generated new operational possibilities, there are still bottlenecks in the prepress production process [Rosenqvist & Lindgren, 1999]. One of the major bottlenecks is the digitalization and preparation of images. This influences the entire production of a print product [Kihlberg and Lindgren, TAGA, 1998].

This paper is a report and part of a research project called Digital Image [Digital Bild, 1999]. The project is coordinated by the Institute for Media Technology [IMT, 1999], Stockholm, Sweden in cooperation with the Division of Graphic Arts Technology at the Royal Institute of Technology, Stockholm, Sweden [KTH/GT, 1999].

## Definitions

In this paper and in earlier publications from the research project, the definitions used for Digital Asset Management, functions, organizations, preflight, prepress, process, productivity, workflow, and quality are the following:

Digital Asset Management (DAM) is the process of indexing, storing, retrieving, distributing and securing digital assets (i.e. files), such as logos, photos, marketing collateral, documents and multimedia files in a distributed network environment.

Functions are an organizational term e.g. sales, printing, administrative function etc.

An organization is a:

"Company, corporation, firm, enterprise or institution or part thereof, whether incorporated or not, public or private that has its own functions and administration." [SS-ISO 8402].

Preflight is a general term used in the graphic art industry for the process of checking analog originals and digital files before sending them for further processing.

"Prepress is a general term for all work done before the page original is transferred to a printing plate or the imaging drum of an electronic press. Prepress includes the preparation and production of text, graphics and images." [Enlund and Nordqvist 1995].

A process is a:

"Set of inter-related resources and activities which transforms inputs into outputs" [SS-ISO 8402]. A process can include several activities which are on a finer level than the process. Activities and processes can be defined on different levels of granularity.

Productivity at its most general level is defined as:

Productivity = Outputs / Inputs

Workflow is a chain of activities through which there is a flow of material or information. A process can have several workflows.

Quality is:

“ Totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs”. [SS-ISO 8402]

Quality is therefore not an absolute value but always depends on the customer’s expectations. It is often described as: “Quality is fitness for use”. [Schnitzler and Has 1997]. “In other words , quality strategy is chosen to suit the circumstances.” [Field 1996].

## Method

The empirical data used in this paper has been collected during two years (February 1997- March 1999) of continual contacts with eleven Swedish graphic arts companies that are participating in the project “Digital Image”. Traditionally one can say that they fit in the following categories: commercial print houses with both web and sheet fed printers, prepress houses and image bureaus. These contacts have been through telephone interviews, workshops, tests, analysis of production data and observations at all companies. Open-ended interviews have also been conducted with both operators and managers at all companies. The data collected has been reported back to the participants for review and validation. Workshops based on collected data have been conducted with the participating companies to jointly analyze their status and possibilities. Apart from the thorough study of the participating companies, studies of other actors in the print production workflow, both in Sweden and in the United States of America, have also been conducted. All the companies studied and interviewed have been selected because they are in the front-line of the industry when it comes to technology and organization.

Several different techniques for collecting data have been used:

Interviews have been conducted with mainly prepress companies and printers with a prepress department. To obtain a clear picture of the entire print production workflow, interviews have also been conducted with actors such as publishers, advertising agencies, photographic laboratories, photographers and service bureaus. Software and hardware manufacturers have also been a source of information, even though they are not part of the print production workflow. The interviews have been carried out at the following types of companies:

- 6 Prepress companies
- 10 Printers with prepress departments
- 2 Newspaper

- 3 Monthly Magazines
- 2 Image bureau
- 3 Photographic laboratory
- 4 Service bureaus
- 3 Digital photographers
- 5 Large print customers
- 5 Hardware and software manufacturers for prepress products

Questions and answers regarding competence and organization in the graphic art industry have been exchanged and monitored at mailing lists such as Computer-to-Plate Pressroom Mailing List [ctpp, 1999], Prorental Mailing List [Prorental, 1999], Infomania PDF Mailing List [PDF, 1999]. The lists have been studied during the second part of 1997 until the first part of 1999.

Questionnaires have been sent to customers in the Swedish graphic arts industry. The objectives were to get their opinion on the service they acquire from their graphic arts service provider, with the focus on prepress. The questionnaires also included questions about how the graphic arts service providers can improve or change their services to better meet their customers' demands.

Studies from the United States of America with statistical information have also been utilized [Webb, 1999].

The studies and earlier publications [Kihlberg and Lindgren, TAGA, 1998] from the research project Digital Image states that: the digitalization and preparation of images is a bottleneck in the prepress workflow. Based on this, the presumption was made that this will effect the complete production of a printed product. It was also presumed that if it would be possible to put the image scanning and preparation activity as a first activity in the production workflow, even before the production has been initiated at the customers site, the productivity of the production workflow and the quality of the product would be increased. This gave the following hypothesis:

Hypothesis: It would be enough to put the image scanning and preparation as the first activity in a print production workflow to increase both productivity and quality of the product.

Documentation gain from the studies described above, were used to test the hypothesis. Although the qualitative data is comprehensive exact measurements are not possible since earlier research [Kihlberg and

Lindgren, SPIE 1998], has shown that documentation about the complete workflow is often hard to find and often is not complete. The qualitative data is therefore mainly used to illustrate the importance of a new image process and when trying to predict the effects of suggested changes in a new image process. The data were also used, together with earlier interviews and earlier results from the project, as a base in the interviews where the hypothesis was presented and discussed.

In the later interviews the respondents reflected on the hypothesis, if such changes would be possible, how it would effect their process and their service providers or customers process. Based on this, a theoretically rearranged workflow was created with the objectives to increase both productivity and quality. Finally the hypothesis was theoretically tested on the new theoretical workflow and its possible effects on the available qualitative data.

### Digital Asset Management as a service by the GASP today

Digital Asset Management (DAM) has, during 1998 and beginning of 1999, become the major hype within the graphic art industry. Multiple vendors, both of software and hardware, are using the term to target their customers. At seminars, exhibitions and conferences such as Seybold Seminar in Boston 1999, QuarkXpress Service Plus in Vail 1999 and VUE Point in Arlington 1999 the DAM sessions have drawn the largest interests. The main focus of these sessions have been on the software, hardware and network used. The usage have been focused on storing, retrieving and transferring digital files. The main reasons, presented, for using DAM systems have been to reuse digital files and to output them on different output devices.

These reasons should be obvious to the actors in the graphic art industry, according to the author. Anyone that handles digital files have to be able to store, retrieve and then reuse them. The real question that is very seldom mentioned is: How is it possible, by using a DAM system, to increase the value of my services to my customers.

According to the studies, industry magazines and the above mentioned conferences, an obvious value is in handling the digital files in a more effective way. The images will be ready for reuse for different media and even for the target audience on an individual basis. However, building a value proposition based on handling digital files for reuse alone can be a very short term strategy. One of the reasons for this have been reviewed in the introduction of this paper, the rapid decrease in

hardware and software prices. To be able to implement such solutions, major investments were needed only a few years ago. Today, image databases connectable to text databases and tracking systems for digital files are available off the shelf in most well sorted software retail stores. Since all the actors in the print production workflow, are using the same or similar software and hardware, these solutions will most probably be used by all actors in a short future. Solutions for handling digital files and to offer that service to customers will therefore be taken for granted. The added value it will deliver will be very small or none existing. However, it will be a must to be able to manage data in a cost efficient and easily communicated way to stay competitive for all actors in the graphic art industry.

On the other hand, there are companies that have based their entire business on storing and letting customers retrieve digital files, namely image bureaus. Examples of today are Associate Press (USA), Pressens Bild (Sweden), PhotoDisc (USA) etc. They are all offering searchable digital files for multiple output. The added value they deliver is the pre-use archiving of images. The customers can search and retrieve images that they have not used before. This increases the creative phase of the production by giving the opportunity to try and "feel" before deciding what to use in the final product, according to interviewed customers. To be able to search for specific categories of images also makes the selection and decision phase easier, according to them.

Apart from the image bureaus, the majority of graphic art service providers studied, do only archive used images and used digital files. A great value, according to customers studied, would be if unused customer specific images and files would be searchable together with the archived used images and files. This would deliver a similar added value as the image bureaus, images and illustrations on CD's are delivering. Today, the customers have to search in mainly analog archives and/or ask colleagues to be able to retrieve such analog information. This is time consuming and in many cases not feasible, it might even be easier to reproduce information although it is available analog or digital somewhere inhouse.

### The new workflow

To be able to store unused customer specific images together with the archived used images and files in a cost efficient way, the GASP's needs a new image workflow. The workflow presented here (Figure 1) is

based on the reorganized workflow presented at TAGA 1998 [Kihlberg and Lindgren, TAGA 1998]. The difference is the extraction of the workflow into the customer's site (the two first steps in the workflow in Figure 1). The extraction includes the proactive approach to collect and digitize unused and none specified images for the customer. The workflow consists of sets of static automated image processes in conjunction with manual image processes. Images are accessible to other operators and customers when they have reached the boxes with the numbers 1 - 4 in the lower right corner.

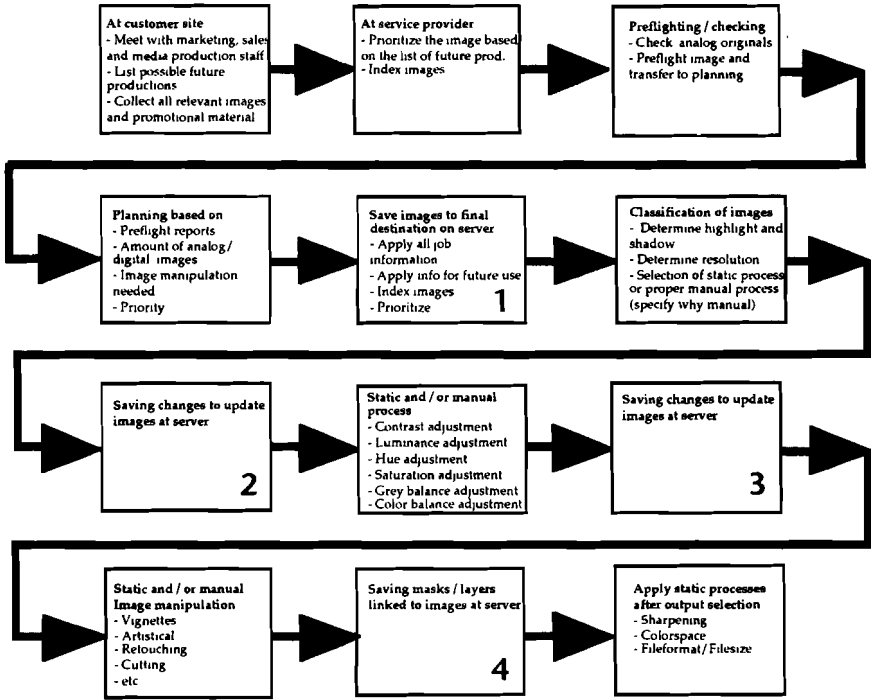


Figure 1. The workflow for digital images from customer site to chosen output

This workflow starts at the customer site. It can be in conjunction with a sales visit, proof approval procedure, follow up meeting or as a part of a production cycle. It is all dependent on the customer, the customer relation and the current situation. While at the customer site, the GASP representative should gather information on planned marketing campaigns, conferences, seminars, sales presentations, product release and other activities that the customer will need images for to realize. The next step for the GASP representative is to collect new and old



images from as many sources as possible. For example; sales, marketing, media production and other departments that have company specific images. Contacts and cooperation with the customers external contractors such as image bureaus, photographers, illustrators, ad agencies etc. might also have to be established.

The collection phase is not a one time operation. It is a continues process during the whole relationship with the customer. Once the added value is understood by the customer and its contractors images will be provided and indexed by them and delivered to the GASP.

When the images reach the GASP site a priority list is made according to ordered production, near future production and future production. The next step is to preflight the images both analog and digital according to the priority list. After preflighting the planning staff will sort the files to a central server and, if necessary, to a physical folder (analog originals). Information about where the digital files and the physical folders are located and all order specific information should be available in a digital format, on the central server. The planning staff can now priorities and distribute work orders to the prepress organization based on processes needed. The images are indexed based on information available and planned production. Indexing of images for future use have to be general enough so that there will be multiple hits when searching for images of a specific category. Images for specified use have to have a more job specific indexing so when searched for there is only one hit.

Scanning staff will scan and open images to and from the server location determined by the planning process. The resolution of the images should be set to match the most common format used. It should be chosen so it will require a minimum of re-scans when used in multiple productions. After opening or scanning the images only tonal range will be set. Then the scanning staff determines which process is needed for each image and saves the image into that process's "to do" folder. If an image is classified as not being able to be processed through any automatic process it should be placed in a manual process folder. The reasons for not being able to be automatically processed should be documented together with the other information about the complete order. After it has been processed, the image will replace its original file at the central server. The images are at this point not adjusted for a specific output device. They are saved in a device independent format and are adjusted to be a digital original which can be reproduced at different outputs. They are now also available for the customer.

If an image is included in an already existing order, the next process in the image workflow is to apply image manipulations requested by the customers. Manipulations made shall be saved as masks/layers and not to the image file on the server. They shall be applied when the images are being processed for a selected output. This will leave the digital original on the server untouched, which makes it possible to use that image with new settings in another production. The images are thereby adjusted for reproduction with mask/layers linked to the images for the manipulations requested. The last process is to adjust the images for the final output. Static processes have to be chosen to fit the output device. The appropriate file size (resolution), sharpness, reproduction curve/ color space (i.e. ICC profiles) will then be applied. Images that have been used are indexed in the data base with information about, masks/layers and output profiles used.

The advantages of this kind of workflow is, the ability to place images into a layout at an earlier stage of the process. Since there is only one original image file on the server, lay-out operators can start to place the images into a lay-out before the image is completely adjusted. This will increase productivity and may eliminate the bottleneck of scanning, in other words increase throughput. Customers can also access images in box 1 - 4 based on agreements and what is considered to increase customer value and or productivity. Unused customer specific images would now be searchable together with images in production and used archived images.

When the customer starts a new production and uses images from the server, the most time consuming process is already executed, the image scanning and preparation. The only step left is to apply customer specified manipulations and to chose output process.

### Case study

To be able to calculate potential increase in productivity with the new workflow, production data from a Swedish monthly magazines were used. The magazine had 32 pages and were printed in two signatures. The magazine was studied during a period of 5 month. The evaluation of each magazine issue was done directly after the magazine issue had been completed in the editorial department and at the graphic arts service provider which in this case was at the printing plant. In total, 10 open-ended interviews were made. The key people of editing; chief-editor, graphical designer and account manager, were interviewed.

At the printing plant, the magazines' coordinator was interviewed. Gathered and analyzed data was verified during several iteration loops with the interviewees.

The total production time was 20 days of editorial work and 10 days of manufacturing. In the studied case the chief-editor was in charge of all activities regarding the editorial work including layout. The principal work task was to put together the right mix of articles for each issue. The activity time for initializing and receiving material from external contributors, e.g. authors, illustrators and photographers, took between 1/2 day to 3 days. However, some articles required weeks and up to one year of pre-scheduling. [Rosenqvist & Lindgren].

As much as up to seventy-five percent of the manufacturing time was spent on images and ads. If the images and ads would have been digitized by the GASP, according to the new workflow, the theoretical time saving would be up to seven and a half days.

To be able to achieve this, the GASP have to collect images and ads before the chief-editor starts with a new edition. This is only possible for ads that are booked in advance. Images on the other hand were in many cases available in advance. The reason not to digitize them directly was that the chief-editor had not decided exactly which once to use. If all images would have been digitized, and made searchable for the chief-editor, the creation of the magazine would have been eased. The manufacturing phase would also be moved into the editorial phase. This would make it possible to decrease to total amount of days after the editorial phase had finished. The highly theoretical savings would be two to seven and a half days, depending on the amount of images available in advance.

## Results

The added value and thereby the quality of the service provided would be increased if a graphic art service provider could digitize, index and store unused and used customer specific images and digital files in a resolution and device independent format, according to customers interviewed. This would also be a step for a seamless interface between creation and manufacturing to ensure the smooth exchange of design decisions and product specification. Which would according to Gary Field increase the quality delivered from a prepress service provider [Gary Field, 1999]. To be able to do this the service provider need to have access to the customers site and a thorough

knowledge about the customers business. This, in itself, would according to the studies increase the quality of the service provided.

Digitizing, indexing and storing digital images, before use, would also increase the productivity of the total print production workflow. This might seem impossible since many of the images will probably not be used. More images would increase the workload of the scanning and image editing process. This statement is true, if we look at a customer that just do one or a limitation of print productions and then does not return to the same service provider. However, over fifty percent of the customer base at the service providers studied are regular customers with multiple print productions per year. The service providers all have peaks in the workload because of the regularities of their customers print productions. These peaks and the periodic of them are well known both to the service provider and the customer. Unused capacity could be utilized if some images could be digitize, index and edited in between these workload peaks. This would then decrease the workloads during the peaks. The static automated image processes would also increase that capacity of the workflow [Kihlberg & Lindgren, TAGA 1998] which would ease the extra workload. The productivity would increase, since image digitalization and editing is a bottleneck in the prepress workflow. It would thereby decrease the total print production time from creation to print, which would increase the customer value substantially.

### Conclusion

The productivity of the prepress workflow and the quality of the service provided may be increased by restructuring the workflow. The reconstruction proposed is that image scanning and preparation is carried out at a very early stage, even before the production has been initiated by the customer.

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