

# To print or not to print (digitally)?

## Innovative digital printing characteristics and their degree of penetration in print media markets

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### Abstract:

Digital printing systems are widely established in traditional as well as in newer companies oriented toward print media production and publishing. The establishment and the operation of digital printing systems within these companies is undertaken with the aims of entering new markets, gaining new customers and increasing profit. In particular, innovative digital printing characteristics such as short-run, print on demand and variable printing appear to offer the possibility of producing added-value products in print media markets.

However, data provided from various studies and surveys, conclude that the penetration of digital printing in print media markets, in as far as these characteristics are concerned, have not yet reached their potential.

This paper explores the possible reasons for the less than expected take up of digital printing and its disappointing degree of penetration in print media markets. Among the factors investigated are: the maturity of the market, customer behaviour as well as the application of appropriate business models.

In particular, this paper explores the printer-customer-end-user relationship and their interactions within existing business models which originate from the traditional graphic arts production chain, in order to ascertain whether existing business models are sufficient for facilitating digital printing or whether new models need to be developed and applied. The results of three case studies of graphic arts companies with regard to their policy and practice concerning the application of innovative characteristics and digital printing technologies are used to document the hypotheses formed.

The importance of these business models to the content industry will be shown, in terms of their relevance to the issue of cross media, with regard to media production techniques.

**Keywords:** Short-run, Print on Demand, variable digital printing, print media markets, business models, content industry, media production techniques.

### 1. Introduction

Books--especially product and service manuals, directories, prospectuses and other bound, multipage documents--traditionally have been printed on offset presses in runs of 5,000 or more. Nowadays, many of these short-shelf-life volumes are increasingly printed on digital presses in multiple runs of fewer than 500 with intermittent updates. The costs associated with prepress, production, warehousing and obsolete versions have made digital printing an attractive alternative. [Ward, 2002]

However, despite the seemingly obvious economies and advantages to digital printing, there is an ongoing debate about digital versus plate printing. [Link, 2001]

The most clear example of this is where there are large print runs, here the price per unit drops considerably from the price of digital printing to traditional printing. This is due to several reasons, such as the high price of investing in new technology, and the problem of the relatively rapid obsolescence of technology. Another class of problem, where there is progress, is that of information incompatibility. Only now are computer programs appearing that can translate original files to the format needed to digitally print, while merging cross media technologies like Quark Xpress that allows

content from the newspaper layout to be easily stripped of its formatting and made ready for posting onto the web, are also appearing.

Thus we are in fact seeing that not only digital printing but also traditional technologies in printing are developing. Apart from digital imaging presses, traditional offset printing machines as well as CTP (computer to plate) systems show increasing popularity. For example, between 2000 and 2001, the number of installations of computer to plate systems worldwide, increased by more than 100%. Based on data provided by Wolf, by the end of 2000 there were 4421 platesetters installed, and by the end of 2001 the installations increased to 8955 platesetters. [Wolf, 2002]

This paper explores the possible reasons for the less than expected take up of digital printing and its disappointing degree of penetration in print media markets. The next section gives some definitions of digital printing, as well as describing the features of (most) digital printing systems that are considered to be innovative and offer added value over traditional printing presses. Section 3 briefly reviews the print media market, and its development to date. Section 4 describes the case studies that were undertaken, and their results. Finally section 5 presents the conclusions with some recommendations to what needs to be done to ease printing innovation into the market.

## **2. What Constitutes Digital Printing?**

The very plethora of definitions that exist to describe digital printing indicates the confusion that reigns in this area, where the boundaries are continually shifting, determined both by technology, and by the breakdown of the traditional boundaries in the work flow, as between, for instance, the processes of print and binding. It serves to highlight some of the difficulties of understanding why and where cross media production techniques are needed.

Definitions of digital printing emphasize sometimes the process and sometimes the machinery used. For instance Juhola et.al., suggest that digital printing is a printing method by which electronically made-up, black-and-white or multi-coloured printed products, which may differ by sample or by page, are produced directly from an information system with a digitally controlled printing engine. [Juhola et.al., 1997] Such a definition excludes low-volume printing in homes, schools or offices. Further, others maintain that digital printing is the process whereby the content and originals for printing are directly transferred as digital data from pre-press to printing process directly, and that digital printing, whatever the technology employed, is considered to span the gap between desktop computer printing and traditional printing. In so doing, it consumerises the printing process, shifting the emphasis from output to content. [Pre-press, 1999]

When describing digital printing in terms of machines or hardware, Holland describes the different types of digital printing machines as follows:

- Non-variable on-press direct imaging (No film or plate)
- True digital which can handle variable content (Image carrier is re-imaged after each print). [Holland, 2001]

Politis, on the other hand, widens the list to include whole systems and suggests the following set ups could be considered as digital printing:

- Stand-alone machines, either for one- or four-colour printing in terms of capacity to offset printing (not copiers), producing sheets or rolls of paper, with further processing in a binding and finishing department.
- Digital printing systems where printing units or machines are combined with on-line binding and finishing systems, leading to a ready-to-deliver printed document. (Trimming can either be included or be a separate unit to these systems).
- Direct imaging printing machines which are termed hybrid printing machines where direct imaging is combined with traditional offset printing systems (74 Karat and Heidelberg Quickmaster are examples of such machines) [Politis, 2001a].

In comparison with traditional printing processes, digital printing can be presented as follows, in figure 1:

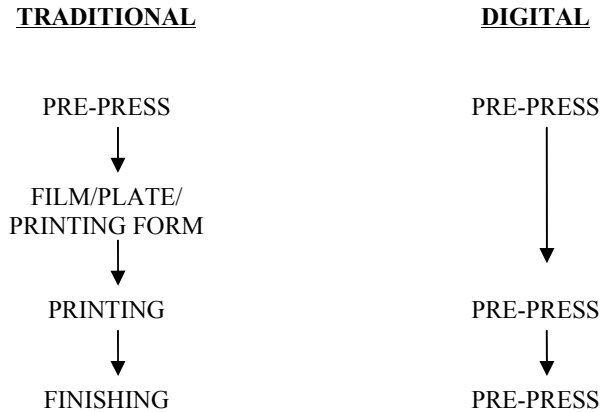


Figure 1: Digital versus Traditional Printing

Another way of defining digital printing is to classify according to the relationship between the output print engine and substrates. Based on this, digital printing can be categorised as:

- Direct to image carrier- (electrophotography)
- Direct to paper-(inkjet, thermal direct, dye sublimation and electrostatic) [Interquest, 1999a]

The same approach classifying digital printing technologies is illustrated in the table presented in Figure 2:

#### Technology map of available digital printing systems

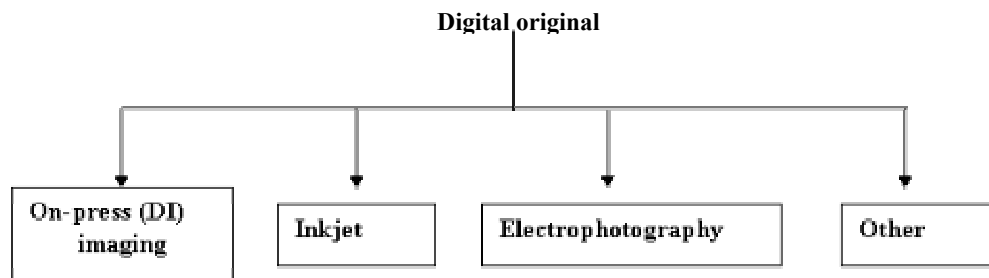


Figure 2: Technology map of available digital printing systems

Source: Digital printing – technology forecast to 2005, Pira international (2000)

## 2.1. Digital printing: innovative characteristics and technologies

The main innovative characteristics of digital printing over traditional printing are considered to be print on demand (PoD), short run and variable printing, [Back et. al. 2001] The next subsections briefly review current thought about each of these innovations.

### 2.1.1. Print on demand

At its simplest, Print on Demand (PoD) is an electronic printing process that delivers exactly and only what the customer wants, when the customer wants it, and at the place where it is needed [Hewson and Bank, 2000]. However, PoD can also be considered as a process that is more than just printing. It is everything from idea generation to printing, to delivering and distributing that information to the end user. Because print on demand is so all-encompassing, it requires a re-engineering of the entire process.

### 2.1.2. Short run

What is still clear is that PoD allows a complete book to be printed and in a matter of minutes, but that it is only cost-effective to produce books one or two at a time or in small lots, rather than in print runs

of several thousand. [sfwa.org.2002] Currently conventional printing presses are more appropriate for some jobs-long print runs or non standard formats-because unit cost is lower with longer print runs. [Parker 2001] But while a digital press may be capable of printing short runs economically, digital printing on printing presses is well suited for longer runs, thus, digital printing is printing from digital files but is not restricted to short runs. [Romano 1999]

### **2.1.3. Variable data printing**

Variable Data are any specific data that is not part of page design and that varies from form to form or page to page. [Romano,1999] whereas the term ‘variable digital printing’ refers to four-colour digital printing systems which are computer-to-paper devices capable of reproducing variable content such as text, graphics or images from copy to copy at reasonable production speed. [Juhola 2000].

Variable data printing technology is in the early stages of its adapted product life cycle. Manufacturers of digital presses and variable data systems are working to improve their products with respect to reliability, quality and speed. Advancements in the technology are being addressed from many sources. Key players such as Xeikon, Indigo, IBM, Xerox, Agfa, Barco and Scitex all continue to improve their product offerings. As all these improvements are made, companies must be aware of the vast variety of applications being demanded by the market place.[PODi 1999] Variable data printing has the potential to offer the highest added value, but also requires most changes in the production chain.[Juhola,2001] It is this feature which allows content and service providers to target their audiences, providing personalization of the content, customization of the presentation mode and versioning to suit the user. [deBronkart 2000]

Given the entrenched and undoubtedly tested tradition of reliability in offset printing, digital printing must provide more than just the possibility of cost-effective short print-runs for it to be a really viable publishing model. The extra key element does exist and can be located in the internet environment, where the possibility to exploit a catalogue of titles online linked to digital printers is a real one. For instance, Gopher, a Dutch publishing house, typifies a new crop of publishers using web sites to create new book publishing models by developing database software that directly links the process of book ordering and production in a centralized network. The system allows users (publishers and clients) to determine the form of content available, whether in the form of personalized fonts or additional elements and features; thus adding an element of customized variability to book production.

Thus variable content, a strong feature of online publishing, is now being used as a feature of traditional paper publishing. This is evident in updated editions of corporate documentation, travel guides, textbooks and learning materials and the related ability to have constantly updated printed versions. It is currently being done and could go further. Two scenarios that are technically feasible, and seem to fulfil user needs are those enabling learning material located on servers, accessible via web sites and linked to digital printers to be printed anytime anywhere, and responds to new needs caused by the increase in people pursuing long-distance and part-time education. A more general scenario currently being pursued is the development of digital printing machines that print and bind at the point of sale, in schools, stalls, supermarkets, bookshops etc. In a machine idealistically named the Perfect Book, readers select titles from a catalogue in a database, through a computer network which sets in motion the printing, binding, and trimming of a book that pops out at the other end. [Sulaiman-BPN May 2002a]

Given the attractiveness of these scenarios, one wonders why they are not already reality. Part of the answer lies in the problem of the situation that prevails in the marketplace. The next section discusses this in more detail.

## **3. Print Media Market: Trends and Characteristics**

### **3.1. General market trends**

The print media market is so closely allied to information and content provision services that it cannot fail to be affected by the far reaching effects of changes there, and overall market trends. Where previously the concern of the print media might have been limited to processes concerned with the presentation of printed documents, this has been enlarged to include such definitions as “content managing and processing” [Enlund, 2000], where content is divided into static and dynamic content. The first traditionally corresponds to the printed page, static content such as photos, logos, text,

signatures, customer data, whereas dynamic content is that in digital format, graphics, images, animations, audio clips, and video.

As the world of information dissemination is changing, more and more of the information and entertainment we encounter is an electronic form. One forecast estimates that by 2020, the relation among paper, electronic and other media will be as follows:

	1900	1950	2000	2020
Paper	61%	57%	49%	25%
Electronic	--	18%	36%	65%
Other	39%	25%	15%	10%

The same source believes that over the next 20 years print will also change. The volume of printing will grow but it will shift to on-demand technologies, with each category of printed product having different dynamics.[RIT-From Pulp to Pixel-Leslie,2001]

### 3.2 Establishment of digital printing in the marketplace

Digital printing has become established in the market with an added value based on certain advantages and characteristics that are important for the rapidly changing environment in print media such as: shorter production times; faster delivery; printing on demand; personalisation. However, this is not the whole story, the installation of a digital printing system can also cause a company to change its behaviour, both internally and in its relationship to its customer base. In some cases, digital printing can act as an agent of structural change in organization and management. This behaviour can be found in enterprises where digital printing is seen as a complement offering customers new possibilities, rather than an alternative to lithographic printing. [Pira, 2000]

One way of doing business is to use both new and old technology in an integrated way. For example, conventional offset printing can be used for the first print run for the highest quality, for offset still achieves this better than digital printers. Then subsequent print runs can be done digitally in line with demand, to ensure a safety net. On the other hand, short digital runs can provide real test-case scenarios for a book in a particular market before more expensive larger runs are pursued. [Sulaiman-BPN 2002b]

Thus the industry is under pressure not just from its traditional print customers but also from alternative media markets. In terms of quality, digital presses have many benefits to offer their clients, such a high quality colour with a short turn around time, exact quantity printing, customisation of documents with variable data, and then there are added benefits, such as the option of revising documents at the last minute. [Interquest 1999b]

Print management agencies and printers sometimes specialise in a particular market place, and promote their organisation as one which understands the needs of customers in that sector. These companies can develop services and processes which focus on industry-specific needs, and can anticipate solutions to their problems.

The print marketplace has become extremely competitive because it is no longer enough to seek differentiation from competitors through speed, quality or cost of service, many printers are seeking different ways of enhancing their attractiveness. Specialising, is one way of achieving this, but is not enough on its own. Hence many are looking to develop new services. [Parker 2001]

### 3.3 Human capital competence for digital printing.

In addition to these pressures, there is that of increasing job complexity: fully digital solutions addressing different market opportunities such a variable data, one-to-one applications and low run lengths can be printed on demand, often with one operator running multiple machines.[CAPStats 2002]. Indeed, digital print creates a number of special requirements and tasks for human capital including the following:

- the need for knowledge of the technical capabilities of the digital printing machine/system.
- the ability to explain to customers the added value of digitally printed documents.
- the need for efficient management capabilities and administration of a large number of small jobs with very short turnaround times, tight deadlines and fast delivery.

Graphic arts expertise, knowledge, experience and skills are considered important for digital printing production environments but they have to be implemented with an extensive range of new skills. These skills can be classified as general computer knowledge, pre-press (colour and colour management, data files and formats), digital workflow production, databases and management skills. Finally, human capital employed in an enterprise with a digital printing system needs to be able:

- to work within a flexible – cooperative working environment (teamwork) with continuously changing tasks.
- to work within a complex management environment where technology, administration, production workflow and customer satisfaction issues are combined.
- to participate in life-long learning programs.[A.Politis- 2001b]

### **3.4. Importance of variable data to cross media**

Digital data in a prepress stage implement established digital technologies. This means that technologies such as PDF find an innovative application regarding printing. An example of this is PDF documents, where mass communications can be encoded easily and flexibly with PDF documents, in ISO Standards with PDF/X-1:2001 and PDF/X-1a:2001 of the PDF/X family” [Driessche, 2002].

The advent of increasing technology in the web-based print publishing solutions is also to be added to the mix. Web publishers want to ease print production into multimedia broadcasting. That is: to take digital files, prepared for print, and convert them to formats that will publish on the Internet. This is of interest to for instance, newspaper companies, who want a web version of their printed newspaper, for customers who prefer their news that way, but also for revenue generated from web advertising.

Companies like Macromedia, which specializes in web publishing and Adobe and Quark, which target print publishing tools, share an interest in developing standards for cross media publishing, using XML. This is also the case of the CONTESSA project [Tsakali and Kaptsis, 2002] where the theory is that XML files are the created as the primary files for content, and then these can be used to publish to various devices, such as mobile phones, PDAs , PCs and of course to paper.

The importance of this trend is that there is the opportunity to create a strong case for variable data printing, that is feasible and not hampered by the existence of conflicting formats.

The next section takes a pragmatic view of what is happening within companies, and describes case studies undertaken in order to better understand the situation for digital printing.

## **4. Case Studies**

Three in-depth case studies were carried out, with existing graphic arts companies that have installed digital printing systems in Greece. The focus was on the application and use of innovative digital printing technologies in these companies, with emphasis on the application of PoD, variable printing and short runs for their customers and core markets. The research was undertaken in the latter part of 2002.

The companies, designated as A, B and C, are briefly described below: each had different strategies and struggles during their digital development.

- Company A was a traditional prepress establishment with an initial orientation in processing advertisement materials and leaflets for printing. Its initial core business was oriented to film processing (with an installation of an imagesetter).
- Company B was traditionally oriented to complete processing of high quality advertisements, magazine covers etc. This service included scanning, image and colour processing and final output in film. An important context for company B is the offer of added-value services in the advertisement field.
- Company C was initially a media service bureau, offering services in processing customers’ data and output in film working on a 24 hour basis.

The case study methodology used was based upon the field study guidelines of Yin [Yin 1994] for designing and conducting case studies. A basic set of questions were drawn up to act as a basis for discussion with the companies, primarily undertaken through interviews.

The basic set includes questions on the position of each company in the market before the investment in digital printing and afterwards, alterations (increase/decrease) in the customer list and the workflow procedures for applications such as variable data and short run productions. Through the interview changes in the manner of cost calculations and the percent of the risk that might be taken while creating a new business model in the new print media market were reviewed.

Analysis of the results revealed that only a part of these innovative technologies are applied in the print media market. According to the perceptions of the companies, two main reasons seem to be held accountable. One reason is that customer demand is not there. Customers are still not fully aware of or informed about the potential opportunities that digital printing can offer for their end users. A further reason is that there is still development of traditional technologies. That is not only digital printing, but traditional technologies in printing are developing, [Enlund,2001] and both can be applied with appropriate transformation of digital data to produce media output.

Regarding investment in digital printing, company A stated that their company was active in the prepress market providing innovative solutions due to the economic level in the small and medium markets that was fairly stable. Also, there were good relations to their customer base, and this helped them to continue their partnerships for greater cooperation. Company B answered that their production had risen because the market has altered and was enhanced with new a customer base active in the wholesale and retail market. Company C responded that their production has risen with new customers, and attributed this to its provision of round the clock services.

Company A also provided estimated percentages of the range of their customers. The changes that have occurred and are still in progress are many, and mostly point to greater demand. The range of their customers is calculated as below:

- 10-15% lithographers
- 25-35% graphic designers
- 25-35% creative bureaux
- 10-15% diverse associates

The customer base has increased and broadened in range and so has the aptitude of the market. The most interesting case is the fact that while lithographers-typographers (previous cooperating partners) were at first inclined to be sceptical about new developments, very soon, they changed their attitude and eventually decided to cooperate with company A for very short run productions (actually they kept the commissioning that would have been lost).

Company B has a PoD wide format department with applications of diverse material in different climate conditions. C company has PoD large format. All companies use workflow systems that manage all file formats (PDF, Postscript, Tiff, Jpeg, etc) for equipment compatibility to PC or MAC.

All three companies agreed about the difficulty of the penetration in the small and medium market and mainly in the specific area of short run production. Company A characterized the short run term with parameters that influence the productivity and not only the figures of the tirage. The parameters mentioned are not standard and are flexible according to the specific requirement of the job. For them the short run production cannot be defined firstly because they did not have previous experience in offset printing and secondly because there is no comparison between the ways they regulate the structure and the evaluation of each job with different criteria available. On the contrary company B was clear that quantity for them meant 400-600 printing material (A3 format), while Company C declared that the short run production are 500-700 quantities.

Regarding variable data, the general opinion of all three companies was that it is to be seen as an advantage of the PoD technology. However it is only applied in special jobs, where the requirements are very specific. In addition, in some cases this application required further knowledge in dealing with databases. The transformation of the data from the databases in variable data printed in each printed sheet of a job has proved to be the main obstacle in such type of jobs.

With regards to cost calculations, Company A used in the beginning a cost calculation model but this system, in the small and medium enterprises with many parameters, is difficult to standardise, thus the calculations made are mostly based on each job and follow the production requirements. Company B and C differ in opinion that there had not been a maturity in the market to accept the quantities and the cost of PoD.

Print on demand is in most cases understood as a marketing description rather than a pure innovative characteristic of digital printing. As such it had to be integrated in a marketing strategy of the companies after they had established and begun operating the new digital printing presses.

According to the answers provided by the case study companies, there is a difference concerning penetration of the different innovations of digital printing in the print media market. The most commonly accepted application is that of short run.

Short run is the first innovative application that could be understood and accepted gradually by the customers. An obstacle to this development was -and in many cases still is- the structure of digital files delivered to the interviewed companies for printing. A large percentage of the delivered files need to be corrected. This amounts to an unexpected production step for the companies. This problem can be corrected not only by applying of trialling pre-flight software but also by proactively educating customers about creating correct final files to be delivered for digital printing.

In terms of business models used, all referred to those dominant in the small markets, especially for small and medium sized enterprises. The business model to which all three identified with was that based on the “skill-artistry of the businessman”. The owner of company A was clear that it is not the technology of the machine that sells his printing material but “he himself”.

All three companies agreed that in the matters of evaluation and exact calculation of productivity cost, there are various parameters such as education and skills of human resources as well as inter communicative relationships in each company which are fundamental factors leading to the structure of the business model each company represents.

## **5. Conclusions**

The main conclusion from the case study research with the Greek graphic arts companies supports the hypothesis, that although a wide range of products and solutions of services can be offered with digital printing for new applications in print media, these solutions are still not widely applied in print media market.

The degree of penetration of innovative digital printing characteristics in print media markets is hampered by obstacles that have come about for reasons concerning both technical and management/marketing issues. The technical issues refer mainly to disruptions to the production workflow such as delivery of digital files by the customers or subcontractors and the need for greater competence in the processing of databases for variable printing. Problems of lesser degree are those that occur in processes such as pre-flight, ripping and job management.

[Preflight (suite of software programs to check that data sent for printing are correct as it regards fonts, resolution, file missing etc).

[Ripping (transforming digital data from the prepress in order to be mapped on any output machine such as computer to film, Computer to plate or digital printing].

Customer or market-oriented obstacles refer to the difficulty in understanding the innovative characteristics of digital printing by the customers and issues dealing with pricing of digitally printed jobs, especially those in short run and fast delivery.

The degree of penetration in the traditional print market could be improved if the graphic arts professions were to undertake some of the following activities:

- create the necessary environment to help the market mature and accept new products
- research new materials and substrates in order to offer the traditional customers their ‘old’ product with new characteristics in a controlled way.
- increase their knowledge about the local media markets and begin to search for the needs and new requirements for printed products.
- begin adapting to these new requirements with the development of new-upgraded marketing and customer oriented strategies.

There is definitely onus on the shoulders of the entrepreneur and how he “invents” his company, to exploit the opportunities offered by the information age.



“Print is *not* a commodity. Printers with the same equipment have different expertise; they have different printing and finishing equipment; the quality of the output is affected by the skill, training and care of the human operators of the presses. Although the Internet is causing major changes to occur within the industry, it is in other ways than reducing the need for relationships, a need which remains strong. It was frequently reiterated that customers want to meet, want to deal with the same person within an organisation, want reassurance on a project in progress, and want ‘to feel that their job is more important than the others’. Customers are willing, to build up relationships, they’re willing to build up partnerships: they’re not looking for traditional client -supplier relationships. They’re looking for long term relationships”

[Parker, 2002]

Digital printing is here to stay and offers added value based on certain advantages and characteristics that are important for the rapidly changing environment in printed media. Although these case studies pertain to Greece, they can be generalised to the worldwide market. However, more understanding of cross media techniques, for the delivery of content and the importance of production of media, included printed media, is needed.

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