

SMEs IN A DIGITAL AGE: THE CASE OF THE PRINTING INDUSTRY

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ABSTRACT

This paper is concerned with the implications of new digital technology for small printing companies. As the printing industry enters the 21st century, technological change presents enormous challenges to SMEs, both strategically and in terms of the knowledge and skills required by both managers and employees. The paper draws on empirical data collected as part of two projects funded by the European Social Fund, undertaken in the UK in 1998/99 and 1999/2000. The data include 50 in-depth case studies with leading edge SMEs (employing less than 100), a telephone survey of 500 small printing firms and a programme of key informant interviews. The specific issues considered in the paper are the main technology options facing small printing firms, both now and over the next 3-4 years; the implications of these technology options for small firms, focusing particularly on human resource issues; how small printing firms in the UK are responding to the challenge; and finally the policy issues that need to be addressed at the firm, industry and government levels.

The paper suggests an approach that incorporates a strategic appraisal of the implications of new technology for the business; an identification of any new competency required as a result of acquiring this technology; a review of how far these competencies are already available internally, together with the identification of any competency gap; an identification of the recruitment and/or training needs in order to fill this gap; and the identification of the staff most suitable for training. At the industry level, there is a need for a skills strategy that involves increased co-operation between training and business support providers.

INTRODUCTION

The Industry Context

This paper is concerned with the implications of new technology for small printing firms, focusing on the implications for the management of human resources. Whilst printing is a sector in which computer based technology has already made enormous impacts over the last 20 years, it can be argued that the greatest changes are still to come as far as the majority of firms are concerned. Moreover, printing is a key sector in most economies. For example, in the UK it provides some 200,000 jobs, creates an annual turnover of £9 billion and exports of £2 billion (Robson Rhodes, 1996), making it one of the most important in the UK economy. As regards structure, the industry is polarised between a few large firms, serving national and international markets and a large number of small and micro firms serving local and, in some cases, national markets. Indeed, there are nearly 15,000 small and micro firms, employing only eight persons on average (BPIF, 1998) which, despite their size, are responsible for a substantial proportion of economic activity within the industry.

Although the details vary between different branches of the industry, most printing firms face highly competitive market conditions, which help to keep prices down and squeeze profit margins. Following a period of strong growth in the 1980s, investment in new equipment led to a considerable increase in capacity which by the end of the decade contributed to increased competition at a time when demand was falling. Printing is also one of the more capital intensive sectors in which small and medium enterprises (SMEs) are an important element, reflected in high average annual rates of investment per employee compared with other sectors (Smallbone *et al*, 1997). This underlines the importance of both effective investment appraisal by managers and human resource strategies designed to maximise the return on investment.

Another key characteristic of the printing industry is the derived nature of demand which means that the performance of the industry is very sensitive to changes in the level of aggregate demand in the economy as a whole. The problem for smaller companies is to manage the effect of such changes combined with an ongoing need to invest, without the benefits of the larger and more varied internal resource base of larger companies. With some input costs rising and competition keeping prices down, it is speed and responsiveness to customer needs that are the main factors influencing the competitiveness of most firms in the sector, particularly smaller firms. In this context, the skills, knowledge and commitment of a firm's human resources are increasingly important influences on its ability to compete.

The rapid pace of technological change presents a particular challenge to smaller companies, exposing the limitations of training practices that are typically short-term and task oriented, rather than reflecting recognition of the strategic importance of human resources to a firm's ability to compete. Whilst the nature and extent of technological change may be greater in printing than in many other sectors, the issues raised in the paper are relevant to other industry sectors where technology is redefining traditional occupational and workforce skills.

Methodology and Data

The paper draws on empirical data collected as part of two national projects in the UK, funded under ESF Objective 4, undertaken in 1998/99¹ and 1999/2000.² The first project investigated the current and future skill needs associated with technological change in the printing and publishing industry, paying particular attention to the introduction of digital technology. The second was an action research project, seeking to assist firms to cope with these

¹ This project was entitled 'New Technology and Related Skill Needs in the Printing and Publishing Industry', was funded under ESF GB98, (Objective 4) and supported by the Printing and Graphic Communications National training organisation (PGCNTO).

² This project is entitled 'Skill Needs in Printing', funded under ESF GB99, (Objective 4) and supported by the Printing and Graphic Communications National Training Organisation (PGCNTO).

issues, involving three main elements: firstly, the development of a manager's guide to assist small firms to identify skills needs related to technological change; secondly, the development of a national directory of training providers in the printing industry; and thirdly, a telephone survey of small printing firms. In combination, these two projects involved data collection that included more than 50 in-depth case studies with leading edge SMEs (employing less than 100), a telephone survey of a representative sample of 500 small printing firms (employing less than 50) and a programme of key informant interviews. Following a summary of the main technological changes impacting on SMEs in the industry and their implications for workforce skills, some initial findings of the survey are presented.

2. PRINTING TECHNOLOGY, TECHNOLOGICAL CHANGE AND SMEs

There are three main stages in printing namely, pre-press, press and finishing. Pre-press comprises the range of tasks from the acceptance of work and its manipulation through to the point where it is ready to be printed. Typically, the final element of pre-press is marked by the production of plates (usually metal), on which the print impression appears. Once final customer approval has been given, a job proceeds to the press stage where the actual printing takes place. The final phase is finishing, which comprises collation, folding, cutting, and binding, before the completed job is delivered to the customer.

The Pre-Press Stage

It is the pre-press area that has witnessed the main effects of new technology hitherto and where the impact upon the skill needs of managers and production staff has been greatest. Until the adoption of digital technology, text and artwork were manually manipulated by craftsmen who specialised in one or more elements of pre-press, leading to prepared pages being photographed and plates produced. However, pre-press has now been transformed by new

technology. Jobs may be submitted digitally, either on disk or electronically using Integrated Services Digital Network (ISDN), or through wideband Intranet providers. Powerful computers with dedicated software packages enable work to be processed and manipulated digitally. Completed pages may then be sent to a colour proofing device for approval before being output either to plate, using computer-to-plate (CTP) devices, or transmitted straight to direct digital printers. Internal networks can now be used to link all equipment, ensuring that all workflows are digital. In addition, page makeup is entirely digital with tasks often performed by a single individual.

The Press Stage

Although it is pre-press that has seen the most revolutionary technological changes, it is the press area that is now facing the most intense impacts of new technology. SMEs involved in commercial printing face three technology options: firstly, digitally controlled conventional litho presses; secondly, computer to plate (CTP); and thirdly, direct digital presses, which have implications for the type of work undertaken, the financial needs of firms, and for workforce skills. For smaller firms particularly (i.e. 1-49 employee size band), this represents a significant strategic choice, involving considerable uncertainty. Digitally controlled litho presses represent an incremental increase in technology, involving greater automation of conventional presses. As four colour litho presses age, they are being replaced with five and six colour models, which enable the time taken to make plate changes to be reduced from 40 to 10-12 minutes. At present, the high cost of these presses confines their take-up in the UK to SMEs, whilst second-hand four colour presses are cascaded down to micro-enterprises. Direct digital presses enable the plate making stage to be omitted, in much the same way as laser printing enables jobs to be output directly to paper or other substrates.

The second option is CTP technology, which is a hybrid approach to maintaining digital workflows between pre-press and press. These systems enable pre-press to digitally create press

plates, eliminating the conventional film/platemaking process. Since the plates are produced in-line and electronically punched and images are sharper and of a higher quality. This allows 'make-ready' times to be shortened by reducing the production time from design to platemaking, and a larger volume of short-run work to be produced more economically on conventional presses. Furthermore, CTP minimises the potential for errors, and last minute changes can be dealt with more speedily, easily and accurately. However, this technology is expensive and a combination of digital imagesetting/platemaking equipment and CTP press costs upwards of £1m and compatible pre-press equipment, such as digital imagesetters and proofers are also needed. As a result, CTP is not at present a viable option for micro or for the majority of small firms. The relative immaturity of the technology and risks attached to early adoption means that managers have adopted a "wait and see" policy, although it is likely that as equipment prices fall, the take-up by small firms will increase.³

The third print technology option is direct digital colour.⁴ These presses do not require plates, taking the image directly from digital data supplied by pre-press in order to facilitate variable image printing for just-in-time (JIT) short-run personalised jobs. The take-up of these presses has been polarised between medium-size firms on the one hand, and a few entrepreneurial micro-enterprises on the other. The former offer direct digital printing as an addition to their existing services, whilst the latter have done so in recognition of a gap in the market for this type of work, overcoming the obstacle of high initial purchase cost through various leasing arrangements. Although the technology is still evolving (there are a number of variants at present), industry analysts believe that direct digital presses represent the future of

³ This technology has been adopted by those traditional printers who have not chosen, as yet, to go down the digital route. Nevertheless, CTP allows short print runs (300-400) enabling them to operate in the same market as those printers operating direct digital presses, although not the same level of flexibility.

⁴ Currently, there is an installed base of 300 direct digital presses in the UK and these account for 5 percent of the total market for colour printing (Malcolm Macreath, 1998). These presses are principally used for short-run colour and personalised work.

printing since the entire workflow remains digital. It is anticipated that take-up will become increasingly widespread over the next 2-3 years, affecting firms of all sizes.

The Finishing Stage

The final stage in the production process is 'finishing', which has seen the introduction of semi-automatic and digitally controlled collators, cutters and binders. Although the extent of new technology in finishing has so far been limited, analysts believe that it will be subject to significant advances in the near future. The pace of developments in digital printing, together with anticipated advances in finishing technology have led many industry experts to suggest that, within the next decade, the industry will be almost completely digitised, when pre-press, press and finishing will be fully networked.

Some Implications of Technological Change

Over the last twenty years, the structure of the industry has been fundamentally altered by the introduction of new technology and the development of closer ties between printers and their customers. This has resulted in the emergence of additional products and services and the creation of new markets for on-demand, short-run colour printing, as well as database creation and management. Another effect of technological change has been to contribute to the development of new sources of competition for printing firms, as the increasing sophistication of PC based software has made it possible for some print users to undertake origination themselves.

A further aspect of technological change is developments in electronic communications technology which has already had a considerable effect on the links between customer and supplier in the industry, with the majority of all data for printing now conveyed in digital form (CEEDR, 1997). ISDN (Integrated Services Digital Network) links have become a regular feature of document delivery in the industry, with an increasing trend towards EDI, although some small companies may find this prohibitively expensive. In recent times, there has been an increasing trend towards wideband connections (e.g. WamNet) which has facilitated the rapid

transfer of large digital colour work to and from clients. Traditionally, material has been printed and then distributed but increasingly firms distribute electronically to the receiver where the document is printed. It is in these circumstances that speed of response is becoming an increasingly important factor in influencing the competitiveness of printing firms.

Printing technology has changed rapidly during the last 15-20 years and continues to do so, presenting both threats and opportunities for existing firms in the industry. The development of digital technology that can undercut conventional printing in short-run multi-colour work and is likely to grow in impact over time. Digital technology is an example of a development that is contributing to a redefinition of traditional relationships between firms; for example, by allowing graphic designers to move into printing. Although the majority of small printing firms are very uncertain about how to respond to these developments, some have responded by moving into higher volume specialist colour areas. Whilst the precise effect of digital technology on SMEs in the industry is still to be determined, the number of small general printers that are able to rely on conventional processes will almost certainly decline. Adaptation to the effects of these developments is likely to become increasingly critical for survival.

Current trends suggest that if firms wish to remain competitive, they will increasingly need to adopt new technology. As equipment prices fall and customers increasingly demand new services, there is likely to be an increased take-up of technology that is currently considered leading edge, by larger numbers of firms, including smaller firms. Although varying in detail between different branches of the industry, the future competitiveness of printing firms is likely to be increasingly dependent on factors that include their ability to react to technological changes affecting the link between customer and supplier; to respond to changes in electronic media, particularly where this has implications for the basic products/services of firms; to develop new markets; to cater to the needs of increasingly demanding customers in markets that are highly competitive; to make cost effective investment decisions that are appropriate to the

types of market the firm is seeking to trade in; and to recognise the potential value of their human resource base (Robson Rhodes, 1996). Whilst the latter presents a challenge for firms of all sizes, it can be argued that smaller firms face a particular challenge in view of their more limited internal resources compared with larger firms

3. IMPLICATIONS OF TECHNOLOGICAL CHANGE FOR SKILLS

As mentioned previously, the increasing use of external digital connections with customers at the pre-press stage, together with improvements in disk and CD-ROM information transfer have contributed to a faster and more reliable transfer of large complex digital files at affordable rates. Apart from the need for pre-press staff to acquire new ICT skills in order to acquaint themselves with the various file formats, media and electronic transmission technology, digitisation also necessitates the acquisition of ICT skills by other staff involved in receiving work from customers, such as counter and administrative staff and sales representatives. For example, the high cost of rectifying errors has made it necessary for sales representatives to acquire ICT training in order to improve their technical liaison with customers and help rectify file incompatibilities before work is accepted. As the amount of work provided in digital form has risen, sales staff have been obliged to accustom themselves with handling digital submissions and in dealing with the range of problems that can arise with such files.

In addition to dealing with various file formats and associated problems linked to the digital receipt of work on disk, *via* ISDN or wideband intranets, staff in pre-press have needed to understand and deal with IT networks. In leading edge firms (including some medium sized firms), computers and peripherals are linked together, in order to ensure unbroken digital workflows throughout the pre-press area. Moreover, with the advent of digital presses and greater automation in finishing (comprising all operations following printing), these areas of print are also networked. The new technology has facilitated a growth of short-run colour printing, as well as making possible what is known as “print on demand”. This has meant that

jobs are required to be completed within a few days rather than the two to three weeks they took under former working practices, which has implications for a variety of customer relationships (e.g. estimating) and, in turn for the skill needs of the staff involved in these activities. In this context, computer networks become necessary not only to maintain digital workflows, but also to deal with the rise in the volume and pace of work apparent within the industry.

As well as adapting to the digital environment by developing new skills, increased digitisation has also contributed to the development of new working practices. Pre-press staff are increasingly expected to be multi-skilled, taking on the entire range of manual pre-press activities (i.e., scanning, typesetting, page make-up and image setting). As a consequence, the demarcation of tasks is gradually disappearing and staff duties are no longer confined to a narrow range of pre-press operations. The adoption of new technology and a shift to totally digital workflows systems has led not only to a merging of pre-press operations, but has also involved pre-press responsibilities being extended to printing and finishing. Although the high cost of CTP and direct digital presses currently limit their take-up mainly to medium sized businesses, the pre-press and press areas will increasingly converge in firms that adopt this technology.⁵

CTP and direct digital printing require new technology in the form of work stations connected to high powered computer servers with huge data storage capacities (exceeding 100 Gb), in order to maintain the digital workflows. These servers have the additional advantage of being able to facilitate data archiving. As a consequence, the storage and management of digital information is a new service that printers can provide to clients, where digital data can be rapidly updated and printed, complementing 'print on-demand' facilities. This ability to manage data permits printers to offer project management services to customers, which in turn means that archiving and project management are further areas where pre-press staff need new skills.

⁵ As prices fall and the technology matures (current short-comings include more down time for maintenance as compared to conventional presses, restrictions on run lengths, limitations on print size and substrate upon which the

One of the consequences of these developments is that pre-press staff are increasingly dealing directly with customers which, in view of the greater level of contact, emphasises their need to acquire skills with respect to customer service/care. The extent to which the responsibilities of pre-press staff have increased following the introduction of technology means that they will increasingly represent key workers in the printing industry of the future, with a significantly enhanced role from that undertaken by pre-press staff in the past.

With each of the three printing technologies described earlier (i.e. digitally controlled litho presses, CTP and direct digital presses), print workers have been required to become more ICT literate. In addition, the responsibilities of press staff are no longer confined to press operations since they have needed to learn pre-press skills. For example, the increasing expectations by customers for printing 'on-demand' have resulted in some firms introducing 24-hour working. This means that, in the absence of multiskilled night staff, overnight errors with plates cannot be dealt with until the morning. As with pre-press staff, multi-skilling amongst printers is essential, with printers needing to undertake a range of pre-press activities, as well as operate within the finishing area when required.

The final stage of the production of printed material is finishing. Whilst the vast majority of finishing is undertaken by mechanical devices (e.g. 'batch-stitch-trim' or folding machines), greater digitisation is currently taking place. Digitally controlled guillotines, collators and batchers (sometimes appearing as add-ons to presses) were observed in leading edge SMEs in the study, even among some micro enterprises. A recent technological development is finishing equipment that is controlled *via* pre-press data instructions. Although at present, digital pre-setting at the pre-press stage to determine cutting, folding and batching is only found in the most advanced medium-size firms, the trend is creating a demand for new skills among staff previously only concerned with operating mechanical devices. Another general trend revealed

image is produced, and the cost of paper and peripherals), the technology can be expected to diffuse down to smaller

has been the merging of printing and finishing activities “under one roof”. Inevitably, with advances in digital technology percolating through the entire printing process, printers will be able to take-up more finishing activities (Horton, 1997). In general, the pace of digitisation in finishing is forecast to increase, and as the technology matures and prices fall, these systems will be increasingly adopted by greater numbers of printing SMEs by 2002/3 (PIRA, 1996).

4. THE RESPONSE OF SMALL PRINTING FIRMS IN THE UK TO THE CHALLENGE PRESENTED BY NEW TECHNOLOGY

Sources of Data

This part of the paper is based on a national telephone survey of 500 small printing firms (i.e. < 50 employees) in the UK, undertaken in March 2000. Apart from basic company profile data, the survey asked owner/managers about their firms technology base and a variety of training and employment-related issues, including methods of skills acquisition, and their intentions with respect to technology and workforce skills in the forthcoming two year period. In this particular paper, these survey data are used to paint a representative picture of current responses of small printing firms in the UK to the take-up and use of new technology.

The survey was based on a random sample taken from Dun and Bradstreet’s database of UK manufacturing firms. Since our previous research had identified certain differences between microenterprises and other small firms and in order to avoid the survey becoming dominated by very small enterprises, a stratified sampling design was used, involving 250 firms employing 1-9 employees and 250 with 10-49. The vast majority of surveyed firms (87%) were general printers that included some pre-press work as well as machine printing, typically using the offset litho method. At the same time, there were a small number of firms (4%) offering printing services only (i.e. trade printers, serving other printing or publishing houses). In addition, there were 9 firms (1.8%) that only offered pre-press activities (so-called “repro

houses”) and 17 firms (3.4%) engaged mainly in printing on electronic photocopiers (i.e. “High St copyshops”).

Production Technology

In order to establish the extent to which small firms are making use of new technology, owners/managers were asked a series of questions concerning the type of equipment used in both pre-press and press activities. Respondents were also asked about the nature and extent of the use of management information systems (MIS) (Table 3) and about the proportion of work currently received through ISDN. The results show that almost two thirds of surveyed firms had some form of new technology in pre-press (defined as either computer to plate, an integrated computer network and/or a digital proofing device), although this was significantly higher in small firms (74%) than in microenterprises (52%) (Table 1). More specifically, 21% of firms involved in pre-press activities had some form of computer to plate (CTP) device, with little variation between firm size groups. A higher proportion of firms had installed integrated computer networks (53%) and digital proofing devices (34%), although in these cases there was more variation between size groups. Nevertheless, even in the microenterprise category, a significant minority of firms were users of the latest pre-press technology.

Table 1: Use of New Technology in Pre-Press

Firm size	CTP	ICN	DPD	At least one	No of respondents
1-9	47 20%	92 38%	63 26%	126 52%	241 100%
10-19	29 21%	90 64%	51 36%	100 71%	140 100%
20-49	25 23%	78 72%	52 48%	84 78%	108 100%
All firms	101 21%	260 53%	166 34%	310 63%	489 100%

Notes: CTP=computer to plate; ICN=integrated computer network; DPD=digital proofing device

In comparison with pre-press, digital technology was much less common in the press room, which is not surprising in view of the relatively recent nature of the development of digital presses (since 1992), their current cost and the uncertainty surrounding future technological

trends. Our survey evidence suggests that less than 1 in 10 small printing firms in the UK currently have some form of digital presses, although the proportion is higher in the case of small firms than in microenterprises (Table 2).

Table 2: Use of New Technology in the Press Room

Firm size	Xeikon, Indigo or Chromapress	Docutech or Digisource	At least one	No of respondents
1-9	7 3%	9 4%	15 6%	248 100%
10-19	4 3%	8 6%	12 8%	142 100%
20-49	6 5%	11 10%	12 11%	110 100%
All firms	17 3%	28 6%	42 8%	499 100%

Use of Management Information Systems

Another growing use of IT is with respect to management information systems (MIS) that offer potential increases in efficiency and competitiveness through quicker and more effective estimating, invoicing, job scheduling and cost analysis/control. As a consequence, surveyed managers were asked if the firm currently operated a management information system and, if so, what it was used for.

Table 3: The Nature and Extent of the Use of MIS in Small Printing Firms

	1-9 Employees	10-19 Employees	20-49 Employees	All firms
Estimating	45 18%	43 31%	50 47%	138 28%
Invoicing	53 21%	49 35%	52 49%	154 31%
Job scheduling	27 11%	36 26%	39 36%	102 21%
Cost analysis	32 13%	43 31%	47 44%	122 25%
Some use of MIS	59 24%	58 41%	59 56%	177 36%
No of respondents	248 100%	140 100%	107 100%	495 100%

The results show that just over one third of all surveyed firms use some form of MIS, although the propensity of firms to do so increases with firm size: from 24% of microenterprises to 41% of those employing 10-19 to 56% of firms employing more than 20. However, the Table also shows differences between the firm size groups in terms of what MIS are used for. Whilst most firms using MIS for some purpose in all size groups use it to estimate and invoice customers, more sophisticated uses of MIS for job scheduling and cost analysis

were more typically found in firms employing 20 or more employees than in microenterprises: 30% compared with 11% in the case of job scheduling; 36% compared with 13% in the case of cost analysis.

Implications for Workforce Skills

In order to assess the implications of technological change for workforce skills, owners and managers were asked if the firm had required new skills during the previous two years in the following areas: pre-press; press; finishing and customer care (Table 4).

Table 4: New Skills Required in Previous Two Years

Firm Size	Pre-Press	Press	Finishing	Customer care	At least one
1-9	59 25%	44 18%	33 14%	45 18%	81 32%
10-19	48 38%	29 20%	24 18%	42 30%	71 51%
20-49	47 46%	40 36%	34 32%	48 44%	69 64%
All firms	154 33%	113 23%	91 19%	135 28%	221 45%

Table 4 shows that a requirement for new skills was most commonly reported in pre-press where the pace of technological change continues to be the most rapid as far as small firms are concerned. This is more apparent in small firms employing more than 10 employees than in microenterprises, mainly reflecting their higher propensity to have introduced integrated networks and digital proofing devices. Although fewer firms overall reported new skills being required in the press and finishing stages during the previous two years, there was a larger gap between firms with 20-49 employees and smaller firms than with respect to pre-press. Significantly however, the survey results confirm the growing importance of customer care skills, associated with rising customer expectations for service and a tendency for more staff having contact with customers, although at the same time, they may also reflect a traditional weakness of many small printing firms with respect to sales and marketing.

Methods Used to Upgrade Workforce Skills

As well as asking surveyed owners/managers about changes in their skill needs, they were also asked about the methods used to address them, distinguishing between the pre-press, press and finishing stages (Tables 5, 6 & 7). In all three cases, the most common response was that their skills needs had not yet been met, with the highest propensity to report this found in the microenterprise category. Retraining existing staff was used as a response to skill needs by nearly one quarter of all firms, although significantly less commonly by microenterprises than by small firms (10-49 employees). Where skill needs were addressed through a recruitment strategy, this typically involved a need to train new recruits, reflecting wider skills shortages in the sector, reported previously (Bradshaw, 1999).

Table 5: Methods Used to Address Skill Needs in Pre-Press

	Recruit	Train	Recruit & train	Other	Not yet met	No of respond.
1-9	12 5%	35 15%	36 16%	52 23%	92 41%	227 100%
10-19	8 6%	35 28%	24 19%	17 14%	40 32%	124 100%
20-49	12 12%	32 33%	21 21%	13 13%	20 20%	98 100%
All firms	32 7%	102 23%	81 18%	82 18%	152 34%	449 100%

Table 6: Methods Used to Address Skill Needs in the Press Room

	Recruit	Train	Recruit & train	Other	Not yet met	No of respond.
1-9	10 4%	33 15%	41 18%	50 22%	93 41%	227 100%
10-19	17 13%	37 28%	23 18%	20 15%	36 27%	133 100%
20-49	11 10%	33 31%	23 22%	15 14%	23 22%	105 100%
All firms	38 8%	103 22%	87 19%	85 18%	152 33%	465 100%

In circumstances where technology is changing rapidly and where cost effective investment is becoming an increasingly important factor influencing the competitiveness of printing firms, a firm's human resource base is likely to be a key factor influencing the return on investment in equipment. In this context, we sought to establish the extent to which firms were systematically assessing their skill and training requirements and, if so, what methods were being used.

Table 7: Methods Used to Address Skill Needs in Finishing

	Recruit	Train	Recruit & train	Other	Not yet met	No of respond.
1-9	16 7%	30 13%	33 14%	56 24%	99 42%	234 100%
10-19	12 9%	27 20%	25 19%	21 16%	48 36%	133 100%
20-49	11 10%	28 27%	26 25%	18 17%	22 21%	105 100%
All firms	39 8%	85 18%	84 18%	95 20%	169 36%	472 100%

Table 8 shows that less than half of all surveyed firms claimed to have made an assessment of workforce training needs, although once again there are significant differences between microenterprises (31%) and firms employing 10 or more (59%). Respondents were also asked about the activities used in order to contribute to this assessment. Their responses show that formal and semi-formal methods were less common than more formalised assessment methods, such as the use of national benchmarking or expert assessment. At the same time, there are differences between firm size groups in the types of method used. Microenterprises rarely used more formalised approaches involving either appraisal by a supervisor, the use of national standards for benchmarking purposes or a survey of skills by an ‘expert’ consultant. Indeed, appraisal by a supervisor was the only semi-formal method used to assess workforce skills and then mainly by firms employing 10 or more.

Table 8: Methods Used to Assess Workforce Training Needs

Firm size (current employ)	Some assessment made	Self assess. by individuals	Appraisal by supervisors	Use of national standards	Expert survey of skills	No of respondents
	No %	No %	No %	No %	No %	No %
1-9	76 31%	55 23%	43 18%	10 4%	10 4%	243 100%
10-19	82 58%	55 39%	53 38%	17 12%	20 14%	141 100%
20-49	64 60%	35 33%	50 47%	10 9%	8 8%	106 100%
All firms	222 45%	145 30%	146 30%	37 8%	38 8%	490 100%

Previous research has demonstrated that the most common source of workforce training in small printing firms is equipment suppliers, where initial training is provided as part of the purchase package. As a consequence, this survey focused on the main external sources of

training, other than equipment suppliers. The results show that 40% of all surveyed firms had accessed training from some external source (other than equipment suppliers) during the two years prior to the interviews, although this was significantly lower in microenterprises than in firms employing ten or more. As far as the actual sources are concerned, there was little variation between the size groups in terms of the relative picture: further education colleges were the main source, followed by private training providers and trade bodies (mainly the British Printing Industry Federation). However, the point to stress is the low level of use of external sources of training, especially in the microenterprise category.

Table 9: External Sources of Workforce Training used in Previous Two Years

Source	1-9	10-19	20-49	All Firms
FE/HE College	26 11%	39 27%	26 24%	91 18%
Private provider	21 9%	21 15%	26 24%	68 14%
Trade body	10 4%	17 12%	16 15%	43 9%
Private consultant	6 2%	8 6%	10 9%	24 5%
Distance learning	1 -	1 -	1 -	3 -
Other	8 3%	13 9%	11 10%	33 7%
At least one	55 23%	75 53%	66 60%	196 40%
No of respond.	244 100%	142 100%	110 100%	496 100%

Table 10: Types of In-House Methods Used to Help Upgrade Workforce Skills

	On-the-job learning	Structured training by supervisor	Meetings run by team leader	No of respondents
1-9	214 91%	55 24%	33 14%	234 100%
10-19	135 95%	62 44%	40 28%	142 100%
20-49	110 100%	54 49%	33 30%	110 100%
All firms	459 94%	171 35%	106 22%	486 100%

The use of informal methods to assess workforce training needs (where any assessment exists at all) is paralleled by the approaches used to actually upgrade workforce skills. Sixty percent of surveyed firms had not used any external training providers in the two years preceding the interviews, other than equipment suppliers (Table 9), with informal ‘on-the job’ learning

without any direct external input representing by far the most common method (Table 10). More structured approaches to upgrading workforce skills involving supervisors and/or team leaders were used by a minority of surveyed firms, although small firms were significantly more likely to engage in these practices than microenterprises. Microenterprises were also significantly less likely to have made use of any external sources of training.

5. FORMAL AND INFORMAL APPROACHES TO TRAINING: SOME CASE STUDY EVIDENCE

Alongside the picture of the ‘typical’ human resource response to technological change that emerged from the survey, we also investigated the types of response in SMEs that were ‘leading edge’ in technological terms. The picture that emerged from these firms was of an emphasis on re-training as a response to the changing skill needs, with the bulk of this training taking place in the workplace. Initial training is typically supplied by an equipment or software supplier as part of the initial purchase package and the skills gained by the key workers selected for initial training are then passed on informally to other staff in the firm. Firms installing leading edge technology do take trouble to arrange skills training for the workers affected, but their preference for equipment suppliers and in-firm coaching means that their informal approach is under-registered in survey type data. In many respects, this picture is not altogether surprising since previous studies of training have consistently drawn attention to the lower propensity of SMEs to participate in formalised training programmes than large firms (Training Agency, 1989; Matlay, 1997). This is associated with a lower tendency to engage in formal business planning with which training plans and budgets are often linked (Creigh & Clay, 1993; Cosh and Hughes, 1996; 1998). At the same time, it is important to recognise the sectoral variations that exist in the commitment to training by SMEs, with greater training apparent in those markets where constant skills upgrading is required to help firms retain their competitive edge (Marlow, 1998). Printing is an example of such a sector.

However, a lower level of formalised training does not necessarily mean that a lower level of commitment to training exists. Based on a large national multi-sectoral study of training in SMEs, Curran *et al* (1996) point out that: “only a small but not insignificant proportion of small firms have a formal approach to training, based on an explicit plan and/or dedicated budget... although most have a much less structured approach with owner/managers typically taking direct responsibility for training themselves, even if only by default.” Westhead and Storey (1997) describe how training in small firms differs from that in large firms, with a greater likelihood in small firms of work skills and/or knowledge being conveyed informally, mostly from one employee to another. By contrast, in large firms training more usually leads to qualifications that are externally provided and validated.

Certainly the picture emerging from the case studies is that a low level of formalised training does not reflect a low level of learning activity on the part of the workforce. However, the learning process is typically *ad hoc*, task specific and based on “learning by doing”, often with the help of colleagues or the owner-manager himself. The exceptions were a small number of medium-sized firms, where a more formalised approach to training was evident. This was reflected in one case (i.e. a London-based specialist printer employing about 100) by regular (monthly) management meetings to discuss department training needs; departmental management plans for training; the adoption of regular (every six months) employee self-assessment procedures; individual employee training plans; and staff attitude surveys.

The approach to the identification of training need in this firm focused on outcomes, seeking to identify gaps between current and required competencies. The format of training used is flexible and the option selected related to a particular need. A variety of training methods are used, including Computer Based Training (CBT) where interactive CD-ROMS are employed. These are supplemented, where appropriate, by interactive videos supplied by external trainers who provide programmes for learning new software. Open learning is also popular since it can

be tailored to the needs of particular trainees using a combination of text and workbooks along with cassettes to form the basis of the training package. Trainees work through the material at their own pace and tutors offer support when required. On-the-job coaching is also a favourite option, with more experienced members of staff and supervisors passing their skills on to others. Mentoring is also common, with one member of staff taking a more junior person under their wing. In other circumstances, secondments to different departments or job-swaps are considered. Consultants are brought in where the knowledge and skills of those in the company fall short of requirement and need to be augmented from outside. External training consists of visits to equipment manufacturers and suppliers. In some instances, staff exchanges with clients are arranged in order to better integrate the needs of customers with the technical capabilities of the company. Attendance at conferences, seminars and exhibitions also play an important part in providing information about new technologies that have been introduced into the market.

Whilst there are underlying principles in the approach used by this medium-size firm that would seem appropriate to firms of all sizes, their application in the case of micro- and small firms requires modification in recognition of certain size-related characteristics. This case study firm has grown to a sufficient size to justify appointing a specialist human resource manager, which is outside the scope of most smaller firms, in which the responsibility for training and human resource management is most likely to be combined with other management functions, and often retained by the owner-manager themselves. The question is whether or not smaller firms should be encouraged to follow the same path as this medium-size company.

Different approaches to training partly reflect distinctive size-related characteristics, which affect the ability of firms to identify their skill and training needs and also their capacity to respond to them. However, it may also reflect different training needs themselves, particularly with respect to the greater need for multiskilling and functional flexibility in organisations where it is a necessity that workers are able to turn their hands to several tasks. Whilst some of the

differences in approach stem from differences in management resources that affect the ability of managers to define and organise training, there is also a question of management attitudes. A lack of ‘professional’ management training is often associated with practices that fail to recognise the full potential value of training or the more general potential contribution of human resources to a firm’s competitiveness. In addition, behavioural characteristics that stem from the coalescence of ownership and management that is common in small firms means that the attitudes of owner/managers towards, and the experience of, education and training becoming a major influence on the training and wider HRM culture within the firm. Financial resource constraints may also contribute to expenditure on training being viewed as a cost to be justified in terms of its contribution to solving an immediate problem or undertaking a particular task, rather than as an investment for the future development of the firm through upgrading its human resource base. More fundamentally, however, such a view typically reflects a failure to recognise the strategic importance of human resources to the firm’s future competitiveness.

6. CONCLUSIONS AND POLICY IMPLICATIONS

New technology is driving the printing industry into a “digital age”. The process involves transforming what was a craft industry into the equivalent of computer integrated manufacturing, where ICT related skills are essential requirements for production staff and managers. The technology provides additional opportunities for printing firms, enabling them to be part of the “digital communications” industry, offering a wider range of services than previously. Managers need to be aware of the new market opportunities offered by the new technology and understand that traditional printing will be only one part of the range of services that digital media firms of the future will be able to provide. In part, the industry is being shaped by the demands of customers for on-demand printing and a broader package of services as well as the need to try to counter the fall in profit margins by offering greater valued added to printed material. Although investment in new origination and printing technology is expensive, the industry will

increasingly find it difficult if not impossible, to meet customer demands for increased quality and shorter turn-around times without its adoption. As digital technology matures and equipment prices are reduced in real terms, its diffusion will become increasingly spread down the firm size range.

However, in order to capitalise on these opportunities, investment in human resources is needed at both the management and workforce levels. In an industry dominated in the UK by small firms, staff have tended to move up from the shopfloor into managerial positions and are often under-prepared to take on this role. However, firms of all sizes will need to adopt a systematic approach to identifying and meeting skill needs if they are to remain competitive. The approach will need to incorporate a strategic appraisal of the implications of new technology for the business; an identification of any new competencies required as a result of acquiring this technology; a review of how far these competencies are already available internally, together with the identification of any competency gap; an identification of the recruitment and/or training needs in order to fill this gap; and the identification of the staff most suitable for training.

In practice, our survey evidence suggests that small firms in the UK printing industry are not responding to these changes by increasing their commitment to training and human resource development. Few companies undertake training or re-training on a systematic basis, and many only do the bare minimum. At the same time, our case study evidence suggests that a minority of proactively managed SMEs is recognising the need to constantly update skills. According to one industry analyst, it is those companies, which realise that learning must be a continuous process and are prepared to make the required investment in training that will survive the shakeout that will inevitably take place within the industry. Recognising that college based learning can no longer keep pace with the changing technology and is therefore unable to provide the most up-to-date equipment and the specific

skills required to operate it, the responsibility for training needs to be increasingly assumed by firms themselves.

The rapidly changing technological and competitive environment in the printing industry, together with rising customer expectations, suggests that future competitiveness (and ultimately survival) for firms of all sizes is likely to depend on managers recognising and responding to a number of conditions including: that the human resource base of skills and knowledge present in a firm's management and workforce is one of the firm's greatest potential assets; their ability to systematically identify the training implications of investing in new technology, in order to ensure the most cost effective use of what are increasingly expensive equipment purchases; and their ability to respond to training needs in a structured way using a variety of sources of training inputs. As well as recognising the need for workforce skills development to become an ongoing learning process rather than a series of one-off inductions into how to use newly installed machines, SME owners and managers must also recognise the implications of technological change for their own skill needs. This involves an increasing need to adopt a strategic view with respect to new technology, as well as to improve their management skills (Supri et al, 2000).

Whilst attitudinal changes among owners and managers at the micro level are important, the ability of individual firms to meet these challenges will be affected by the response at the industry level, with implications for public policy. In this regard, our previous research has identified a need to improve co-ordination between training and business support providers; to enhance the induction training offered by equipment suppliers; to develop more education-employer initiatives to attract a different type of recruit into the industry than has been typical in the past; to develop industry focused IT centres of excellence and to promote local network initiatives for skills development in SMEs. In short, successful adaptation to the size of the challenge facing smaller firms depends partly on the responses of individual managers, but it also depends on an appropriate policy response at the industry level to provide an appropriate

framework to enable SMEs in the printing sector to enter the digital age. As far as the UK is concerned, this requires closer partnership between the public and private sectors, involving employers and trade bodies (such as the British Printing Industry Federation), training bodies (such as the Printing and Graphic Communication National Training Organisation) and the Small Business Service (SBS⁶).

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⁶ The SBS is a new body established by the UK Government in 2000 to bring together all government support for small firms and to promote the interests of small enterprises.

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