GRAVURE VS. WEB-OFFSET!
THE CHANGING WORLD OF PUBLICATION PRINTING 1986-2006

ANDERS BJURSTEDT

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Abstract

The European publication printing industry and its markets have undergone profound structural changes between 1986 and 2006. This thesis is an investigation of these changes and of how the publication industry has been affected, as well as of the balance between publication gravure and commercial heat-set web-offset. The publication printing market has grown substantially during 1986-2006, and the increase in volume is about 250%, from 5 million tons to 13 million tons of paper. In 1986, gravure was the dominating publication printing technique. Since 1986, however, web-offset printing has grown substantially, and the process has today a much larger market share of the European publication market. This domination is also reflected in the investments in new printing capacity since 2000, where 70-75% has gone to commercial heat-set web-offset press manufacturers.

This thesis focuses on the reasons why the balance between the two competing publication printing techniques, gravure and web-offset, changed between 1986 and 2006. It also studies the main driving forces determining the developments of these techniques and their related processes as well as their competitive strengths. Is gravure a printing process suitable only for very large runs, for huge volumes and for large markets? The changes in the European media market have affected the two major segments of the publication market; magazine and catalogue printing. In the magazine market, print runs in the segments of medium to large titles have decreased, and catalogues have changed from a single, thick catalogue to thinner; more targeted catalogues.

This thesis is based on two studies. The first, focused on the market requirements and techno-economical comparisons of gravure and web-offset in 1985-1986, was carried out by the author as the Secretary General of the European Rotogravure Association (ERA), and the second, in 2005-2006, has investigated the present situation on the European publication markets. The methodologies used in the investigations have been questionnaires (the originals 1985-86 have also been used in 2005-2006), surveys, literature studies and a substantial number of interviews with representatives of print buyers (publishers and catalogue producers), printers and all the major suppliers to the industry.

Given these changes, how can the competitiveness of publication gravure be improved and what strategies should a publication gravure printer use in order to survive in a very competitive European market? With shorter runs in very fast running gravure presses, the turn-around time in the cylinder-engraving department becomes very critical. A Double Ender gravure press for paginations from 16-64 pages, with an alternative up to 96 pages, where only four cylinders are needed, in combination with high-speed laser engraving of the cylinders, may be the answer.

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Preface and acknowledgements

In the spring of 1985, the European Rotogravure Association (ERA) Board of Directors asked me, as the Secretary General, to organize a taskforce containing some of the most influential executives among the ERA members, and the objective of the taskforce was to investigate and evaluate the competitiveness of Gravure vs. Web-offset printing and suggest some substantial actions for possible improvements. The project published two comprehensive reports in 1985 and 1986, of which the second later became available also to non-members. The presentations were made in such as way that no individual participant could be identified, and one prerequisite was that all data collected should be kept confidential in the ERA Secretariat and only the Secretary General should have access to the individual figures. Among those were sensitive data and information about individual cost calculations and estimations of specific printing jobs, comments about the supply of raw materials (ink and paper), relations to customers etc. from the participating members.

When I decided to leave my position as Secretary General and return to Sweden in 1987, I was asked by the Board of Directors to remove all the information and data, databases and software programs specifically made for this purpose and take them with me to Sweden. In the beginning of 2003, I started to rearrange my home office environment, and by a coincidence I found those personal files from my tenure as Secretary General of the European Rotogravure Association (ERA) in Munich. During more than 15 years all this information had been stored away and not until spring 2003 did this treasure of information from the publication printing industry in 1985/86 resurface.

The project about the European publication printing industry had been in my mind for a considerable amount of time, and when I found the files I realized that this information was too valuable to be just forgotten. I started to investigate the interest from some contemporary executives in the industry for making a more scientific approach to the material and for making some in-depth comparisons with the present situation in Europe. The interest I received was very encouraging, and I then contacted Professor Nils Enlund at the Royal Institute of Technology (KTH) in Stockholm.

Mr Enlund very quickly realised the potential of the information I had in my possession and verified that I did indeed have the theoretical qualifications to graduate as Doctor of Technology in due course. He invited me to write an application with a detailed project description with a time schedule included. A few months later, in August 2003, the application was accepted by the administration, and during the following week I decided to visit the present Secretary General of ERA in Munich to inform him about my project and ask for support. Following his approval, I was then asked to present my project to the ERA Management Meeting (Annual Business Meeting) in Nuremberg on 22 October 2003. Hence, the official start of my project can be traced to October/November 2003.

With this thesis for the doctoral degree at the Royal Institute of Technology, I have now fulfilled my obligations from 2003. I would like to thank Nils Enlund for his continuous interest and great support in my project. Without him, there would have been nothing of my late academic career, and I am most grateful for his enthusiasm and valuable comments. I would also like to thank the ERA Secretariat for allowing me to take an active part in the activities of the ERA technical commissions during 2004-2007. Further, I would like to thank Rune Sirvell, former President of ERA, my mentor and a very good friend, for his keen interest and most valuable support. With his knowledge and industrial experience in the publication printing industry, he has been very helpful in giving my valuable advice, which has made it possible for me to present this thesis at the Royal Institute of Technology in Stockholm. A friend and a supporter of my project, who is still very active in the European publication industry, is the President of Honour of ERA, Mr Giorgio Gianoli from Italy, and his numerous suggestions, wide contacts in the industry and support have been more than welcome. During these years I have also met many old friends from the ERA days, but more importantly also gained many new friends, who have been able to support my investigations – nobody named but also no one forgotten. For their openness and frank exchange of information and ideas, I will always be thankful. Dr Anthony Bristow has been a valuable contributor for both research ideas and the linguistic overview.

Finally, my wife Suzanne can not of course be forgotten. Her strong spirit and never ending support during more than 30 years of marriage has always kept my confidence and will at a high level. In particular, during the last three years, she has been asked, maybe too many times, to read and comment on my deliberations. Not always an easy task, but she always granted my wishes in her own very gracious way. Our children, Christian and Caroline, have never ceased to surprise me with their staunch support and telling me: “Very cool, daddy, really very cool!”

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Content

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1. Introduction

This thesis is a study of the European publication printing industry and it highlights the processes which have impacted the structure of the publication printing industry and its development between 1986 and 2006. In 1984, The European Rotogravure Association in Munich (ERA) and its Board of Directors formed a Working Group with sixteen top executives and managers of the publishing and printing member companies to investigate the competitiveness of gravure vs. web-offset. The Working Group discussed the pros and cons of the gravure and web-offset technologies, as well as how one or the other method should be used. In 1985-86, two comprehensive studies of the publication printing industry were carried out by the European Rotogravure Association in Munich. These studies were the first of their kinds and comparable studies have, to the author's knowledge, never been compiled. In 2003, a follow-up study was started at the Royal Institute of Technology in Stockholm, and subsequently endorsed by the ERA Board of Directors. This thesis comprises seven papers, primarily based on the two studies, which have presented and been published between 2005 and 2007.

In 1985, the production methods in the prepress area to create pages for both the gravure and web-offset processes were mainly manual and analogue with the extensive use of graphic films. The extremely fast progress of digital technology in the 1990's had a great impact on the printing industry, in particular in the prepress area. New and affordable software packages for editorial work and image manipulation were quickly adopted by the printing industry, and within a short time the previous analogue technology was abandoned. These new techniques created a dramatic change in the way the industry had previously operated, and the customer/publisher gained control of the prepress work flow, mostly based on the PDF technology (Portable Document Format - a subset of Postscript – developed by Adobe Inc.), and of much of the prepress work previously performed and controlled by the printing industry. Cox et al. confirm that *"…DTP[1] technology acted to disentangle the hitherto totally integrated processes of publishing and printing"* (Cox et al. 2005, p. 112). Publishers became content-driven and started outsourcing print production says Jaspert (1998). At the few integrated publishers/printers which are left in the industry, prepress work has moved from the manufacturing to the publishing business area.

Although many publication gravure printing companies have been struggling with this change during the 1990's, most web-offset printers have been benefiting from the new digital workflow systems available on the market. The reason is quite simple; most web-offset printers never invested in prepress technology, and they opted very early to outsource all prepress work (except plate making) to

[1] DTP – Desk Top Publishing – shrink-wrapped software programs for Mac/PC by Quark Inc. or Adobe Inc.

third parties. Since 1995, plate-making for offset has made dramatic progress, and many technical solutions have been developed for the Computer-to-Plate technology. One example is Time Magazine, produced 100% digitally since late December 1997, that *"… replaced by a process that creates plates directly from the edit and ad files……….. the new process is faster, better and cheaper…"* praises Logan (1998, p. 107) The perception of the gravure cylinder processing, on the other hand, is that little has changed during the last decade, as stated by both Tribute (2002) and Klemm (2003).

These new developments in the prepress area have put the gravure industry under pressure to change, and Puri (2001) suggests that the medium-sized gravure printers have been neglected. Most efforts in publication gravure have gone towards the development of super-wide presses, currently 3.8 m or more, whilst little effort has been put into the lower end of the market (Ibid., p. 333 and p. 337). Krauss (2007) suggests that the newly developed folders in the super-wide gravure presses are very flexible and allow for many split exits without sacrificing the efficiency of those presses. Andreou (2007) states that publication gravure has made large cost reductions in cylinder processing, but gravure cylinders are still significantly more expensive than web-offset plates. New 64 pages heat-set web-offset capacity is much less expensive than publication gravure presses (Ibid.).

This study of the European publication printing industry focuses on some of the driving forces behind the growth of web-offset printing in relation to that of gravure printing, and elaborates on the structural changes which have been taking place since 1985, as well as on what changes can be expected to happen.

2. The area of research

2.1 Overview of the European publication printing industry

The area of research in this thesis is the European publication printers and how techno-economic factors have changed their working conditions over the last twenty years. Publication printers are those printers who are producing periodical products but not newspapers, directories and/or books. In the past, most publication printers were owned by publishers, e.g. they were integrated companies, but at the time of these investigations most publishers had decided to outsource their printing divisions/companies according to both Bastien (2002) and Bormans (2002). If this trend continues, the few large integrated publisher/printers still left in Europe may in due course outsource their print production resources.

Periodical products are magazines (published weekly or a few times a year), catalogues for retailers and mail-order companies, travel brochures, supplements to newspapers and other periodical inserts. Although recent research suggests (Birkenshaw and Smyth 2001, p.34) that the volume of publication printing has more than doubled since 1985, the previous market dominance enjoyed by the gravure printing technology has been lost and heat-set web-offset printing technology is now dominant in the European market with the single exception of Germany.

Notwithstanding all the efforts made by the publication gravure printing industry to maintain its position, industry watchers have noted a decline in the use of the gravure process. Already in 1991, during an international executive conference it was argued (Mandel et al. 1991, p. ES-13), that:

"Although rotogravure will grow more slowly than offset and flexographic printing, technological improvements will enable rotogravure to remain competitive with offset (better efficiencies and shorter run jobs) by streamlining cylinder preparation and higher speeds."

"Automation of rotogravure presses will lag offset; the major opportunities will focus on automated cylinder change over, the transport and loading of paper rolls, and related functions."

A few years later, at the annual conference of IARIGAI[2], Bruno (1995) reported that gravure will decline in use, as demographics and versioning will split some of the very long runs that have previously been common in magazine and cata-

[2] IARIGAI = The International Association of Research Organizations for the Information, Media and Graphic Arts Industries

logue printing. Hence, he suggested that between 1995 and 2010, a decline in gravure printing by 18-20% in volume was to be expected. Lithography (he did not differentiate between newspaper printing, sheet-fed offset and heat set web-offset) would lose almost 40% of its former volume. The big winner is supposedly the plate-less systems, like the ink jet and electro-photographic processes.

In 2007, Smyth (2007) at Pira International (a printing technology institute in the UK) presented an investigation and a forecast concerning the various printing processes for the coming five years, and according to Table 2.1, printing in Europe grew in sales volume by 10% between 2001 and 2006, and until 2011 printing it is estimated to continue to grow by another 3 % in volume.

The most extreme growth rate, however, can be attributed to digital printing, which is expected to increase from € 4.0 million in 2001 to € 15.1 million in 2011, and to be larger than that of publication gravure printing. Similar growth rates have also been shown by Pitkänen (2006, p. 4)

Table 2.1 – European market shares and future growth

Printing method	**2001 Actual data (b€)**	**2006 Actual data (b€)**	**Growth (b€) 2006 -2001**	**Growth (%) 2006-2001**	**2011 Fore-cast data (b€)**	**Growth (b€) 2011 - 2001**	**Growth (%) 2011 - 2001**
Sheetfed offset	28.4	30.2	1.8	6%	31.4	1.2	4%
Coldset offset	24.3	23.8	./. 0.5	./. 2%	23.4	./.0.4	./.2%
Heat-set web-offset	25.7	27.8	2.1	8%	28.7	0.9	3%
Gravure – public-ation	11,0	10.4	./. 0.6	./. 6%	10.0	./.0.4	./.4%
Gravure - packaging	5.5	5.2	./.0.3	./.6%	5.0	./.0.2	./.4%
Flexo-graphic	28.0	30.2	2.2	8%	30.4	0.2	1%
Digital printing	4.0	11.9	7.9	298%	15.1	3.2	127%
Total	**126.9**	**139.5**	**12.6**	**10%**	**144.0**	**4.5**	**3%**

Source: Smyth 2007

Publication gravure is predicted to decrease somewhat into 2011, whilst heat-set offset is expected to enjoy a growth rate of 3%. Flexographic printing is expected to grow at 1% whilst packaging gravure is expected to decrease in the packaging segment by 4%. According to Table 1 heat-set web-offset will increase its market share, and in 2011 it is expected to be almost 74% of the total publication printing market. This means, if these figures are correct, that the future for both suppliers and printers in the gravure publication industry is rather gloomy. Investors and new ventures are interested in growth and will most probable not invest in a stagnant or declining industry, and it may thus be difficult to find fresh capital for the necessary reinvestments (Ibid., p. 3)

2.2 Views and opinions about gravure in textbooks

There is a well established perception in the printing industry that gravure technology is meant only for large companies printing large volumes and long runs. Textbooks used at universities, colleges and other institutes all teach the same message; large volumes, long runs and large printers. Except for the two older textbooks from 1967 and 1998, the following textbooks are used in the advanced courses at the Royal Institute of Technology which may lead the students to believe that gravure is only for very big markets and/or big companies. In one of the older graphics arts textbooks in Sweden, from 1967, which was used as the main textbook in the 1960's and 1970's in the Royal Institute of Technology's special course in 'Graphic Arts Technology', it was claimed by Carlsson (1967, p. 107), that:

"Because of the high costs associated with cylinder processing, gravure can only be used for very large runs, or in those cases where the customer is prepared to pay a very high price for the printed product, because of its quality!"

In the textbook used in the Royal Institute of Technology in the beginning of the 1990's, it was suggested by Krebe (1988, p. 6), that:

"When printing larger runs and/or for higher paginations, gravure printing is the most efficient printing process. To this fact shall also be added that the frequency of web-breaks and waste generally speaking is lower than in web-offset."

A textbook on the Swedish market published in 1998 communicates very little about gravure, but is used in the basic courses at the Royal Institute of Technology. This textbook (Johansson et al. 1998/2006 p.216) mentions very briefly that:

"Gravure is a very old printing technique with its roots in intaglio engraving on copper. It is an expensive technology, which is economically viable only with very large runs."

In the 2001 edition of the textbook on gravure published by the Gravure Association of America (GAA), this is also explicitly pointed out, and it says in the very beginning (GAA - 2001, p.5):

"Gravure printing has clear economic advantages over other printing processes in the production of long print runs that require uniform color and vivid graphics."

and then the author goes on to say that publication gravure printing is only suitable for a few very large companies (Ibid. p.7):

"Publication printers produce a high volume of printing at multiple sites. These very large companies utilize huge presses with in-line capabilities to produce folded signatures ready for completion with finishing operations."

Following that, the author asserts (Ibid. p.9):

"Gravure is positioned well for long-run printing due to the exceptional durability of gravure cylinders."

The author then suggests that the process has gone from an industrial craft to a process-oriented industry, and this has supposedly given some advantages to the industry (Ibid. p.22):

"The gravure process was the first printing technology to close the digital loop and produce image carriers directly from digital files. …… The traditional manual processes of the past have given way to applications of high-tech digital workflow that make the gravure industry more economically viable than ever before. The gravure industry was for many years an industrial craft, passed down through the decades (even centuries) by apprenticeship programs and on-the-job training"

The North-American publication gravure industry is active on a market which is highly fragmented and with a high cost of distribution with its postal rates (Ibid. p.51):

"In the United States, gravure has been the printing process of choice for run lengths over one million copies…….. The magazine publication industry is under a great deal of economic pressure. Not only are publishers segmenting their markets by more special interest publications; they are also facing increasing postal and delivery costs. The cost of delivery has risen to a point where it exceeds the cost of raw material. Combined with pressure from the Internet, delivery costs will have a major impact on this market sub-segment in the future."

In the textbook Handbook of Printed Media by Kipphan, a similar attitude is evident (Kipphan 2001, p.48):

“Rotogravure printing is used for the economical production of long print runs. … ……………… A special feature of industrial rotogravure printing is the fact that a whole cylinder (and no plate) is used per colour separation. This means in a four-colour press four separate cylinders have to be changed for each new job.”

and later in the book (Ibid. p.360), the author goes on to give a figure similar to that in the Gravure Manual (GAA 2001):

“The simplicity of the printing principle is, however, offset against the problem of a labor-intensive and costly manufacture of the gravure cylinder. Hence, gravure printing is principally used for very long runs. The minimum print run is approximately one million copies. Weekly magazines of general interest and mail order catalogs are therefore the main products produced by means of gravure printing.”

But, then the author has second thoughts, suggesting that the growing costs of the publication gravure process may only to some extent be offset by faster and wider presses (Ibid. p.392):

“It must also be taken into consideration that most of the problems associated with a further increase in speed become considerably more severe and that a further increase in the web width would place higher demands on other elements of the printing process, such as transport of paper reels or logistics in general. ……………………….On the other hand, a contrary trend has become apparent for some years now. The increasing individualization of printed products means also that mass production must be replaced by individual products suited to special interests, hence shorter print runs. However, gravure printing is poorly prepared for this, due to the expensive gravure cylinder preparation. For this reason the majority of these new products are produced on heat-set web offset presses. A move towards smaller, more functionally flexible gravure printing presses, on which the change-over of products can take place more quickly, can therefore more likely be expected. In the coming years, the industry will concentrate on the development of easy-to-change printing units and perhaps also simpler gravure cylinder preparation.”

The author is also aware of the increasingly segmented markets for publication gravure printing, more titles and shorter runs. He is rather optimistic in concluding that the gravure industry will become more flexible and less expensive for its customers (Ibid. 2001).

2.3 Views and opinions about gravure in international conferences

During the last two decades, it seems that most well-known industry watchers and observers have been seeing gravure as a less interesting and probably vanishing print technology. This can be seen from the proceedings and reports from a series of international conferences arranged by Comprint International. They were from 1960 until 2002, among the most important international conferences for the graphic arts and allied industries. Prior to the Comprint conference in Madrid in 1991, the Printing Industries of America commissioned SRI International (a large US consultancy company) to investigate the future of print and print technologies through a survey which was presented to the delegates at the meeting. The future of publication gravure is presented as follows by (Mandel et al. 1991, p.V-15):

"*However, while direct-to-cylinder could provide the winning card in rotogravure, it does not appear that this area is getting the needed research and development funds, and system sizes are still formidable; the pace of development seems unlikely to produce a practical system for widespread use by 2000.*

Other technical developments that will occur in response to demands for rotogravure to stay competitive with offset include:

- *Improvement in halftone gravure*
- *Water-based and/or ultraviolet-curable inks to save on capital costs of thermal incinerators*
- *Wider presses (and lighter cylinders, as noted before)*

Rotogravure printing will grow more slowly than offset and flexographic printing through 2000. It could be economically competitive with offset in the 100.000 impression range as the result of faster cylinder make-ready times and higher press speeds; these improvements will lower costs (due in part to less waste and cylinders preparation labor) and shorten turn-around times. The bulk of the market for rotogravure printing will remain longer run jobs in catalogs and magazines."

The last paragraph was reiterated, and was the only reference to publication gravure in the following conference in 1994. In 1998 in Edinburgh, however, publication gravure became a non-issue and was not mentioned at all.

In 2002, which was the last international conference organized by Comprint International, the following statement was made by Tribute (2002, p.95):

"*In the gravure market, there is a desperate need of new digital cylinder technology to reduce costs and time to print, but currently no signs of suitable technologies being developed. Gravure is therefore likely to become isolated as a very long-run process for packaging and a magazine process for very static types of data. Gravure will be seriously impacted by both digital flexo and automated web-offset processes."*

A research article about publication gravure was presented by Puri at the annual scientific conference of TAGA (Technical Association of Graphic Arts) 2001 in Montreal. He describes the market situation in North-America (Puri 2001, p.333):

"The Gravure process is dominant in high-circulation (1-million plus) magazines, Sunday supplements, retail flyers, and mail order catalogues. The process is capital-intensive and requires long-term printing contracts."

and he is also rather critical about the recent trend to "go super-wide" in Europe (Ibid. p.333), which he fears may put the industry in a difficult financial situation:

"In the EU Countries there is the challenge of increased capacity due to the installation of very wide 143" presses. Some printers are lowering their profits to maintain the market share, but for how long? …. …the magnitude of investments in new 143" presses with accompanying wider engraving units may NOT provide sufficient return on investment (ROI) due to the falling demand in printed advertising and the reading habits of the younger generation; and yet to stay competitive the printer is obliged to install "Jumbo" presses."

He draws the following conclusions about the present management style in the North-American publication printers (Ibid. p.334):

"Thirdly, being capital-intensive, the Gravure Industry is controlled by large corporations. The management style is 'command & control'; let the market adjust to the Gravure parameters whereas Offset/Flexo is very fast to innovate and adapt to the market needs. Also many print buyers, advertising executive, investment bankers, and Offset executives have the impression that Gravure needs a minimum 1-million run and must have long term contracts to be profitable! ……………………The management knows that the market will not change to their Gravure plant; instead they have to change to the market in order to be

competitive and profitable. One million minimum run is another myth or half-truth and mind-set!"

He concludes, nevertheless, by saying that the one million run is another myth and mind-set! You may have to think out of the box (Ibid. p.334)!

Finally, in the German trade press, an article published by one of major gravure press manufacturers tries to reinforce the virtues of publication gravure (Rehmann 2006, p.22):

"Today it can be shown that publication gravure, due to a high level of automation (from cylinder engraving to the loading bays) still enjoys a strong market position in the catalogue and magazine markets".

but he goes on to say (Ibid. p.24) that:

"Because of the cheaper and faster production of plates lithography has an advantage, when products with less pages and shorter runs are to be printed"

It seems, that the publication gravure industry has been very shy of its virtues, and needs to reinforce its status as one of the major printing processes, not only for large companies operating in the larger European markets. It used to be the major process in most European markets until the end of the 1980's, also for the smaller and medium sized companies. A new strategy for publication gravure printing is needed.

2.4 Present structures in the European publication printing industry

Since 1985, only two printers in Europe (of about 550) have moved from heat-set web-offset to gravure; one in France, Lenglet Imprimeurs (2002, p.37) and Print Forum in Germany (Print Forum 1985). In the rest of the world, only two more companies coming from the web-offset industry have invested in gravure, namely Quad Graphics in 1985 in North-America (Quad Graphics 2007) and ten years later Sagawa Printing Co in Japan (Dätwyler 2006). Table 2.2 shows the number of European gravure printing presses and installations (= plants) in 2006 in comparison to 1987.

Table 2.2 – European publication gravure printers – 1987 and 2006

Gravure capacity	1987		2006	
Country	**Inst.**	**Presses**	**Inst.**	**Presses**
Austria	3	7	1	2
Belgium	7	29	1	6
Denmark	3	8	1	1
Finland	3	7	2	6
France	9	36	5	28
Germany	19	115	17	93
Great Britain	8	35	5	19
Italy	13	23	8	32
The Netherlands	7	65	4	21
Norway	1	2	0	0
Poland	0	0	2	7
Spain	8	13	3	11
Sweden	6	12	1	1
Switzerland	5	15	1	2
Slovakia	0	0	2	4
Total	**92**	**367**	**53**	**233**
Paper (x 1000 ton)	**4 355**		**5 040**	
Paper/plant (x 1000 ton)	**47**		**95**	
Paper/press (x 1000 ton)	**12**		**22**	

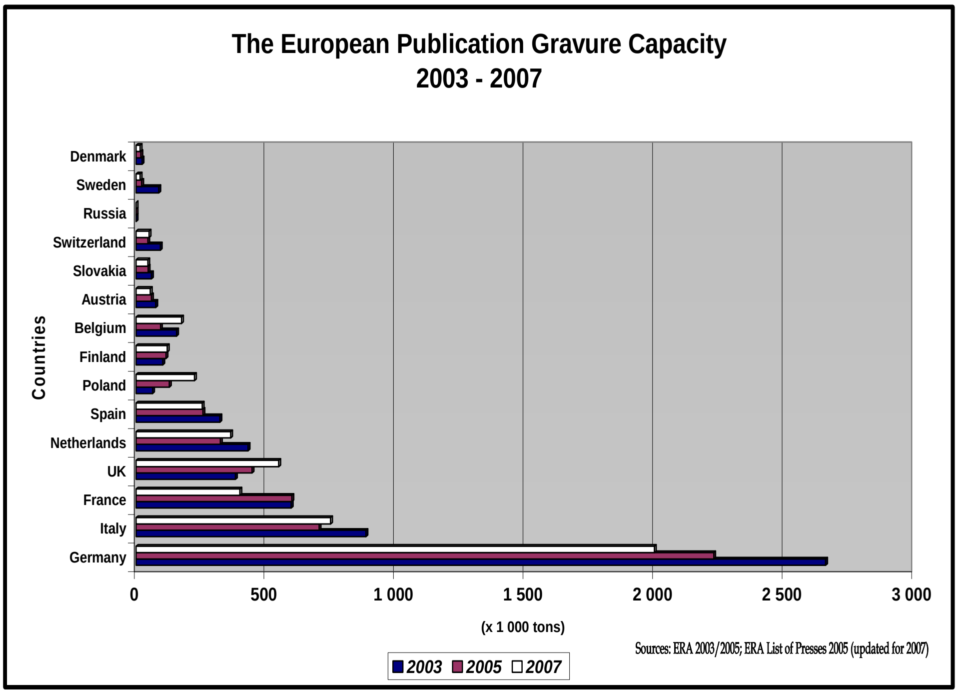
Sources: ERA List of Presses 2006/1987

In 2005, the number of gravure plants has been reduced by almost 50% in comparison to those existing in 1985. Some of these companies have abandoned the technology and converted to heat-set offset and others have gone out of business. In most countries, except Germany, there has been a remarkable reduction in the number of gravure plants (and printers). Nevertheless, the total print capacity of the remaining plants has increased from 47 000 ton to about 95 000 ton.

This is very noticeable in the smaller countries, e.g. the Nordic countries, Switzerland, Belgium and the Netherlands. The closures in France by Quebecor World (Quebecor 2006) and added capacity in the UK (Polestar 2006) and Belgium (Quebecor 2006), made in 2006, have been considered in Table 2. It should be noted that three out of four gravure plants in Eastern Europe are owned by the German publishers Burda Medien and Bauer Verlag (ERA List of Presses 2005).

Figure 2.1 shows an estimate of the publication gravure print capacity in each of the European markets based on information provided by ERA (ERA List of Presses 2006).

Figure 2.1 – Estimated gravure capacity per country in Europe



The publication gravure capacity has been reduced since 2000, while heat-set web-offset capacity has grown substantially since 1991, which was the first year when Euroffset published a reliable list of presses, Table 2.3. It should be noted that in Spain, Czech Republic and Poland the first presses were installed as late as in 1991 (no capacity was recorded by Euroffset prior to 1991).

Table 2.3 shows that from 1991 to 2006 the average size of a web-offset installation has grown three times and almost the same applies to the average press, which indicates that web-offset presses have become faster and/or wider. The gravure capacity per plant is, however, much larger, even though the total growth in 20 years has been moderate. There has been a strong growth in the segment of very large (64-80 page A4) web-offset presses, about 20% in numbers, but in added capacity close to 40% (64-80 page size web offset presses have only been available since the end of the 1990's).

Table 2.3 – European heat-set installations in 1991 and 2006

Web-offset capacity	**1991**		**2006**	
Country	**Install**	**Presses**	**Install**	**Presses**
Denmark	14	16	8	21
France	101	273	107	341
Germany	98	254	114	322
Great Britain	83	187	56	196
Italy	54	129	66	172
Belgium	44	89	27	80
Finland	33	50	27	70
Spain	0	0	25	65
Austria	20	43	16	53
Netherlands	36	75	18	47
Sweden	34	61	14	38
Switzerland	28	47	19	36
Czech Republic	0	0	11	26
Poland	0	0	8	20
Norway	10	23	10	22
Total	**555**	**1247**	**526**	**1509**
Paper (x 1000 ton)	**2 800**		**7 950**	
Paper/plant (x 1000 ton)	**5**		**15**	
Paper/press (x 1000 ton)	**2**		**5**	

Source: ERA List of Presses 2006/Euroffset 1991

Birkenshaw and Smyth (2001) claim that twin web-offset presses of 32 pages each are quite common, which would add another 10-20%. Thus, the total capacity of 64 page printing is estimated to be about 50% of the new added capacity (Ibid.), Table 2.4.

Table 2.4 – heat-set web-offset presses installed per country 2000-2005

Heat-set Web-offset presses installed in Europe (according to the number of pages) 2000-2005							
Country	**16 p[3]**	**24 p**	**32 p**	**48 p**	**64 p**	**> 64 p**	**Total**
Austria	2	3	1	4	1	0	**11**
Belgium	5	2	4	4	1	0	**16**
Denmark	3	2	1	3	0	1	**10**
Finland	6	0	0	1	2	1	**10**
France	22	3	1	10	2	0	**38**
Germany	50	6	18	18	9	5	**106**
Great Britain	28	1	0	8	9	5	**51**
Italy	10	2	1	7	14	8	**42**
The Netherlands	4	2	2	0	0	0	**8**
Spain	13	2	1	8	1	2	**27**
Sweden	1	0	1	0	0	0	**2**
Switzerland	8	0	0	2	0	0	**10**
Total	**152**	**23**	**30**	**65**	**39**	**22**	**331**

Sources: ERA List of Presses 2006/MAN-Roland

A similar table for publication gravure presses can be computed from the ERA List of Presses (2005), Table 2.5.

Table 2.5 – publication gravure presses installed per country 2000-2005

Publication gravure installed in Europe (according to the number of pages[4]) 2000-2005					
Country	**48-64 pages**	**72 pages**	**96 pages**	**124 pages**	**Total**
France		1	3		**4**
Germany	1		9	2	**12**
Great Britain	2		4		**6**
Italy	1	1	5		**7**
The Netherlands	1		1		**2**
Spain	2				**2**
Total	**7**	**2**	**22**	**2**	**33**

Source: ERA List of presses 2005

[3] 16 p = 16 pages (A4 size) etc.
[4] Page size = A4 or close

From Table 2.4 and Table 2.5 it can be derived that, counted in numbers, new publication gravure presses are only 10% of the installed presses 2000-2005. The inherent new capacity, however, is about 25-30% of the total new capacity when the sizes of the new presses are considered. In monetary terms, the total investments in new capacity are about 2.8-3.0 € billion, of which 20-25% is attributed to gravure. It should also be mentioned here that the number of pages shown in table 2.5 is calculated with 4 pages around (4U) in landscape[5] mode. However, all those presses can also run 6 pages around (6U) adding 50% more pages in the print run, albeit with a 2/3 reduced speed (the speed of the web is constant).

[5] Landscape – the spine of the pages is oriented along the cylinder axis

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3. Research questions and delimitations

3.1 The research questions

The research questions in this study are as follows:

- How has the European publication printing market changed between 1985 and 2006?
- How has the balance between the two competing publication printing techniques, gravure and heat-set web-offset, changed between 1985 and 2006?
- What have been the main driving forces determining the developments of these printing techniques?
- Is gravure a printing process suitable only for very large runs, for huge volumes and for large markets?
- How can the competitiveness of publication gravure be improved?

3.2 Delimitations

This work is an investigation of the European publication printing industry, with some emphasis on, but not limited to, the members of the European Rotogravure Association (ERA). However, during the work on the thesis, and indeed in the preparation of the research papers which are a part of it, it has become apparent that there is very little scientific literature available related to the publication printing industry. Hence, the references are, to some extent, from the general printing industries chosen because they are close to publication printing.

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4. Theoretical Considerations and Methodology

4.1 Sustainable competitive advantage

The concept of competitive advantage in driving business strategies has received considerable treatment in the literature during the last three decades. Within this framework of strategic management literature, there are two main competing models of sustainable competitive advantage; one based on neoclassical economics in the industrial organization literature such as Porter's work from 1985 (Porter 1985). The other model is the resource-based model where competitive advantage is considered as the competences which a particular company possesses, Lado et al. (1992, p. 77) suggest that "*Thus, in the neoclassical economic and industrial organization traditions, competitive advantage is ascribed to external characteristics rather than to the firm's idiosyncratic competences and resource based deployments."*

In Porter's view, competitive advantage can be sustained by increasing the height of the barriers to entry by potential competitors such as scale and scope economics, product differentiation, capital requirements etc. A firm should accordingly reinforce these barriers by continuously reinvesting in new technologies and/or markets. The threat of substitute products or the bargaining power of the customers and/or suppliers should under no circumstances be underestimated (Porter 2004).

The resource-based concept, on the other hand, emphasizes utilizing *"anything which could be thought of as a strength or weakness of a given firm"* and a firm's resource-based competences consist of core human and non-human assets that allow it to outperform rival firms over a long period of time (Wernerfelt 1984, cited by Lado et al. 1992). Resources may have to be assessed in relation to the particular market, and they are only valuable if they meet the customers' needs better than those of the competition.

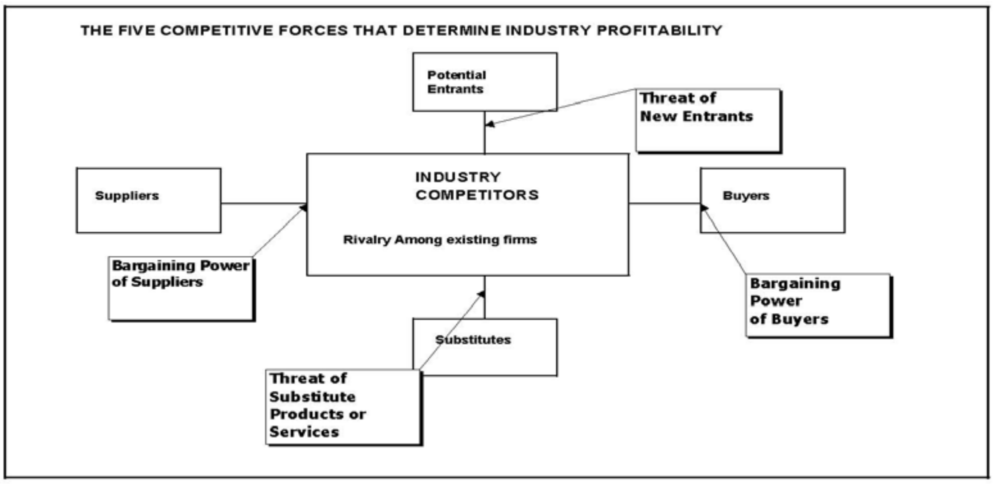
However, management and technical assets are easily changed and/or acquired depending on the financial assets at hand, and this makes the management of a company more complex and difficult in a non-static world.

Substitution and imitation are some of the most common external threats to a company. Hence, the focus should be on developing and supporting those competences that are not easily imitable (Porter 2004).

Other views on the resource-based concept focus on the core competence of a company and suggest that *"True core competences are hard to define precisely and are often discovered retrospectively." ………"Core competence is clearly* *an important concept, and some companies seem to be able to make it work. But for most, it is like a mirage; something that from a distance appears to offer hope in a hostile environment, but turns into sand when approached."* (Coyne et al. 1997, p. 42).

Porter's description of the five competitive forces was originally published in 1985 (Porter 1985), in a second edition 1996 (Porter 1996) and in an export edition 2004 (Porter 2004), Figure 4.1.

Figure 4.1 - Five competitive forces



Source: Porter 2004, page 5

The five main areas of interest for the competitive situation of a company are the present competitors, the bargaining powers of suppliers and buyers, potential entrants and last but not least the threat of substitute products or services. Porter insists, though, that this framework should not eliminate the need for creativity in finding other ways of increasing a company's competitiveness. Figure 4.1 shows that in any industry there are very many elements which can influence to the profitability. Porter, in his foreword to the export edition, proposes that (Ibid., p. 2):

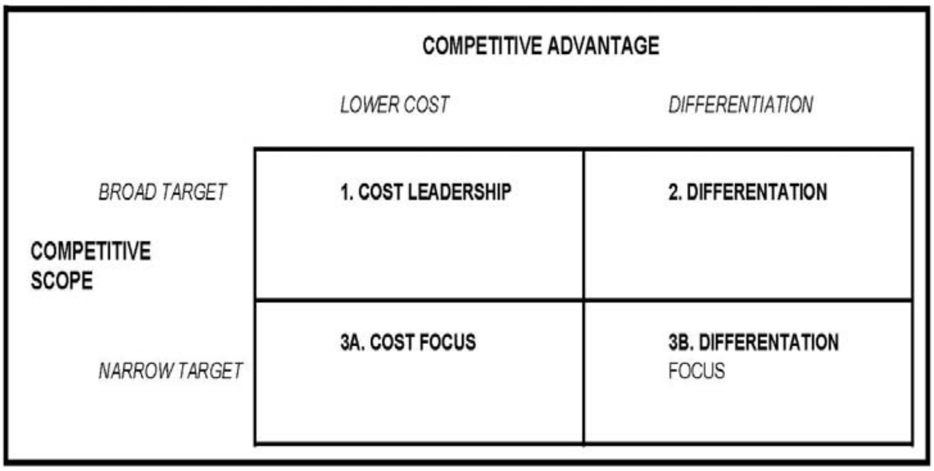
"Many strategic concepts have ignored industry attractiveness and stressed the pursuit of market shares, often a recipe for Pyrrhic victories. The winner in a fight for share in an unattractive industry may not be profitable, and the fight itself may make the industry structure worse or erode the winner's profitability."

Further, Porter suggests (Ibid., p. 5) that there are a limited number of Generic Competitive Strategies, and he says that "*The fundamental basis of above-aver-*

age performance in the long run is sustainable competitive advantage. There are two basic types of competitive advantages a firm can possess: low cost or differentiation. The significance of any strength or weakness a firm possesses is ultimately a function of its impact on relative cost or differentiation. Cost advantage and differentiation in turn stem from industry structure."

The general overview of the relationship between these different strategies is shown in Figure 4.2.

Figure 4.2 – Generic Competitive Strategies



Source: Porter 2004, page 12

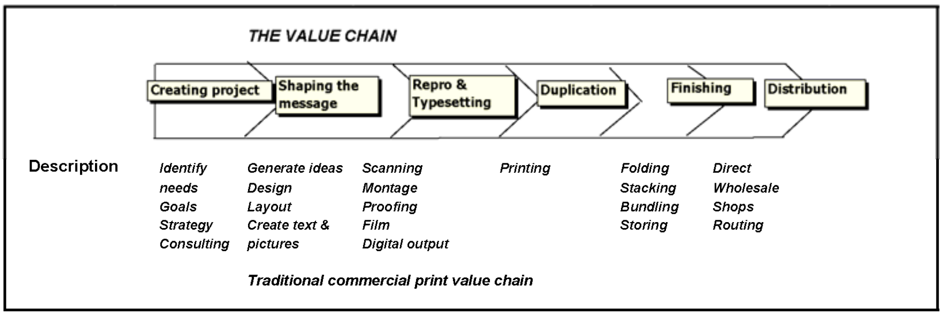
Porter goes on by stating (p. 13) that "*If a firm can achieve and sustain overall cost leadership, then it will be an above-average performer in its industry, provided it can command prices at or near the industry average. … A cost leader, however, can not ignore the bases of differentiation. If its products are not perceived as comparable or acceptable by buyers, a cost leader will be forced to discount prices well below the competitors' to gain sales. This may nullify the benefits of its favourable position."* Cost is generated by performing activities, and cost advantage arises from performing particular activities more efficiently than the competitors (Ibid., p. 61).

One strategy of differentiation is to serve the market with a product or service for which the customer is willing to pay a premium price exceeding the cost of differentiation. The cost focus strategy, on the other hand, serves a segment of the market with a product or services at a lower cost than the competitors. The chosen segment must have customers with special needs or the company has a production or delivery system serving this segment which differs of that of its competitors.

According to Porter (Ibid. p.3) value is defined as *"….what buyers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price.* "

Competitive advantage can not be understood by looking at a company as a whole. A systematic way of investigating all those activities a company performs and how they are interacting is needed. This analytical tool is called the value chain by Porter (Ibid. p33). The value chain separates the strategic activities of a company in order to improve the understanding of cost relations and how the company may use its resources of differentiation. A company derives its competitive advantage by performing these activities more economically or better than its competitors. Figure 4.3 shows the value chain for a commercial printer (following the definitions of Porter) as depicted by Ertesvåg et al. (1998, p. 81).

Figure 4.3 – Value chain according to Porter



Source: Ertesvåg et al. 1998, page 81

Porter has expanded his theories further (Porter 2004, p.61), and argues that:

"For almost two decades, managers have been learning to play by a new set of rules. Companies must be flexible to respond rapidly to competitive and market changes. ….. According to the new dogma, rivals can quickly copy any market position, and competitive advantage is, at best, temporary."

"But those beliefs are dangerous half-truths, and they are leading more and more companies down the path of mutually destructive competition….. companies have properly invested energy in becoming leaner and more nimble. In many industries, however, what some call hyper-competition is a self-inflicted wound, not the inevitable outcome of a changing paradigm of competition."

In this thesis, the model developed by Porter is used to define the five competitive forces that determine an industry's or a company's profitability (Ibid., p. 5).

His concept of the value chain in an industry has been supported by other strategists in the graphic arts industry such as (Ertersvåg et al. 1998). On the other hand, Birkenshaw suggests (2007) that the current strategies may lead to new business models, because the publication markets, magazine and catalogue printing may change more rapidly than other studies have implied. Krauss (2007) stated that publication printers who understand the changing needs of their customers and adjust quickly to those will succeed.

How these concepts, including the value chain, influence the publication printing industry will be further presented in Section 7. In this context, they will also be further considered in relation to the present market situation.

4.2 Research methodology

4.2.1 Introduction – the European Rotogravure Association (ERA)

The association was founded in 1956 by nine publishers with integrated gravure production facilities and one of the objectives was to improve and develop gravure technology by personal, technical and financial cooperation. In 1965, the ERA merged with another group of publication gravure printers (Club International Heliogravure) and became the only European association for publication gravure printing. In 1970, a new category of members, Associate Members, i.e. suppliers to the gravure industry, was created. By 1984, the Association had about 120 members of which 22 were Active Members, i.e. publication printers, some of them using both gravure and web-offset. Integrated publisher/printers, i.e. printers owned by a publisher, were 17 of the 22 Active Members or almost 80% of the membership.

Active Members were selected among the most prominent publishers/printers in each country, and membership could only be achieved by personal invitation from the ERA Board of Directors and with the support of all other members in that country. The main work in the association was done by the technical commissions and the Board of Directors. Although many of these printers were also competing on the open commercial market, the cooperation within the technical commissions or the Board was never compromised.

Until the end of the 1960’s, heat-set web-offset within European publication printing was rather small, and although the volume grew fast, it was still in 1985 only about half the volume of gravure. Nevertheless, in 1984, some of the members from the UK were complaining about the increasing pressure from competing heat-set web-offset printers, and suggested that a study of the competitiveness of gravure vs. web-offset should be started. The ERA Board of Directors asked the Secretary General to set-up a special Working Group for this purpose. This Working Group was constituted in 1985 and with 16 companies actively taking part. Three other companies were contributing to the study, which means that all members except three were both interested in and concerned about the subject matter. The members of the Working Group were all senior managers and/or executives in their companies.

In 2006, the Association has other categories of Members - Packaging printers and engravers - Publishers and catalogue producers - but the work is organized in a similar fashion as 20 years ago. In 2006, however, one major difference is obvious; there are only three integrated publisher/printer of a total of 17 Active Members in the Association, i.e. a majority of the Active Members or 82% are printers only.

4.2.2 The investigations made in 1985 and 1986

A comprehensive study of the European publication printing industry was carried out between 1984 and 1986 by members of the European Rotogravure Association (ERA) in Munich, Germany. Most of the technical questions/issues in the study were debated and discussed during a number of meetings which took place in the autumn of 1984. Then, in 1985, the methodology and the research area were again debated during several meetings conducted by the Working Group, and a questionnaire was designed with all relevant technical questions. The questionnaire could be used for both quantitative and qualitative analysis. Hence the relevance of the questions was certified. Therefore, it can be ascertained, that all of the participants (= members of the Working Group) understood the background and the meaning of the questions. Later, in 1985, the questionnaires were mailed to the contact persons at each member company (22 in nine countries) with a 75% response rate. Hence it can be assumed that both the reliability and the validity of the answers to the industry in general were assured.

In 1986, the next investigation concerned the cost of printing certain products (= signatures of different paginations). This investigation was extremely confidential, and before the request for information was distributed, the content and structure were discussed and decided upon by the Working Group. The participating companies in the Working Group sent their estimates directly to the author, and the information was kept strictly confidential. The report was published in 1986 (Bjurstedt).

4.2.3 The investigations in 2005 and 2006 – Papers II and IV

A pilot study, with a small number of companies, was carried out in 2005, and it was found that the questionnaire from 1985 was still valid in its context. One minor addition was made with a question asking what digital formats are used today when advertisements or editorial texts are delivered to the printer (twenty years ago, very few printers could accept digital data at all). The new surveys were mailed to the respondents, but in most cases they were also supplemented by personal interviews and the relevance of the questions remained. Paper II, *"Benchmarking Gravure Cylinders vs. Web-offset Plates"*, is investigative and can be regarded as both a qualitative and quantitative research paper. Paper IV is a qualitative survey based on personal interviews and the previously mentioned questionnaire.

4.2.4 Investigations in 2006 – Papers IV and VI - do they differ from previous methodology?

Paper VI, *"Break-even Analyses Gravure vs. Web-offset. A new Approach!"* is a quantitative analysis of the techno-economical changes which have taken place in the publication printing industry during the last 20 years. This follow-up investigation in 2006 from the investigation in 1986 followed very much the older investigation, but this time some non-members were also approached and agreed to participate. These were gravure printers but, in addition, some larger heat-set web-offset printers were also asked to participate. The reason for including the latter category was that during 2002-2004 these companies had invested in the latest web-offset technology, which was indeed relevant for the new investigation. The participating companies were asked to make the same calculations as in 1986, but with one exception – no wet gravure proof was to be included. The reason was, simply, that wet proofs are no longer standard procedure in magazine printing. This became evident during the investigation presented in Paper IV; hence it was decided to use contemporary practices. The participating companies send their estimates directly to the author, and the information is kept strictly confidential. Almost the same number of printers has been involved in submitting the information, although there have been some changes in the industry:

- Many companies in the first study have merged, changed ownership or gone out of business,
- Many of the leading managers are no longer in the business; they left the industry, retired or are no longer available.

In Paper VI, the questionnaire was also used to investigate whether the print quality of SC grades in gravure is comparable to that of LWC grades in web-offset. The survey concerning the perception of the paper grades and gravure print quality relative to heat-set web-offset quality is a qualitative analysis, because the answers were based on the opinions of the respondents rather than on the use of test prints and a panel of observers. By using different sources from both users and suppliers in this survey, some of the results deduced may be stronger than if they came only from a single source.

4.2.5 Investigation in 2007 – Paper VII

The last survey presented in Paper VII has a wider target, and the main emphasis is on both a quantitative and a qualitative approach extended with personal interviews. The interviewees have been selected among the most important customers and supplier companies in Europe. The customers to the publication printing industry, mainly magazine publishers and catalogue producers, are most important to the industry. The number of publishers asked to participate in this study was six, of which one did not want to participate. The catalogue producers asked were five, of which none declined.

The reason for including the suppliers this time is that most of the research in developing new technology and/or production processes is now concentrated to the suppliers. Between 1956 and the end of the 1980's, work in this area was also done by the larger publishers/printers (= users) in Europe and by the ERA. In this context, there are a limited number of suppliers to the publication printing industry (such as plate and printing cylinder processing equipment manufacturers, printing press manufacturers, and ink manufacturers) and all are Associate Members of ERA. All companies agreed to participate in the survey with the exception of two paper makers. It can be stated that there was 100% coverage in all areas studied with the exception of papermaking with 50% coverage. However, the participating papermakers represent abut 65% of the European market (Paper VII).

This questionnaire had to be constructed from the very beginning, because a similar one was never prepared in the 1980's by the ERA. Nevertheless, the structure followed mainly the previous questionnaire, and the questions were first tested with a small group to check both relevance and completeness. The main effort has been to interview these managers personally, and only a few have declined to participate. Because of constraints of time and financial resources, some of the interviews were done by telephone.

With the recommendations of Bruhn Jensen (2002), the interviewer chose to structure the discourse as follows:

1. Introduction about the purpose of the interview (survey) – secrecy, non-disclosure agreements etc.
2. Some minor less controversial questions about the market conditions in general
3. More complicated questions about background information and knowledge about the industry
4. A few controversial questions related to the position of the company and problems perceived by the company/individual

5 Conclusion; asking some less controversial questions – some background questions

In order to be well prepared for the interviews, background information was collected for each company (or group of companies) to be interviewed. Today, such information is normally available via the Internet on the relevant home-pages.

The duration of the personal interviews varied between one hour and about half a day. The answers were noted and later submitted to the interviewee for verification and acceptance. Those whom it was not possible to interview personally were approached first with the questionnaire followed by a telephone interview lasting about ½-1 hour upon receipt of the response. The depth of the interviews was assured by asking some complementary questions where, for example, it became obvious that the customer’s choice of suppliers and printing methods is related to the perceived environmental impact.

The method of doing most of the surveys as a qualitative study is of course time-consuming and expensive. On the other hand, it may only be possible to discuss some of the more important issues face-to-face rather than through a more anonymous questionnaire distributed by mail. The notion of using more depth and time during the interview gives the interviewer more time to reflect and the possibility of adding supplementary questions. This strategy is also supported by Schatzmann & Strauss (cited in Bruhn Jensen 2002). Hence, the interviewer has gained not only a personal contact but also more in-depth knowledge about the conditions on different markets in Europe. This context has been very valuable in the survey about the future markets for the European publication printing.

The approach in this study is based not only on the scientific methodology used but also on the competence, knowledge and experience of the publication printing industry in applying the methodology. Hence, most knowledge and/or experience are derived from an on-the-job position in the publication printing and allied industries, and by working close to those industry leaders in various managerial positions.

4.3 Assessment of the answers in 1984 and recent surveys

One of the most important issues in a survey is the assessment of the generality of the answers. Are the answers also valid for those not taking part in the survey, as it is not possible to interview all companies and/or executives in the European markets? Is it possible to generalize the results of the survey and to state that these are the common perception of the market in Europe? In other words, is the group from whom answers have been received representative of the total population which one desires to study? There are two fundamental questions here:

- Is the sample to which the questionnaire has been sent, representative of the population being studied?
- Is the group of those who have replied representative of the sample or is it a biased selection?

In this work, since the members of the ERA - the only European association in publication printing - are the most influential companies in each European country, thus they are among the important gravure printers and/or web-offset printers in each country, depending on the size of the market. Since these companies are predominant on their individual markets, it can be justifiably claimed that their answers are quite general and are valid for the purpose of this particular research study and that they represent a distinct majority of publication printers.

In this study, the data collected have come from both personal interviews and four different surveys asking for both numerical data and market information, and these have been the basic information in Papers II, IV; VI and VII. The other three papers – Papers I, III and V - have been based on scientific literature studies and other relevant literature sources.

5. Summary of included papers

This thesis is based on seven papers presented at various scientific conferences on media technology and published in their proceedings. The author is the sole contributor to all the included papers but one, Paper V. All papers are describing the effects related to the digital revolution in the printing industry at the end of the 1990's, which changed the way the industry works (Paper I). Particularly affected were the prepress operations in producing magazines, newspapers or general printed matter which all became commodity tasks, moving not only the control of but also the execution of those operations from the printer to publishers and print buyers. On the surface, these events may not look very dramatic, but in reality they have caused the earlier strong bonds between printer and print buyer/publisher to disappear. The large prepress departments in the printing works with specially trained craftsmen employed as scanner operators, retouchers, typesetters, planners and plate makers have vanished and only a few specialists have been able to retain their jobs (Paper I). Another effect has been that entry barriers for producing pages and indeed new titles have been lowered (Paper VII).

However, these changes did not happen without implications for industrial relations. In many countries and/or companies with powerful print unions, there were long, bitter battles between publishers/owners of the printing companies and the unions. One of the fiercest battles took place between 1982 and 1986 in the UK. The story of Robert Maxwell (and of course also other industry leaders e.g. Rupert Murdoch) is closely connected to these events, and is presented in Paper II. In other countries, similar patterns have emerged, in many cases as bitter as those in the UK, but with less publicity. Visiting the plants of major publication printers today in Europe, you may find whole storeys empty of any operation, which are witnesses to the "good old days", when the prepress operations occupied these premises with many hundreds of skilled craftsmen.

In Papers III, VI and VII, the strong growth of heat-set web-offset printing operations during the last twenty years is discussed, as well as how the break-even levels between the two competing methods of publication printing have changed to the detriment of gravure. Paper VI shows the strong growth of installed large heat-set web-offset presses since the beginning of the 2000's, and how the market share for web-offset has grown substantially since 1985. On the other hand, in Paper III, it is suggested that the processing of gravure cylinders can be done almost as inexpensively as that of web-offset plates, provided that a sufficient number of cylinders is produced using the best available technology. In Paper VII, one of the suppliers of process equipment for engraving systems says that in Europe there are still too many old and inefficient units in operation. The gravure publication industry needs to modernize its equipment for cylinder-making.

Paper IV is dealing with the present market conditions for European publication printers. The digital revolution, as described in Paper I, has made a strong impact on the working conditions for the printers. In the middle of the 1980's, most of the prepress work was done by the printer, who controlled the entire workflow from accepting the originals, scanning the images, typesetting the text, processing the pages ready to be engraved or making plates for web-offset etc. The lead-time for e.g. advertisement material could be several weeks until the first proof was pulled unless the printer accepted screened separation films. However, almost all web-offset printers accepted films and the lead-time was reduced to 1-3 weeks prior to plate-making by doing so. Since the end of the 1990's, all printers accept digital files, normally in PDF-format[6], and most advertising material is standardised according to specifications made by Adobe Inc[7]. The lead-time is thus now counted in days (or hours) rather than weeks prior to the start of the production. A general overview of the break-even levels between gravure vs. web-offset in the different European markets was part of the study. The research questions were related to what factors were determining when choosing a particular printing method. This paper shows that the same factors are still valid, and on signature sizes up to 64 pages, heat-set web-offset, particularly on coated grades, is the preferred choice by the customers for both technical and economical reasons.

Paper V is written together with Enoksson, and it deals with how four colour pictures should be manipulated using modern DTP[8] software. These manipulations are necessary in order to obtain optimum printing conditions in the offset press. The basic colour separation theories and the historical background are described by the author. The paper introduces a new terminology which is renaming both UCR[9] and GCR[10]. The previous definitions have confused many operators in the prepress industry therefore the new terminology suggests using only Compensation by Black (CB) in the future. It should be mentioned, that the historical review reveals that UCR technology was developed in North America in order to avoid severe trapping problems in printing wet-to-wet in heat-set letterpress printing of the Time Magazine and Life titles at the end of the 1940's. The UCR and GCR are both replacing the black portion of the coloured inks and hence reduce the maximum coverage of inks (the maximum allowable depends on the paper substrate used).

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[6] PDF = Portable Document Format from Adobe Inc.
[7] Standard in advertising material – PDF/X-3
[8] DTP = Desk top publishing
[9] UCR – Under Colour Removal – removing the gray/black portion of the colours of an image to be printed. It was commonly believed that UCR was applicable to neutral tones only, but the investigations in Paper V shows that this is a misinterpretation.
[10] GCR – Gray Component Replacement – as above UCR

The GCR concept has been important for the development of high-speed heat-set web-offset printing during the 1980's. Not only is the consumption of the coloured inks reduced, but it also solves the trapping problems in connection with wet-in-wet printing. Without UCR/GCR applied to the coloured pages, the speed of web-offset (whether cold-set or heat-set) would have been severely limited. Before the desk top revolution in the beginning of the 1990's, these manipulations were done by specialists in the prepress departments, but many printers have now, however, invested in software packages applying UCR/GCR prior to output on plate or cylinder. In publication gravure printing trapping does not occur, because the ink layer is dried before the next is printed. To save the more expensive coloured inks, publication gravure printers use both technologies.

Paper VI describes the investigation done in 1985 the aim being to determine the break-even level between gravure and web-offset printing. Other investigations – such as in Paper IV – did not distinguish between different sizes of signatures but described only more general data and/or opinions. The investigation in 1985, however, calculated for the first time the break-even levels on real data obtained from the industry using different sizes of signatures, e.g. in 32, 48, 64 and 96 pages. The A4 page size was used which was considered to be the worst case for gravure, because A4 is the standard fixed cut-off in web-offset. In 1986, gravure presses were capable of printing signatures of 64[11] and 96[12] pages in full colour on one web, but most heat-set web-offset presses, however, were limited to 16 or 32 pages, in long grain configuration (= portrait size).

The investigation showed that commercial web-offset printing was very competitive when printing smaller signatures with 16 or 32 pages, but gravure printing became competitive from 48 page signatures (and larger). In order to produce larger signatures than 32 pages, web-offset printers had to print additional signatures for subsequent binding, but those extra costs were not included in the calculations. Adding those costs to 48-96 pages signatures would have improved the competitiveness for gravure in this segment. Further, it could also be shown that gravure printers who were engraving cylinders directly from digital data (and did not pull a wet proof of the gravure cylinders) were competitive even on a 32 page signature. Soon after the investigation was published, some gravure printers pioneered the new digital technology, and became the first to benefit from the use of direct digital interfaces. By doing so they eliminated the use of graphic film, and this greatly reduced costs, improved the quality of the final printed product and shortened the lead times. Within a decade, almost all gravure cylinders were produced digitally.

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[11] 64 pages – four page around the printing cylinder and a web of 2.40-2.45 m
[12] 96 pages – six pages around the printing cylinder and a web as above

In Paper VII, the present and future conditions on the market for publication printers are described, but from the customer's and supplier's perspectives rather than from that of the publication printer's. The investigations show that the demands from the customer will change the conditions of the market, and meeting those new demands will be very difficult for those printers with old and inefficient equipment. The financial constraints of changing old and inefficient equipment in publication gravure need to be considered. The relentless pressure on prices from the customers has put printers under severe strain.

The customers are of course also feeling the pressure, as new digital channels are taking an increasingly larger percentage of the total advertising revenues. Information provided over the Internet and e-commerce is a new phenomenon, which have been growing since the beginning of the 2000's. The growth of advertising revenues spent on Internet is very fast; albeit starting from comparative low levels, but in the 2010's the traditional print media – magazine, inserts and newspapers publishers - may be challenged. Some mail order catalogue companies claim that their volume of sales using e-commerce is now larger than the traditional telephone or mail sales channels (Paper VII). Fast moving consumer goods marketed by traditional mail order companies are channelled through e-commerce rather than through the catalogue. This will undoubtedly challenge the traditional catalogue printers, and will put the flexibility and adaptation of those printers who are in these businesses to severe tests. The attitudes of the customer's customer are of vital interest for the publication printing industry.

5.1 Paper I - Converging technologies in the prepress from 1980-2003

This paper is devoted to the technical developments in prepress technology and deals with the technical convergence which has taken place since the beginning of the 1900's and more specifically since the 1980's. A survey approach was used in the investigation with extensive literature searches in various technical and scientific literature databases. From 1967 to 2001 the author was also active in the European printing industry, both as customer and later as supplier, which has given him an insight into both analogue and digital technologies and into the associated technical development.

The research questions in this paper were:

- How has the development of technology influenced the publishing and printing industries since 1987?
- Is it possible to identify distinct paradigm shifts since 1900?
- Have the developments led to an increased technological convergence?

This study identified three major technology shifts since the turn of the 20th century. The first shift was at the beginning of the 20th century, when modern typesetting technology was introduced. The new technology, the first major step in prepress operations since the invention of movable type by Gutenberg in the 15th century, became one of the most important contributions to the mass market circulation of newspapers, magazines, books, textbooks, and other publications during the years to come. There was no suppression from competing technologies, and the new typesetting invention called Linotype[13] became, after a slow start, a commercial success. Before this technical revolution in the beginning of the 1900's, newspapers were thin, because manual typesetting, which was slow and expensive, made it impossible to produce more than a few pages every day. Books and textbooks were expensive to produce, and only a minority of the population could afford to buy them. With the new technology, textbooks became available for large circulations, which together with school reforms in many industrialized countries quickly spread knowledge and information among their citizens.

The line casting technology remained more or less unchanged until the beginning of the 1950's, and only a few technical changes, such as the introduction of punched paper tapes after the Second World War, increased the productivity. A major concern for quality was the excessive wear of the brass matrix forming the movable type for each font[14] and size in the Linotype units. These were rather susceptible to wear by the hot metal used in the machines, which led to frequent and expensive maintenance. When a customer of a publisher considered introducing new fonts, the line casting technology became rather inflexible and expensive. In the beginning of the 1950's, many attempts were made to replace the hot metal[15] technology with other methods such as phototypesetting. The first attempts were emulations of the line casting machines, but other technologies were soon introduced.

A major step forward came in 1964, when the first affordable computers were introduced into the market (such as the PDP-8 from DEC[16] and later the PDP-11), and many software companies used these to develop typesetting and hyphenation programs for output to phototypesetters. Many publishers were attracted by the new technology, because the competition among them was hard and the old hot metal technology was considered expensive and rather slow. But now there were many forces which wanted to suppress the new technology. The major force was the traditionally very powerful labour unions, particularly those organizing the labour in the British newspaper production concentrated on Fleet

[13] Linotype – A Line of Type which one of the first customers, an editor, exclaimed when he saw the first results from the new machine
[14] Font - a specific design of letters and numbers, e.g. this font is called Times New Roman
[15] Hot metal – typesetting using lead and Linotype (or similar) machines
[16] DEC - Digital Equipment Corp., one of the first manufacturers of small and medium sized computers

Street in London, but similar opposition among newspaper unions was also found in Sweden and Denmark. With the introduction of computerized composition systems for newspaper and other publishers, the first step towards the second paradigm shift was taken. This was the transfer from analogue technology in producing text (as hot metal), line works and images to a digital technology. Colour separations made by electronic drum scanners became a standard procedure during the 1970's. A major breakthrough occurred when Scitex Corp. showed the first colour page make up system (CEPS[17]) – the Response system, which was quickly followed by other major suppliers – Dr Hell and Crosfield Electronics. The graphic art industry adopted digital technology late in the 1980's, and this became the second paradigm shift.

The colour and text systems presented by these suppliers were extremely expensive, and yet there was no simple technique available for exchanging digital information between different systems, and publishers were looking for cheaper production methods. The introduction of the third paradigm shift was slow, but eventually the Apple Macintosh computer and Adobe PostScript[18] became the dominant technologies in the digital age of publishing. Around 1995, most printers stopped using analogue technologies, and became 100% digital with the advent of desk top publishing, using PostScript and affordable software packages like Adobe Photoshop, Aldus PageMaker and Quark Xpress. In the middle of the 1990's the third paradigm shift was completed in most European markets. In 2006, the investing in a workstation for publishing operations (creating pages - manipulating images, creating lay-outs and text etc.) is only about 5-10% of the level in 1985. The rapid decrease of costs of personal computer hardware and shrink-wrapped software for editorial work has contributed to this phenomenal development.

Today, Apple is still in the market, small but influential in the publishing world, but Adobe – the inventor of PostScript and PDF technology – is the new giant on the world market. In 1980's, many customers were complaining about the lack of competition and industry standards in the front-end market. Now, however, Adobe has created a de facto world standard with the PDF-product, which is also supported by the International Standards Organization. A new monopoly in front-end technology has been created. Never before has a single company been in such a position in the graphic arts industry[19].

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[17] CEPS – Colour Electronic Page Make Up System, a digital system for manipulating text and images on a page based on mini computers

[18] PostScript – a page description language (software) – made for output units (Laser writers, film setters etc.)

[19] Adobe Inc. – 2006 Annual Report states revenues to $ 2.6b

Since 1987, the development of technology in the prepress has had a huge influence of the publishing and printing industries, and has made it possible for publishers not only to lower the costs for prepress operation, but also to gain control of the prepress work-flow, previously the domain of special trained prepress operators employed by the printers.

It has been possible to identify three distinct paradigm shifts in the industry since 1900; the first in the turn of the 1900's century when the line casting technology was introduced. The second was the shift from analogue to digital technology during the end of 1970's and finally, the third paradigm shift was the introduction of Desk Top Publishing (DTP) in the end of 1980's. These developments were initiated with the introduction of Postscript by Adobe Inc. in the beginning of the 1980's which was later followed by the PDF technology also developed by the same company. In 2006, there is no other visible rival technology, hence the technical convergence has led to one technology only, namely the PDF.

5.2 Paper II - Leadership in the media – about Robert Maxwell – a study of power in leadership

The changes in the publishing and printing industries during the 20th century were to a large extent the result of strong leadership and exercise of power. The concept of power in leadership and management has been much debated in recent years. Power is the capacity to influence the attitudes of people in a desired direction, and to make them execute orders they might not otherwise obey. Further, an understanding of how people or managers may influence each other in an organization and leadership is related to power because it is dependent on the possible level of influence a specific person may exercise. A manager with little power will have little or no influence or authority, and authority is the right to influence others in a specific way. Managers do things right, but leaders do the right things. Effective leaders incline towards personal rather than position power and adapt their style accordingly. Thus, power is an important basis for influence in formal organizations.

The research question in this paper is concerned with how the use of power in leadership can affect the conditions of the publishing and printing industries. As one example, this paper shows how the late Robert Maxell, regarded between 1980 and 1991 as one of the leading publishers and media owners in the world, used power in his leadership to overcome most of the obstacles on his path to success. A survey approach has been used with extensive literature searches in scientific and other literature databases, and during the 1980's, the author met with Maxwell on several occasions and obtained an insight into his personality and leadership.

Maxwell was always regarded as an outsider by the establishment in the UK, but he managed by his sheer energy, personal charm and persuasion to be financed by the leading banks and financial institutions in Europe and overseas. In 1964, he became an MP for Labour but lost his seat in the 1970 polls when the party lost the government to the Tory party. He founded Pergamon Press in 1949 together with a partner, and the company went public in 1964. But Maxwell still ran the company as a private company when he in 1969 tried to sell the company. The sales negotiations collapsed, and although the sales never went through he lost control of the company. In 1973, because of the problems related to the sales process of the company, he was accused in an investigation of the UK Department of Trade and Industry (DIT) that *"he was not a person who can be relied on to exercise proper stewardship of a publicly quoted company".* The following year, nevertheless, he was able to regain control of the company because of a minor flaw in the legal process which was part of the aftermath of the investigation.

At the end of the 1970's, he publicly said that he was going to be an important publisher of a daily newspaper in the UK. The first opportunity came when The Times and The Sunday Times were up for sale in 1980. However, he was not considered by the sellers to be a serious bidder, and Rupert Murdoch became the owner of these two titles. In the same year, however, he bought a 29.5% stake in the British Printing Corporation (BPC) and his shares in Pergamon Press were used as collateral. BPC was at the time one of the largest printing companies in the world, and the following year he gained complete control of the company. He announced that he was not only the elected chairman but appointed himself chief executive officer of the company. This event was the first example of the use of power in his position. Another example of his power as leader of the company was when he started to confront the powerful print unions, although he had previously stated that he was a socialist and a friend of the trade unions.

- In 1981, he asked for concessions and reduced staffing in all the printing plants belonging to BPC. After several weeks of negotiations, more or less alone against four print unions simultaneously, he succeeded and was hailed as the saviour of BPC. Most of the prepress and printing equipment was renewed, and staffing levels were closer to the standard of the rest of Europe. The same year, the company was renamed to the British Printing & Communications Corporation (BPCC).
- In 1982, Reeds International sold Odhams Printers, the largest gravure printing plant in the UK, to Maxwell. The print unions at Odhams went on strike, but Maxwell took his time with the central union leaders. As a result, Odhams was integrated into BPC, and the plant in Watford was closed. In this process more than 2 000 people were made redundant.
- In 1985, Maxwell bought the Mirror Group from Reeds International. At last, Maxwell had become the publisher of an important newspaper

on Fleet Street. He confronted the print unions of the newspaper, and after successful negotiations the paper was reorganized. In 1989, Maxwell was also the first publisher to introduce four-colour offset printing in Fleet Street.

- In 1987, he renamed BPCC to the Maxwell Communications Corporation, and although it was a public company, it was run as his own private business
- At the end of 1990's, he was also involved in the restructuring of the North American publication gravure business.

These examples show his dealings with both the corporate level in publication printing and newspaper publishing, and how to defeat and control the print unions in the UK. Maxwell showed how to use personal power and charisma. However, during 1991, Maxwell's debts grew and finally became too large, and he was obviously unable to repay his debtors. On November 5th 1991 he was found dead floating in the water off the Canary Islands, apparently having fallen overboard from his personal yacht the *Lady Ghislane*, but the cause of his death has never been fully established.

Soon afterwards, his empire collapsed and it was discovered that for several years he had illegally used pension funds to pay off debtors. In May 2001, some of the leading financial institutions and audit offices were fined for gross negligence in dealing with these matters, and about two thirds of the total embezzled money was repaid to the pension funds. In the end, he was given a state funeral in the state of Israel attended by some of the most influential leaders in the country.

Despite being considered by public opinion as a thief and a fraud, he was nevertheless a person who was, between 1980 and 1989, very much involved in the restructuring of both the publication printing and the newspaper industries in the UK and overseas. This paper shows how strong leadership in combination with absolute power can have a direct impact on the structure of a whole industry, not only in the UK but also in North America.

5.3 Paper III - Benchmarking gravure cylinders vs. web-offset plates

Benchmarking is a method which is used to compare certain industrial processes. One example is the automotive industry in Europe and Japan, where manufacturers are comparing the assembly time (in man-hours). It has been shown that the assembly time during more than a decade has been reduced by 60-70% among European car manufacturers, closing the gap to the previous superior Japanese manufacturers. A similar approach has been used in this study when comparing the cost of processing gravure cylinders and web-offset plates. Data from the ERA study from 1985/86 (Bjurstedt 1986) has been used to compare new data collected from the industry in 2005. However, in 2005, there were fewer Active Members in the ERA and some other publication printers were asked to participate to have about the same number of participants as in 1985/86.

The research questions in this paper are related to cost of the processing gravure cylinders and web-offset plates, and how the lead-times from receiving digital data from the customer to the first saleable copy can be compared between two competing printing methods. Hence, in 2005, the following research questions were formulated:

- Between 2005 and 1985/86, have the processing costs (calculated per A4 page size or m^2) of gravure cylinders increased significantly in comparison to web-offset plates?

- Is the lead-time (from receiving the data for a new job until the first accepted printed copy) significantly shorter in web-offset than in gravure?

The paper presents the technical developments in processing offset plates and gravure cylinders. With many players marketing and selling web-offset plates and CTP-solutions[20], there is a tremendous competition on the world market. Hence, most industry observers have the opinion (or belief) that producing a web-offset plate is today much less expensive and easier than processing gravure cylinders. The gravure cylinder processes are perceived to be very expensive, cumbersome to handle and carried out with an old fashioned technology.

However, modern web-offset plate technology is in fact emulating the much earlier technology developed specifically for publication gravure, going directly from the digital file to the image carrier. The big difference is that modern computer and networking technology has made the direct digital interfaces much less expensive. One of the major benefits of the digital process for gravure printers is the improved reliability of the engraving process, which means that gravure wet proofs (printed proofs from the engraved cylinders) are no longer necessary.

In order to compare the manufacturing cost of 1985 to that of 2005, a statistical analysis of a European macro-economic index (an index showing the development of the price of publishing and printing) has been done. The processing costs have decreased by almost 70% in nominal value (= no compensation for inflation) since 1985. However, it seems that these cost savings have been transferred to the print buyers, and have not improved the profitability of the publication printers.

[20] CTP - Computer-to-Plate technology

In the investigation it was shown that the relationship between the processing costs of gravure cylinders and web-offset has been improved to 2:1 from 3:1 in 1985/86. Part of the improvement is due to the fact that no wet proofs in gravure are pulled. However, the statistical scatter among those participating was quite large, particularly for the publication gravure printers.

Hence, the answer to the first research question is that the relationship between gravure cylinders and web-offset plates has improved significantly since 1985. The investigation of the lead-time for both processes reveals that they have improved significantly, but the web-offset plate processing is still faster. Hence, the second research question was answered.

An investment model is also presented in the paper comparing the processing costs of gravure cylinders and web-offset plates. This model compares the processing costs and lead-time for the same printed product size i.e. a 64 page signature (in A4) preparing a cylinder or a plate for 32 pages of A4 size. The reason for developing the model is that in the sample data from the industry, many different sizes of gravure cylinders and web-offset plats were compared, and in a more detailed investigation a 1:1 comparison would be more transparent. This model was created in cooperation with the major suppliers of processing gravure cylinders and web-offset plates. It is shown that the gravure cylinder process can be very much improved using best available technology (or best business practice) both in cost and lead-time in comparison with modern web-offset technology. That implies that many publication gravure printers could improve their competitiveness by investing in modern cylinder process equipment and automatic cylinder handling.

5.4 Paper IV - Market conditions for European publication printing – A twenty year survey 1985-2005

This paper deals with the market conditions and product specifications for publication printing in 2005 in relation to those in 1985. The objective of the paper is to determine what factors are important when the choice of a printing method is made, and to consider whether these were fundamentally different in 1985, when the production methods in the prepress area for both gravure and web-offset were mainly manual with the extensive use of graphic films. The hypothesis is that the determining factors in 1985, such as the economy of scale, the speed (lead-time) and the quality of the printing process to be chosen, were fundamentally different from those in 2005.

The Working Group of ERA (see previous section) worked out a questionnaire in 1985 which contained questions related to product sizes, paper grades for publication printing, quality assessments, lead-time for advertising materials and other questions related to heat-set web-offset and gravure printing. The questionnaire was sent to all ERA Active Members with a response rate of almost 80 % of the 22 Members. In the follow up study in 2005, the same questions as in 1985 were used in order to make the two studies comparable, with only one minor addition related to what digital format the customers prefer. This question would, of course, have been unrealistic in 1985. The methodology in 1985 took a quantitative approach and the questionnaire was distributed to the respondents, and their individual responses were later analysed. In the 2005 investigation, a qualitative approach has complemented the quantitative study, and most questionnaires have been answered during rather extensive personal interviews. In the follow-up study, the response rate was about 65% of the Active Members, but in addition some other publication printers were also participating in the study.

In 1985, the processing of advertising material was an important issue. In some countries centralized reproduction of advertising materials was the state of the art, and in those cases no distinction was made between gravure and web-offset printing despite their different colour gamut. In the major European markets, however, centrally processed materials were not used at all, forcing the advertising agencies to produce many colour duplicates of the originals and to physically distribute those to all publishers/printers involved when a particular advertisement was to be published.

The local gravure printer produced the separations needed under close control by the advertising agency. These processes were seen as a differentiation of quality between competing publishers (and printers), and were considered to be a part of the core business of their magazines. Yet other aspects were lead-times for receiving artwork, the use of preproofs[21], and particularly the extensive use of cylinder proofing and corrections due to the lack of process control of the engraving process.

In 1985, most gravure printers were handling their prepress operations in-house, whilst many web-offset printers received finished pages from their customers as screened separations ready to be stripped[22] followed by plate processing. The use of colour preproofing methods, such as Cromalin™ or Matchprint™, had made the evaluation and control of customer produced (or outsourced) pages and separations much easier than in the 1970's when only highly trained specialists using ocular control of the film separations[23] were available.

[21] Preproofs – mechanical preproofs simulating the finished printed product
[22] Planning in gravure terminology
[23]The four colours were exposed each on one sheet of continuous photographic film.

Since the beginning of the 1990's, many publication gravure printing companies have been struggling with the dramatic changes when most of their prepress operations have been taken over by the customers. Hence, the printers have been forced to dismantle their prepress operations and make staff redundant. Most web-offset printers, however, have been totally unaffected by this change and have benefited from the new digital workflow systems available on the market, because they never established any prepress operations of their own except for the processing of plates.

Today, standardized preproofing methods have become extremely important for both customers and printers. These new methods ensure that the printed copy meets the expectation of the customer, and older mechanical proofing technologies have been replaced by standard ink-jet printers. However, these ink-jet printers are driven by third party software packages developed by colour specialists, and it is reasonably simple for the customer/printer to create common preproof standards which are repeatable and consistent with the final print. The use of generic preproofing systems is one of the most important steps in creating a digital workflow where the lead times can be extremely short, some times only a few hours prior to press start.

In 1985, the answers to the questionnaire relating to typical break-even levels between gravure and web-offset in various European markets were as follows: going from the Nordic countries with about 150 000 copies, 300 000-500 000 copies in central Europe to the British market with more than 1 million. The typical run length in web-offset was said to be between 100 000– 200 000 copies in most markets, the exception being the UK with much larger runs. In 2005, however, the main perception among the publication gravure printers was that the typical run length in gravure has increased considerably and also the average number of pages in a signature.

Another determining factor in 1985 was the availability of a wider selection of paper grades suitable for gravure printing. Many members of the Working Group were of the opinion, based on discussions with their customers, that the range of available grades was too narrow in comparison with that of web-offset. The LWC sheet for gravure was felt to be flimsy, in particular when the printed product was put in a standing position at the points of sales. The opinion was that web-offset grades felt "stiffer", and there were more grades to choose among, e.g. matte surfaces. However, the SC magazine[24] grades for gravure were considered superior to the web-offset equivalent, HSWO[25], even if there were some successful web-offset publications using this paper grade in the UK and the Nordic countries. In 2005, however, there are many more grades avail-

[24] SC – super calendered
[25] HSWO – heat-set web-offset

able for the publication gravure printer and his customers (most of the larger European customers buy and deliver the volume of paper needed to the printers).

This paper shows that the determining factors that are important when choosing a printing method have not changed between 2005 and 1985. Nevertheless, technical developments since the previous study in 1985 have made heat-set web-offset more economical and the preferred method of printing for signatures up to 64 pages (in A4). Heat-set web-offset printers can today deliver an acceptable quality on the finished product, in particular on coated sheets with much shorter lead-time, more cost efficiently than the publication gravure printers. No publication printer – whether gravure or heat-set web-offset – has any prepress operations in-house, and the customer is supplying all the relevant data. The main issue for the publication printer is to handle a multitude of digital data formats, although the PDF format has gained considerable success and constitutes the majority of the data supplied. Lead-times for digital advertising materials supplied to the publication printers can be counted in hours or days rather than weeks, and there is no difference in lead-time between the methods.

These developments in both prepress and press for web-offset have put the gravure industry under pressure, and the interviews shows that the medium sized gravure concept has been forgotten. Most development effort has gone into the development of the super-wide presses, today 3.8 m or wider, whilst little efforts has been put into the lower end of the market. A new approach to defend the mid-size markets for gravure in Europe may be needed.

5.5 Paper V - Separation by Black – a new separation

This paper was written in cooperation with Emmi Enoksson. The aim of the paper was to examine the differences between UCR (Under Colour Removal) and GCR (Grey Component Replacement) by testing these separation functions in three different applications; Adobe Photoshop CS (an image editing application), Gretag Macbeth's Profile Maker 5.0 (a ICC[26] profile maker) and Heidelberg's PrintOpen 4.0.5 (a profile maker). A review of the literature pertaining to the different types of separation was compiled. The author's contribution to this paper was a historical review and literature search of the colour theories describing UCR and GCR, as well as the documentation of the first and second generation of electronic scanners.

[26] ICC profiles – a colour profile defined by the International Color Consortium

The literature search and review reveals that UCR technology was developed in North America in order to avoid severe trapping problems[27] in wet-to-wet in heat-set letterpress printing of the Time Magazine and the Life titles at the end of the 1940's[28]. UCR and GCR both substitute the black portion of the coloured inks with only black ink and hence reduce the maximum coverage of inks (the maximum allowable depends on the paper substrate used) which reduces the trapping. It was found that the original effect of UCR was almost identical to that of GCR, but for various reasons, mostly commercial, the interpretation was narrowed of UCR to only cover neutral grey tones.

Nevertheless, the original claims from 1952 did cover all CMY and black combinations, although GCR (or UCR) was almost impossible to apply with conventional photographic methods. At the end of 1970', digital scanner manufacturers suggested that commercial printers would save process inks and/or avoid trapping problems when printing with GCR applied colour separations. Hence, the concept of GCR was launched to boost the sales of electronic scanners, and in the beginning of the 1980's the sales of digital scanners took off. In publication gravure printing trapping does not occur, because every ink layer is dried before the next one is printed on top. Hence, UCR/GCR was not found necessary to use, and in addition gravure print customers often preferred heavy coloured pages.

The conclusion of the investigation suggests two alternative proposals:

- Discard the term UCR and use only GCR, as it really only concerns gray component replacement. This would make it easier for people in the business to focus on the process itself instead of trying to understand the difference between the two types of separations, a difference which actually cannot be seen visually in reality.
- Discard both terms and introduce a new term CB (Compensation by Black). The software should give the user the possibility of choosing how much black will be used and where it will replace the use of a combination of the CMY process colours. In addition, a single term would make the user more aware of the problems of the separations and how these will affect the printed result.

The traditional definitions have confused many operators in the prepress industry. Thus, it is strongly recommended that the term, CB (Compensation by

[27] Trapping – the acceptance behaviour of the ink in wet-on-wet overprinting of several inks. The maximum ink coverage allowed in four colour printing (the norm in heat-set web-offset about 280-290%)
[28] The first drum scanner was invented by Time-Life Corporation in the end of the 1940's

Black) should be implemented. The recommendations also imply an extensive review of accepted terms and abbreviations within the graphic arts industry with the aim of giving them a uniform scientific meaning and definition.

The GCR concept, although considered a commercial term, has been important for the development of high speed heat-set web-offset printing during the 1980's. Not only is the consumption of the coloured inks lower, but it also solves the trapping problems connected with wet-on-wet printing. The trapping problems also increase with higher speeds and without UCR/GCR, the development of web-offset (whether cold-set or heat-set) would have been severely affected. Before the desk top revolution in the beginning of the 1990's, these manipulations were done by specialists in the prepress departments. Since the beginning of the 2000's, many publication printers have, however, invested in software packages applying UCR/GCR prior to the output (on offset plates or gravure cylinder). To save the more expensive coloured inks, the publication gravure printers also use these technologies.

5.6 Paper VI - Break-even analyses – Gravure vs. Web-offset. A new approach!

Paper VI compares the break-even levels between gravure and web-offset from the study in 1985 with the follow up from 2005/2006. The aim was to determine the change in break-even level between gravure and web-offset printing, and the research questions were defined as:

- Is it possible, printing a signature of 64 pages, to achieve a break-even level below 350 000 copies?
- Is it possible that print quality in gravure using SC grades is perceived by the market as equal to that of heat-set web-offset using LWC grades?

Earlier investigations – such as that in Paper IV – did not distinguish between different sizes of signatures but described only more general data and/or opinions. In 1985, however, for the first time an investigation was made which calculated the break-even levels based on real data obtained from the industry using different sizes of signatures, e.g. in 32, 48, 64 and 96 pages. The A4 page size was used which was considered to be the worst case for gravure, because A4 is the standard fixed cut-off in web-offset, whereas gravure presses can handle many different product formats.

In 1985, the contemporary gravure presses were capable of printing signatures of 64[29] and 96[30] pages in full colour printing on one web. Most heat-set web-offset

[29] 64 pages – four page around the printing cylinder and a web of 2.40-2.45 m
[30] 96 pages – six pages around the printing cylinder and a web as above

presses, however, were limited to 16 or 32 pages, in long grain configuration (= portrait size). The investigation included in depth interviews with the participants in the ERA Working Group (page 5), and data of the printing costs of all these signatures were investigated and given to the author under a non-disclosure agreement.

During 2005/2006, new data was collected from a number of printers – both gravure and web-offset printers – using the same kind of investigation as in 1985-86. The only change in comparison with 1985 is that no wet proofs[31] in gravure are included (gravure wet proofs are no longer necessary in the European markets). A similar non-disclosure agreement as in 1985 has been used to secure that confidential data is kept undisclosed, and it is not possible to identify any single printer.

The investigation in 1985 showed that commercial web-offset printing was very competitive when printing smaller signatures with 16 or 32 pages, but gravure printing became competitive from 48 page signatures (and larger). Manufacturing costs in the bindery for gathering of smaller signatures in web-offset were never considered. Further, it could be shown that gravure printers which were engraving cylinders directly from digital data (and did not proof the gravure cylinders) were competitive even on a 32 page signature. Consistent with this acquired knowledge, some gravure printers subsequently pioneered the new digital technology, and they were the first to benefit from the use of direct digital interfaces. By doing so they eliminated the use of graphic film, and this greatly reduced costs, improved the quality of the final printed product and shortened the lead times. Within a decade, almost all gravure cylinders were produced digitally.

The results in the follow-up show that a break-even level below 350 000 copies is only possible when printing a signature of 96 pages (in a standard A4) or higher. This is quite a significant change in competitiveness between gravure and web-offset compared with 1985/86, when 48 pages was sufficient.

The second research questions related to gravure print quality on SC grades in comparison to LWC in heat-set web-offset printing. The perception that the print quality in gravure using SC grades is at least equal to that of web-offset using LWC grades was supported by 2/3 of the respondents (the remaining were undecided). In addition, there were complaints about waviness (longitudinal waves) of LWC grades in web-offset, but earlier print defects in publication gravure

[31] Wet proofs in gravure – the gravure cylinder are mounted into a special gravure proofing press and a four colour print is pulled. This was standard procedure in the gravure industry until the middle of the 1990’s.

printing, such as missing dots, are seldom seen today due to improvements in paper surfaces, gravure inks and new ESA[32] technology.

Why and how did the heat-set web-offset printers become more cost-efficient than the publication gravure printers? There are a number of explanations and technical developments behind this fundamental change, and some of them are analyzed in this paper. The extremely fast progress of digital technology in the 1990's had a great impact on the printing industry, particularly in web-offset, and there was an urgent need for a new process technology for exposing the offset plate directly from digital data, the Computer to Plate – CTP - technology. This technology became technically and commercially available at the end of the 1990's. Simultaneously, new digital workflow techniques were introduced, all based on the PDF technology (a subset of Postscript), which allowed improved control and transparency in the prepress process. These new techniques led to a dramatic change from the way in which the industry had previously worked, and the customer gained control of the work flow.

In the beginning of the 1990's, some press manufacturers started to redesign their heat-set web-offset presses. Within a few years a completely new breed of commercial presses was presented to the publication printing markets, and not only the traditional 16-32 pages (in short grain and long grain), but also larger and wider presses capable of printing 48-64 pages in a single web. Not only was the increase in the number of pages important but there was also a significant leap in web speed. Automation of plate mounting and other press variables led to a sharp increase in productivity and print quality. Web speed and productivity in web-offset became close to or in some instances even higher than that in gravure printing.

During Drupa[33] 2004, a series of in-depth interviews were conducted with some top managers selected among the most important suppliers of prepress, plate and engraving processing equipment and press manufacturers in the industry. (Web-offset technology was seen almost everywhere at the exhibition and made a strong impact on most visitors.)

Since the year 2000, very few gravure presses have been installed with a web width narrower than 3.60 m (Section 2). Those presses are capable of producing signatures with 50% more pages (96 to 144 pages) than 20 years ago with a productivity increase of close to 100%. The investment for such a gravure press is about € 16-18 million, and any gravure printer contemplating such an investment

[32] ESA (Electro-Static-Assist) – a static charge is applied between the gravure cylinder and the paper web which improves the ink transfer from the gravure cells

[33] Drupa – Druck und Papier - the largest exhibition of the graphic arts and allied industries, held every four years in Düsseldorf, Germany

needs quite a good control of his markets. The web-offset printer has, however, the choice of installing new capacity in 16 page increments, which might be less risky.

The notion that publication gravure print quality on SC grades is perceived by the market to be at least as good as that on heat-set web-offset is very important for the publication gravure printers. This means that smaller publication gravure printers may still survive, although that they, in particular in the smaller European markets, are running rather aging presses and ancillary equipment. They are supposedly waiting for more efficient and less costly cylinder engraving methods and are abiding their time.

In the 1985/86 study, a study was done by the ERA Working Group on the PONY concept (*A PONY press is a press consisting of only four units, where half of the cylinder width is used to print the recto side, then turning the web to go back to print the verso on the other half of the cylinder- cited from the 1986 report*). Similarly, in the follow-up study the PONY or the Double Ender[34] (DE) concept, using modern press control technologies, has been assessed. The investigation shows that the Double Ender compared with a 32 page heat-set web-offset can achieve a break-even below 110 000 copies for a 32 page signature (A4 sized) using the same paper grade.

5.7 Paper VII – Is there a future for the European publication printing industry? A study of the European publishing markets and the effects of important techno-economical factors 2007-2010

This paper is an investigation of the European publication printing markets, and how these may change in the next few years. The research targets are the European customers and suppliers to the publication printing industry. In this study, a survey technique has been used, and a large group of companies and/or executives has been surveyed collecting in-depth information.

What effects do the techno-economical constraints have on the future developments of the European publication printing industry? The hypothesis is that due to changes in advertising spending and consumer behaviour, the conditions for the European publishers and catalogue producers will be influenced. This in turn will affect the publication printers and further adaptation, and a very flexible attitude is needed from their side. The market conditions for publication printers would be significantly changed. This investigation will determine whether this hypothesis is supported or falsified.

[34] The press manufacturers prefer to call it Double Ender (DE for short) rather than PONY

The present and future conditions on the market for publication printers are discussed in this paper. The findings indicate that those publication printers working in the segment of catalogue printing will find that the market is becoming increasingly difficult. Many of the major catalogue producers are changing their marketing focus from catalogue to e-commerce, which means that the era of very thick catalogues will probably be replaced by thinner products issued more frequently. The total volume of print may nevertheless be reduced. Information provided over the Internet and e-commerce is a recent phenomenon, which has been growing since the beginning of the 2000's.

The growth of advertising revenues on the Internet is very fast; albeit starting from comparative low levels, but in the 2010's the traditional print media – magazine, inserts and newspapers publishers - may be challenged. Some mail order catalogue companies claim that their volume of sales using e-commerce is now larger than that of the traditional telephone or mail sales channels. Fast moving consumer goods marketed by traditional mail order companies are channelled through e-commerce rather than through the catalogue. This will undoubtedly challenge the traditional catalogue printers, and will put the flexibility and adaptation of those printers who are in this business to the test. The attitudes of the customer's customer are of vital importance for the publication printing industry.

The notion that, due to changes in the media markets, the conditions for the European publishers and catalogue producer will change is supported by the results of this study. This will of course also affect the publication printers and, for their survival in a very competitive market, further adaptations and a very flexible attitude are mandatory. In terms of strategy, the publication printer needs to be both a cost leader and differentiated on the market. The major differentiation will most probably be in the value added services which are marketed and promoted to the customers. One example might be an intensified environmental effort with increased pressure for new "green" products from both ink and paper makers, such as finding substitutes for the present use of aromatic solvents in publication gravure printing.

Will new and emerging technologies, in new press designs and in cylinder/plate processing, be factors which aid the short-term survival of the publication printing industry? Since 2000, many new presses – both in gravure and commercial web-offset – have been installed, and the latest generation of publication presses is running wider webs and with higher speed. They need less staffing and allow very fast make-ready, and improved up-times due to new and improved press controls. This in turn means that the additional, aggregate net production capacity is very large and will not easily be absorbed if the future growth of the publishing market is limited. The responses from the manufacturers indicate that, although it would be possible to design and install even wider presses in the future, there are other concerns which are more important. In order to be more efficient and productive, the printer will demand much higher up-time in the press room processes and, last but not least, the demand for ever more rapid change-overs to new jobs will probably increase. This is, of course, important if the circulations and/or versioning of magazines and catalogues leads to very frequent changes of pages and/or complete new jobs.

The technical and financial constraints lie, implicitly, in that it is not possible to retrofit these new features into existing installations. The publication gravure printers have always been proud of using ageing presses, slow and not very productive, rather than investing in more efficient presses. The technological developments in this segment have been rather slow and targeted to wider and wider gravure presses. The web-offset printers, however, seem to have a more flexible attitude and the existing presses are more frequently changed to more modern and efficient units.

Since 2000, direct laser engraving technology has been very successful in the packaging and speciality gravure markets, but it still has a limited success in the publication gravure markets. The constraints are basically in the perception and attitudes towards using another material (zinc rather than copper as image carrier) rather than the laser technology itself. It is to be expected, however, that, with the ever-increasing pressure from the customers for lower costs of cylinders and shorter turn-around, these demands will undoubtedly be important factors in changing the attitudes of some of the more conservative printers.

Those printers working in the magazine and catalogue markets will also see major challenges in the near future. Despite the fact that publishers and/or catalogue producers are increasing the number of titles, the total print volume is not expected to increase. Hence, all publication gravure printers need:

- To change their attitudes and accept new technology in cylinder processing
- To find new financial means to change their existing presses to the state of art technology.
- To improve the perception among customers of an environment-friendly process
- To realize that conservation of energy is a must for future competitiveness in relation to electronic media

Removing these techno-economical constraints will be one of the most important areas for the future survival of gravure printing. All the changes in the conditions of the markets will put the flexibility and adaptation of those printers who are in this business under pressure.

Anders Bjurstedt, Royal Institute of Technology, Sweden

Are we witnessing a new paradigm shift in the technology of producing magazines or catalogues, moving *"from a structure of skilled craftsmanship to an industrial process"*? A process reengineering – how to integrate plate processing or cylinder engraving (incl. chrome plating/finishing) with an automated make-ready process into an automated press run – needs to be investigated, and the necessary technologies developed. The aim of this process is to produce a first saleable copy without manual intervention – faster than today and with less waste, which undoubtedly serves the publication printer's customers well in the future!

Anders Bjurstedt, Royal Institute of Technology, Sweden

6. Restructuring of the European publication printing industry 1985-2006

6.1 Introduction

Already in the mid-1970's, many European publishers began to reconsider the integrated publishing/printing works model, and found it to be obsolete (Paper I and III). That the ownership of a printing plant was no longer to be considered a part of the core business of the publisher was later suggested by both Jaspert (1998) and Ertesvåg et al. (1998). In 2006, there are very few remaining integrated publishers and printers in Europe – e.g. Burda Medien and Bauer Verlag in Germany, Mondadori Editori in Italy, Egmont Magasiner and Aller Press in Denmark - but it should be noted that all the production facilities of those companies are separate legal identities. It would be rather easy to divest them if need be.

It has been shown that since 1987 the number of publication gravure plants (and printers) has been almost halved (Section 2, Table 2.2). On the other hand, the number of commercial web-offset printers has slightly decreased in West Europe (Section 2, Table 2.3), although large installations are now to be found in Spain, Poland and Czech Republic. The average production capacity has, however, trebled, which means that most installations have been modernized with larger presses.

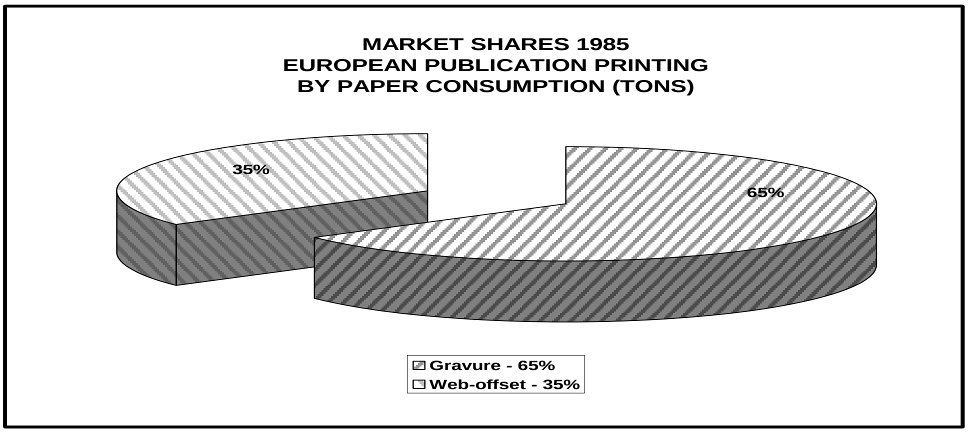
6.2 Market size and volume growth 1985-2006

In Paper VII it is estimated that the total consumption of publication printing paper in Europe was about 6.7 million tons of paper in 1985. In 2005, the consumption was estimated to be 13 million tons of paper. MF[35] grades are expected to have a rapid future growth, because many print buyers may wish to downgrade their paper grades for economic reasons (Paper VII).

The achievable print quality on MF grades is acceptable for some products (Scott 2006 and Hohol 2006), but adaptive actions in both gradations and ink manufacturing (special extender) are needed (Müller-Starke 2007). It is not possible to achieve a similar quality using heat-set web-offset. The relative market shares for gravure and web-offset in 1985 are shown in Paper VII – Figure 6.1.

[35] MF paper grades – machine finished – calendered in the paper machine

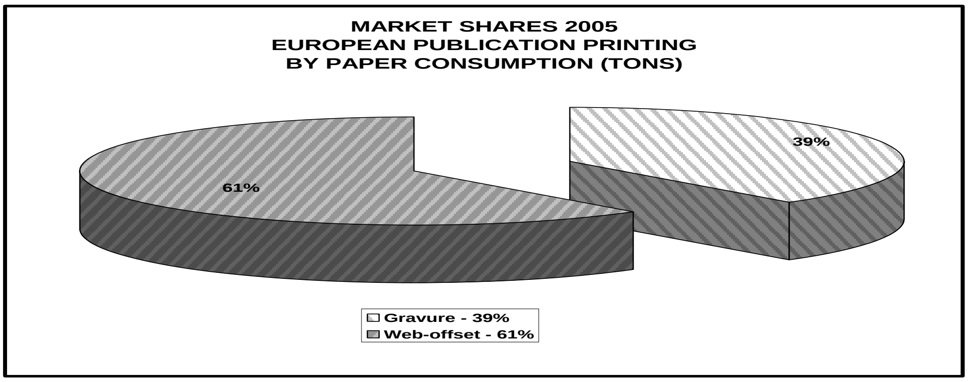
Figure 6.1 – Estimated market share in 1985



Source: Paper VII

In Paper VII, the corresponding figures for 2005 are shown in Figure 6.2. When calculating the relative market shares for the two publications printing methods, there is another point to consider, the printed surface area. It has been suggested by Birkenshaw and Smyth (2001) that the average grammage, particularly in gravure, has decreased, maybe by 5-10%, since 1985

Figure 6.2 – Estimated market share in 2005



Source: Paper VII

The reason is the rising costs of postage and transportation, hence the quest for lower grammage from publishers and print buyers (Paper VII). In another survey (Birkenshaw and Hart 2000), it was claimed that gravure, because of the erosion of market prices, has lost substantial market shares during the last decade. These two investigations claim that the segment for larger publications has had a dis-proportional high decrease in manufacturing costs (less expensive paper grades

and lower printing costs) which has influenced the publication gravure printers much more than the heat-set web-offset printers.
Hence, Paper VII shows that the growth of the publication gravure market has been about 20% since 1985, which is in strong contrast to the situation for commercial web-offset printing which has grown by about 200% during the same period of time. The annual growth of gravure has been very small; about 1% since 1985. Web-offset printing, on the other hand, has enjoyed a growth rate of 4.5% annually.

6.3 Changes due to technological developments in prepress

In this context, it must be mentioned that the introduction of new technology in the editorial departments has lowered the technological and financial barrier to establish new titles and/or produce more editorial pages, as was observed by Birkenshaw and Hart (2001). This development has had a profound impact on both the magazine publishing market and the printing market. The real breakthrough came with the advent of desk-top publishing in the early 1990’ using PostScript and affordable software packages such as Adobe Photoshop, Aldus PageMaker and Quark Xpress (Paper I). These programmes have made the prepress operations of handling pages in magazines, newspapers or general printed matter almost a commodity task, moving not only the control but also the execution of prepress operations from the printers to the publishers and print buyers (Jaspert 1994, Mandel et al. 1994 and Mills-Davis 1998). These events may not look very dramatic on the surface, but in reality they have caused the previously strong bonds between printer and print buyer/publisher to disappear.

Bruno (1991, p.17) explains that the investments in a proprietary stand-alone colour workstation in 1990/1991 was of the order of US $ 335 000, including the output and a simple proofing device. Today, the market price for a powerful standard personal computer including a colour display and the necessary software (e.g. Quark Express/ InDesign/Photoshop) is less than US $ 10 000. Hence, investing in an advanced work station for colour page manipulation and processing in 1984 would have been about 30-40 times the present level, but more importantly; the present processing power is now 10-20 times greater. In 1984, the printer needed to send away his personnel for several weeks of training before they could work with these devices. The training time has been reduced significantly, because the new programmes are more user-friendly and intuitive. No proofing device is needed, however, because the entire workflow is digital (Bastien 2002). Hence, the total cost of ownership for producing a colour magazine page has been significantly reduced.

6.4 Investments in new print capacity

In Section 2 it was shown that since 2000 the capital investment in new press capacity has been substantial, and that web-offset press manufacturers have enjoyed 75- 80% market share during recent years. Further statistics from Puri (2003) suggest that the capital investments in lithographic[36] technology sheet-fed offset, newspaper and heat-set web-offset presses) amount to 80%, and another 10% to flexographic printing presses, of the total investments of printing equipment on a global basis.

Hence, it can be deduced that capital investment in new gravure press capacity has been less than 10% of the total investment in new press capacity. The main emphasis in future developments in gravure – cylinder processing and press design – should concentrate on regaining the market shares in the low and mid-size markets, because it is in these markets that the real future growth will be found. The time of the large multi-million publications has probably gone for ever, even though there are some exceptions (Paper VII).

Although recent investments in new gravure plants in the UK (Prinovis, Liverpool and Polestar, Sheffield), Poland (Bauer Druck Polen - BDN), Italy (Eurogravure in Treviliglio) and Germany (Burda Medien) are large, these can be regarded as an exception to the rule of the last 20 years. In addition, a few gravure plants have been rebuilt in connection with a renewal of the press capacity.

In the Nordic countries, Austria and Switzerland there have been no further investments in new gravure technology since 1990 (ERA List of Presses 2005) (except for two second-hand presses in Finland). The reason, why no investments in these smaller markets can be found, is most probably that the capacity step of a new modern gravure press exceeds the potential demand. There are further discussions on this subject in Section 7.

6.5 Consolidation of the publication gravure industry and demands for future development

Consolidation of a fragmented industry comprising a large number of small and medium sized companies, usually underperforming in relation to other industry segments, has been seen by financial institutions and industrial organizations as a way of improving the competitiveness of this industry (Ernst & Young 2007) and suggested by Mockett (2007). Mockett also states that the European publi-

[36] Lithography – non-printing areas are made hydrophilic by wetting; printed areas hydrophobic and accepting ink

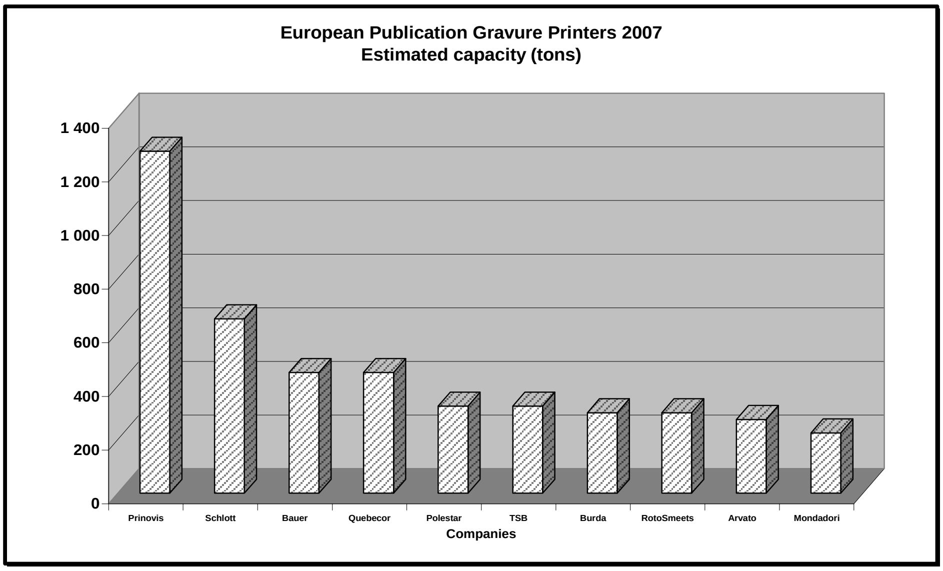
cation gravure industry is quite consolidated in comparison the commercial web-offset industry (see also Tables 2.2 and 2.3 in Section 2).

The total European publication market today is about three times the gravure market (Section 2); hence the fragmentation is large with many smaller printers, particularly in the heat-set web-offset industry. Yet, the consolidation in publication gravure has taken another step forward during the autumn of 2006.

The German Schlott-Gruppe announced on the 10th of October 2006 that they had acquired the Dutch publication gravure company Biegelaar BV, the second largest publication gravure printer in the country (Schlott Gruppe 2006). The Polestar Group announced on December 12th, 2006 (Polestar 2006) that the company had received unanimous support for the recapitalization and restructuring of the business. The former major owner, InvestCorp, has to write off its receivables of the order of £ 500 million, and the ownership will be transferred to the preferred lenders. In addition, the new owners will provide the company with a working capital of £ 40 million. In the German trade press (Deutscher Drucker 2006), this event was commented on by suggesting that "*The bride is dressed for a new marriage*!"

The structure of the European gravure publication gravure industry in 2007 is shown in Figure 6.3, and data from the ERA List of Presses have been used in combination with information on announced mergers and added press capacity.

Figure 6.3 –Estimated capacity of the major European publication gravure printers



Source: ERA List of Presses 2005/Update 2006

The estimated capacity of the 10 largest companies constitutes about 75-80% of the total European publication gravure capacity (ERA List of Presses 2005). It should be noted, however, that most of the acquisitions in Germany and, indeed, also in Europe, have been made during the last 10 years. Ten years ago, the three largest companies, Prinovis, the Schlott Group and Quebecor World Europe, were groups that had not yet been founded, and no company had more than about 200 000 -300 000 tons of capacity. The industry was fragmented, and it is estimated that the 10 largest companies had less than 45-50% of the market (ERA List of Presses 1995). It is also to be expected that further acquisitions in the gravure industry will occur, adding to the consolidation process as pointed out by Rose (2007).

6.6 Print buyers and magazine publishers – the most important customers

6.6.1 Magazine publishers

The magazine printing business is by far the largest customer segment for the European publication printers, and the paper volume is about 6 million tons and twice that of catalogue printing (Paper VII). Hence, the performance of this sector is of the utmost importance for the future of publication printing. There are a few very large publishers/print buyers in this media business, and according to FIPP (Federation International de Presse Periodique – the International Federation of Magazine Publishers) the consolidation process in the Media and Information segments has regained its former level (FIPP 2006).

Paper VII shows that the publishers are dependent on advertising revenues, which are between 35-50% of the total revenues (depending on the type of magazine). The printed product is still considered to be the core business, but leveraging their brands of well-known titles across a suite of media, including the internet (website and email), newsletters, special interest magazines, books, videos etc. is adding to their area of commercial interests; hence, the printed magazine is becoming relatively less important in relation to other sources of revenue (Paper VII). Reduced time to market will increase in importance, and this will add to the pressure to decrease the lead-time from the time when the digital files are supplied until the products are available for sale at the retailer (Birkenshaw and Hart 2000). The advantage for the printer, however, is that the production process repeats itself at regular intervals. This makes a tight integration between customer/printer both necessary and possible. Nevertheless, these conditions will put both papermakers and printers under pressure. How a gravure printer may handle shorter and fragmented runs is discussed in Section 7. The very wide gravure presses may not be flexible enough for such conditions.

6.6.1 Catalogue producers

The second largest customer segment in publication printing is the catalogue buyers, the mail-order companies (renamed to Remote Distance Sellers) and other catalogue producers. In Paper VII it is shown that this segment has a projected paper consumption of 2.9-3.0 million tons of paper in 2006. There are about 2 000 companies in this segment in Europe according to EMOTA (the European Distance Selling Trade Organisation). The consolidation process has been very strong during the 1990's (Paper VII), and further consolidations are expected. There are many specialist and smaller niche mail-order companies, which are of interest as complements to the larger chains.

The strategic issues for these companies are very much the same as those for the magazine publishers. Since the 2000's, the internet has become an important business driver, and some producers have already announced that they will reduce their catalogue volumes during the next few years (Paper VII). Others claim, on the other hand, that the internet is a new sales channel complementing the more traditional channels such as taking orders by telephone and/or regular mail. These new market conditions will put both paper-makers and printers under pressure.

Some companies, like IKEA and Argos in the UK, use the catalogue as a vehicle for pulling the customers into their stores and/or shops. Representatives of these companies say that there will also be many smaller and specialised catalogues and other periodical and magazine-like products, such as the IKEA Family monthly (Ibid.). For both these companies, telephone sales and/or sales by the net still account for very small volumes (Ibid.).

With shorter runs and more fragmented volumes, the present gravure technology may not be sufficiently fast and flexible for these market conditions.

6.7 Suppliers to the publication printing industry

6.7.1 Prepress equipment supplying companies

Since the beginning of the year 2000, there have been some major changes in the prepress equipment market and in particular for those suppliers to the lithographic printing markets. There are only three global companies offering a total business concept; selling equipment, software and materials for the lithographic printing industry, Kodak, Agfa and Fuji Film. Smaller competitors have been acquired during the last few years, consolidating the total business (Paper VII). Agfa-Gevaert announced (Agfa 2007) the intention to break up the group into three independent public companies at the end of 2007. Agfa Graphics is the working name of the new company. Similarly, Kodak has announced the sale of its Health division which means that Kodak will have two major businesses, Kodak Graphic Communications and Kodak Consumer Products (Kodak 2007).

If there are three major players in the lithographic prepress market, there are only two in gravure prepress - engraving, plating and cylinder logistics equipment – Dätwyler AG in Switzerland and the Max Ried group (Paper II and VII).

It should be mentioned here that workflow solutions offered in the prepress markets are based on technologies developed by Adobe Inc. Both the PDF and the JDF technologies have been licensed to third parties by Adobe which enjoys a near monopoly situation in this market (Paper I). Hence, the prepress market is dominated by North American companies, albeit with one exception, gravure cylinder processing equipment (Paper VII) where there are only European companies.

6.7.2 Paper manufacturers

Since the beginning of the 1990's, the consolidation process among the paper manufacturers has been driven forward by the Finnish forest products industry and to some degree by the Swedes. This process seems to have started when Finnpap (the marketing and sales organization for the Finnish paper and forest industries) disintegrated in 1996.

UPM/Kymmene announced that they would merge the remaining Finnpap sales and marketing organization into their own (Paper VII). In 1998, the companies in Figure 6.4 were active on the publication printing market with a total capacity of close to 11 million tons (Jallinoja 1998).

Almost 10 years later, the publication printing segments (wood-containing paper grades except newsprint and directory grades), are dominated by the companies in the European markets (Paper VII) listed in Figure 6.5.

The total capacity is estimated to about 15 million tons in 2006/2007 (Table 8), although the demand is estimated to 14 million tons (Hohol 2005). The companies are fewer and have grown larger since 1998, and the process of consolidation in the industry is visible in these tables. The following mergers and acquisitions have taken place since 1990.

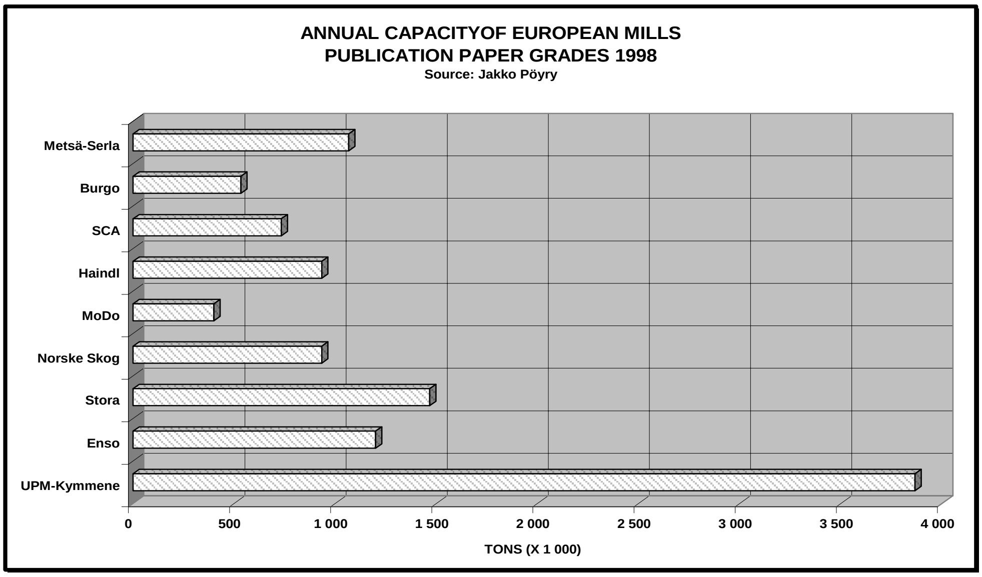
- UPM-Kymmene Oyj, Finland. In 1996 the merger of Repola Oy (main owner of United Paper Mills) and Kymmene created the identity. In 2001, Haindl was acquired, but later the publication paper part was sold to Norske Skog

- Stora Enso Oyj of Sweden/Finland. In 1990 Stora acquired Feldmühle AG, and in 1998 Stora and Enso Oy merged. During recent years, the company has disinvested business not belonging to its core.
- Myllykoski Oy, Finland. Since 1987, there have been many acquisitions of German paper mills (Albruck in 1990, M-D Mills in Dachau and Plattling in 1996. A new SC machine is about to be erected in Plattling with a capacity of 0.5 million tons. The start-up is planned for 2008.
- Burgo, Italy. In 2007, the Burgo Group will be created; a merger of Burgo and Cartiere Marchi creating a capacity in coated grades of 2.4 million tons
- M-Real Corporation (previously Metsä-Serla), Finland. Metsä-Serla acquired Modo Paper in 2000 and Zanders Feinpapiere AG in 2001. Metsä-Serla changed its name to M-real Corporation in 2001. The capacity is mainly for heat-set web-offset.
- Norske Skog, Norway. Bought the Walsum Mill from UPM in 2001.

- SCA, Sweden. The company owns mills in Sweden and Austria. The board of directors announced that they have shelved the projected enlargement with another publication paper machine in Sweden due to increasing costs of energy (SCA 2006).

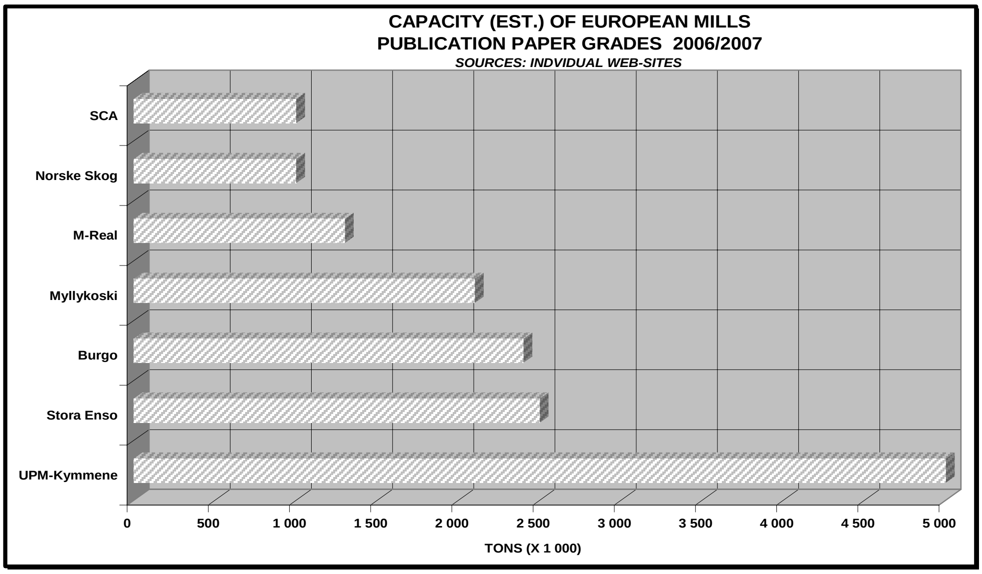
The information about mergers and acquisitions etc. has been obtained from the relevant web pages for each company involved and from EMOC (Anon. 2003).

Figure 6.4 – Annual capacity of publication paper grades in 1998



Source: Jallinoja 1998

Figure 6.5 – Estimated capacity of publication paper grades in 2006

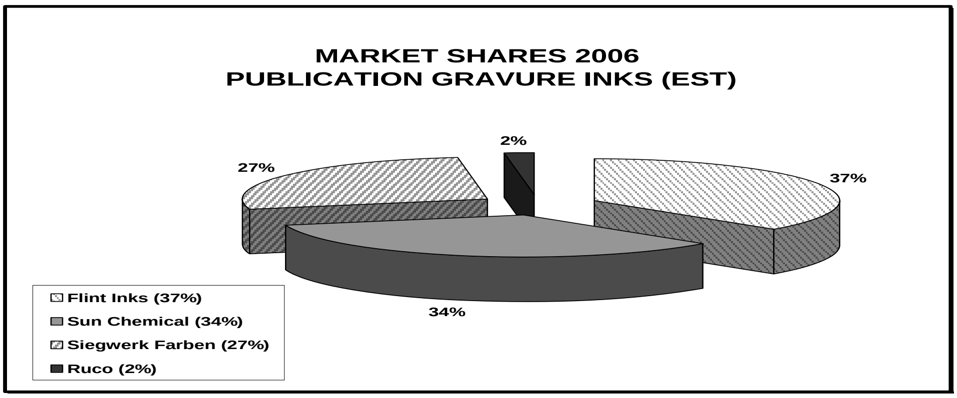


Sources: Paper VII

6.7.3 Ink makers

In the middle of the 1980’s, a number of publication gravure printers were producing their own inks in Germany, France, the Netherlands, Denmark and Italy (ERA 1986). With increasing demands for new product developments to increase print quality and with new legislation for environment, health and safety, the smaller in-house gravure ink plants were sold to the established ink makers in the beginning of the 1990’s, Figure 6.6.

Figure 6.6 – Estimated market of publication gravure inks in 2006



Source: Paper VII

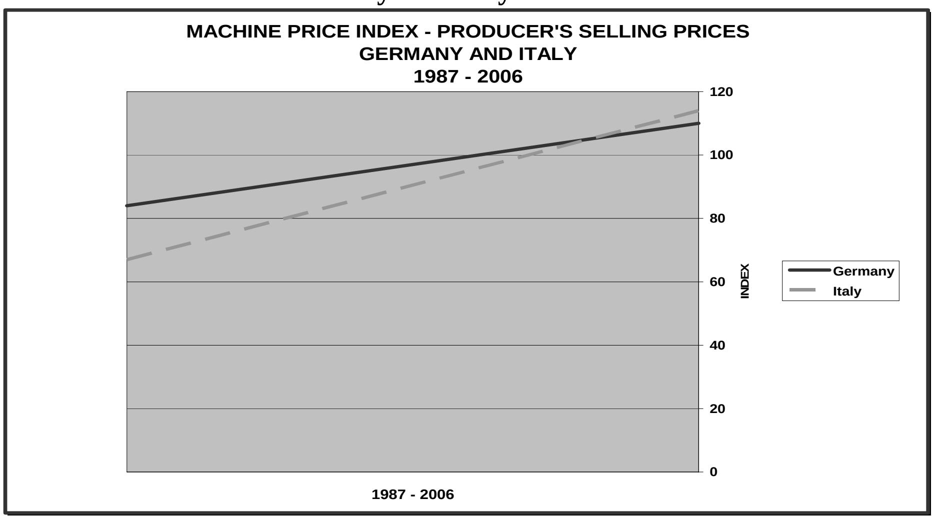
There are considerable advantages in being a large company with regard to research and development, and the consolidation process has meant to that in 2006 the large suppliers of publication gravure inks are only three.

The ink industry is very concentrated and large in comparison with most of its customers in the publication industry, but it is, nevertheless, small in comparison with the paper industry (Paper VII).

6.7.4 Press manufacturers

There are only two competing manufacturers in the publication gravure printing press business, Koenig & Bauer in Germany (KBA), including the Albert Frankenthal gravure press division, and Officine Meccaniche Giovanni Cerutti SpA (Cerutti) in Italy. During the last 20 years, these two companies have had almost equal shares of the publication press market, but in the last two years – with the development of the very wide gravure presses (4.32m) – KBA has gained a slight advantage (Paper VII). According to the statistical agency of EU – Eurostat – the producer price for machinery indicates how the prices of printing machinery have evolved between 1987 and 2007. In 1987, the price level was low in Italy whilst in the same year the price in Germany was approximately 27% higher. In 2006, however, the German index was lower which indicates that the German press manufacturers have been able to keep a lower relative price level than the Italians, Figure 6.7.

Figure 6.7 – Machine producer's selling price index Germany and Italy - 1987-2006



Source: Eurostat 2007

It is obvious that the printing press manufacturers have been able to adjust their selling prices to the inflation and level the prices since 1987, which is in contrast to the paper and ink manufacturers (Paper V) who have had an almost flat price development during the same period of time. In addition, the printing presses have been greatly developed and in paper VI it is shown that the potential productivity has been increased by more pages printed on wider webs and at much higher printing speeds (> 100 %) than those in 1987. Further, automation of loading/unloading of plates and cylinders has considerably shortened the make ready process and has made it possible to reduce the staffing of the presses. All these efforts have made it possible to increase the up time in the press room.

6.8 Restructuring of the industry – a summary

There have been many changes in the European publication printing industry during the last two decades due to consolidation and technological changes. These changes have made it possible for publishers to dramatically reduce the entry barrier for new titles and editions, but more importantly, to change the previous customer/print buyer relationship to the printing industry. What are then demands on the publication printer?

Quality is no longer a technical issue, as print quality can be regarded as a commodity or as a relative factor only assessed and/or perceived by the customer. What does count, however, is consistency in folding and colour register, and of course a competitive price level. What the customer accepts is good enough quality. The smaller colour gamut (ISO 12467-4) achievable in web-offset does not worry most of the print buyers, only the professional gravure printer. The following demands on the publication printer were proposed by Birkenshaw and Smyth (2001):

- Being able to handle run length reductions
- Timescale reductions
- Cost reduction
- Attention to environmental issues

Other ideas have been voiced by Lucas (2006) suggesting that the customer of today wants:

- Shorter runs
- Versioning (the same edition is split into smaller separate parts)
- Cost reductions

A sustainable strategy for a publication printer must take these demands seriously and incorporate them into his business. In Section 7, a strategy for sustainable competitive advantage will be discussed.

Levitt (1960) suggests that publication gravure printers have suffered from marketing myopia. He claims that companies, or even sometimes a whole industry segment, can suffer from marketing myopia in the sense that that they do not understand what market they are working in. His classic example was the US railway companies which lost the battle for travellers in the middle of the 1950's in the US to the emerging air transportation industry. The railway industry thought they were in the railway business, instead of realising that they were really in the transport business.

In this case, one may suggest that publication gravure printers are not in the publication printing business; but that they are in the media and communication business. The industry has to make sure that it is competitive in this particular business by not giving away some of the most obvious assets such as format flexibility, print quality and speed. It should be noted, however, that there are some examples where gravure printers decide to invest in complementary web-offset capacity in order not to lose their relative market share and/or important customers. Major gravure publication companies in the Netherlands, Germany, France, Italy and the UK are among those. However, more frequently publication gravure companies in the smaller European markets have switched to web-offset and closed their gravure capacities. This has been very obvious in the Nordic countries, Switzerland and Belgium. There may be alternative strategies, which will be further exploited in Section 7.

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7. Competitive Strategies in the publication printing industry

7.1 Bargaining power of the print buyer – publishers and other buyers

Bargaining power is one the fundamental issues in the sustainable competitive strategies formulated by Porter (1998). Of utmost importance for the publication printing industry is the balance of power between customers and suppliers, in this case the publication printers. This opinion is also emphasized in an earlier magazine article by Porter (1996, p.62).

It could be assumed that the steady growth of magazine titles and published volume might create a balance on the market, but recent interviews with executives from the industry indicate that this is not the case (Paper VII). Notwithstanding, since the middle of the 1990's, the bargaining power of the print buyer has been strengthened for many various reasons, as described in Papers IV, VI and VII:

- The separation of certain publishers from their production facilities
- Excess capacity both in publication gravure and in the heat-set web-offset sector (the segment of 64-80 pages web-offset presses)
- Techno-economic factors, such as the total digitalisation of the prepress work flow
- Control of the production work flow – from print buyer to prepress and beyond
- The convergence of the prepress, plate and cylinder processing technologies, which makes it easier for the buyer to change supplier at will

The bargaining power of the customer has led to a buyer's market, which will not change in the short and medium terms, unless a consolidation process followed by a reduction of capacity of a magnitude not before seen in the publication printing industry were to take place. Hence, a shortage of supply would be created even though, since 1986, the volume of publication printing has more than doubled (Paper VII).

The buyers are controlling the entire creative process where in former times the printer had the advantage of giving advice on layout, typography and the selection of images to be printed and published. Sometimes the printer used these competences to create a strong bond between the client and the supplier. Most of the larger customers now have their facilities in house and do not have to rely on the suppliers in this respect (Bormans 2002).

7.2 Bargaining power of the supplier – papermakers, ink and machine manufacturers

The bargaining power of the suppliers of paper, ink and equipment seems not to have improved despite the consolidation processes that have been apparent among those companies (Section 6). In Paper VI, the cost of materials in the break-even analyses is given, Table 7.1.

Table 7.1 – Relative cost of materials

Cost of materials (paper/ink) – relative costs index	1986	2006
Web-offset 64 pages – A4 format – 350 000 copies	78	54
Gravure 64 pages – A4 format – 350 000 copies	68	54

Source: Paper VI

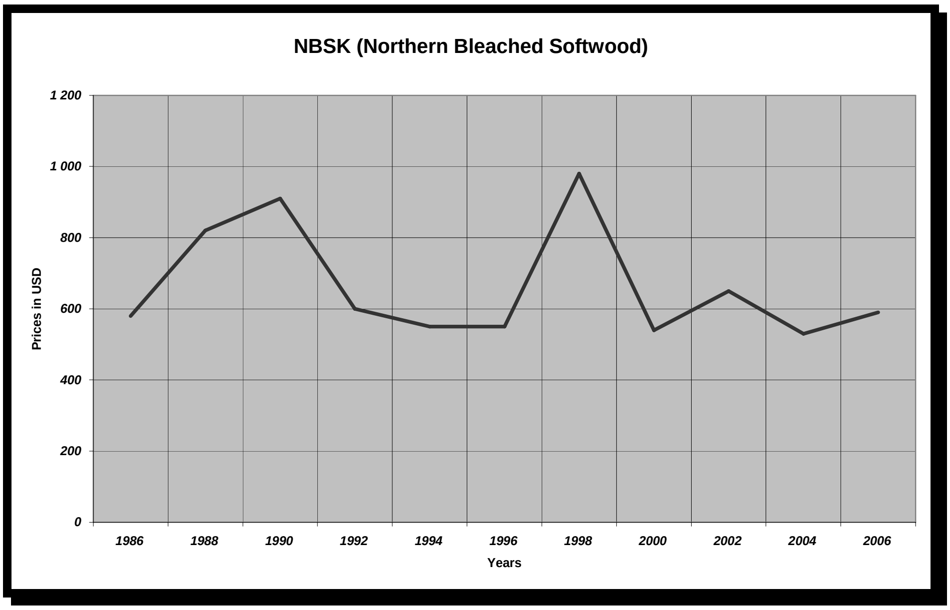
Table 7.1 shows that the manufacturing costs (in nominal monetary terms) of materials have dropped in twenty years. The technological improvements in press control, in both gravure and web-offset, have led to reduction in the waste - both make-ready and printed waste. The trimming waste has also decreased, particularly in web-offset, where sleeves or mini-gap technologies minimizing the blanket gap have been successfully used (Paper IV and VI).

It should be noted that the price of paper has fluctuated greatly during these twenty years, and if other pairs of years had been compared, a different result might have been obtained. In 1998, Jallinoja (1998) stated that price volatility was not in the interest of either paper makers or the customers, and that more stable and predictable prices would be a benefit to all concerned.

Figure 7.1 shows the fluctuations of northern bleached softwood pulp (NBSK) from 1986 to 2006, and NBSK prices are used as indicators of the prices for woodfree paper grade, and to some extent also for wood-containing paper grades. Note the peaks in 1988-1990 and then ten years later! Since 2000 the prices have been less volatile, but according to EUWID (2007) the trend is now again peaking slightly upwards for 2007.

Notwithstanding this, another factor is of great importance to the gravure printers. In 1986, gravure printers enjoyed the fact that gravure paper grades were less expensive than the web-offset grades. The paper mills claimed that the price difference corresponded to the actual difference in manufacturing costs. Nevertheless, today there is little difference either in trimming waste (=cost) or in paper price for similar grades

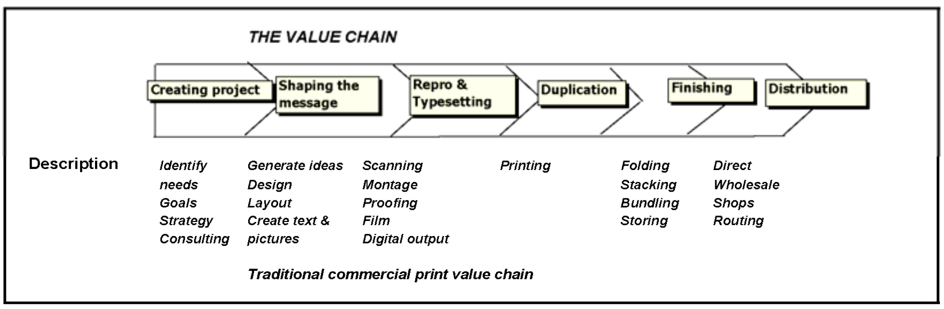
Figure 7.1 – Prices of NBSK (Northern Bleached Softwood Pulp) 1986-2006



Sources: Jaakko Pöyry, Pulp&Paper2006

The gravure printer has, however, still one economic advantage; the print quality on SC grades is at least as good as the print quality in heat-set web-offset printed on LWC grades (Paper VI). The main winners are, in this case, the print buyers, because most of the larger customers are buying their own paper, and to only a small extent does the publication printer have a direct financial benefit (Paper VII). The traditional value chain for commercial printers was described by Ertesvåg et al. (1998) and is shown in Figure 7.2. However, the processes where added value could be created for the printer are becoming fewer and fewer.

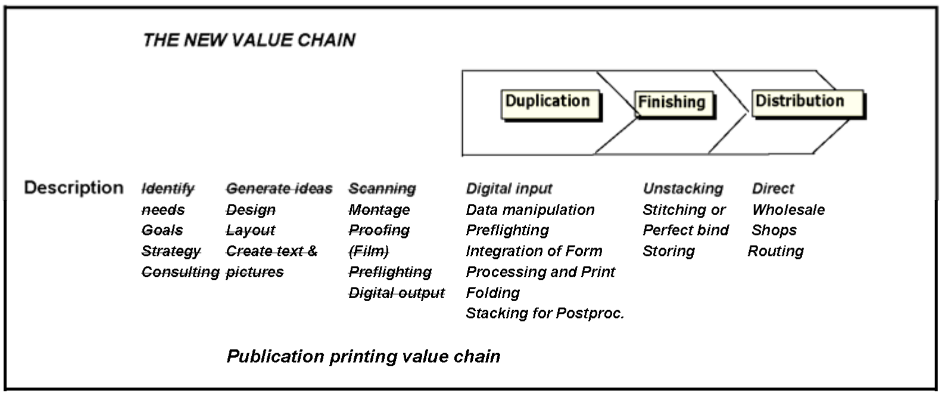
Figure 7.2 – Traditional commercial printer value chain in 1998



Source: Ertesvåg et al. 1998

Since 1998, the value chain has changed to that shown in Figure 7.3 and some of the inherent values have moved into the domains of the print buyer. Many of the processes in 1998 have vanished because of the digitalization (creation of pictures, scanning, montage, proofing, film output etc.) of the production workflow. The remaining areas of services, where added value can be created, are those of finishing and distribution. A higher level of segmentation and/or targeting gives the printer an opportunity of differentiation, hence, a more valuable service can be provided to the customers.

Figure 7.3 – The new value chain for a publication printer



Source: Paper VII

7.3 Vertical linkage – both with suppliers and customers

According to Porter (2004), linkages with suppliers and customers are very important for a company and they exist not only within the value chain of the company but also connected to the supplier's value chains. These linkages may enhance the competitive advantage and it is often possible to benefit by influencing the configuration of a supplier's value chain to jointly optimize the performance of activities. Such a linkage is a relationship in which both can benefit, and it is not a zero sum game, where one party gains at the expense of the other. In the publication printing industry, these linkages have existed for a long time in the supply of paper and ink. The integration of order/logistics/ invoicing of paper supply is an example of a vertical linkage between supplier and customer which has reduced the administrative paper work and costs for both parties.

This linkage is important for the printers even if most paper supplies are negotiated and bought by the customers. It is rather difficult to estimate how much paper is actually bought by printers, because most of the printers are not public companies. One of the few public companies in the market is the Schlott Gruppe, and their 2005 annual report stated that the paper supplied was 79% of the total tonnage of paper. The reason why this figure is published is because a public company must publish statements about forecasts of sales and profits etc. If the quota changes between periods, the forecast may not match and a public company must explain such a discrepancy (Schlott Gruppe 2006).

Another example of linkages is those which are decided at an industrial association level, such as how to mark and package paper reels. These standards are important for easy stock handling of paper (standardized bar codes for identification of reels), and they reduce the handling of stock and job administration work etc. The same applies to the packaging of reels, which reduces damage and waste during the chain of logistics. Even such a trivial effort as having common codes for known paper faults during the printing process eases the communication between supplier and customer.

A further aspect is the standardization of reel diameters, which is important for the paper-makers. There is, however, no standardization of reel width, even though A4 is a standard page format. In order to produce A4 signatures, different printers do not have the same reel width, because the exact size depends on technical issues such as the folders of the presses in the plant, and, not least, on the post-press equipment available in the bindery. There is, however, a discussion going on in the industry to increase the standard diameter from 125 cm to 150 cm. This would mean an increase in weight and web length by about 40% depending on paper grade. The advantages are obvious – 30 % fewer reels means less white and core waste, fewer splices which in turn means less waste and a lower risk of paper breaks. This is, however, a very lengthy and complicated process with many aspects to consider; reel stand/press and paper manufacturers, transportation/logistics and handling devices at the printers (PrintCity Webline 2006).

Many printers have very little space for the storage of paper. With modern communication and procurement practices with precise planning and logistics, printers do not normally have more than a few days’ or weeks’ consumption of paper in stock, which gives them a distinct economic advantage; less capital bound in paper stock, less space for the storage of paper etc. Paper supplies from the Nordic countries to Central and Southern Europe are shipped directly to terminals in Central Europe, from which paper is supplied to the customer. The main objective is to have as few unloading/reloading processes and as little handling of the reels as possible in the chain of logistics. Hence, these vertical links are of utmost importance for both the printer and the supplier.

Ink is supplied in bulk, and most of the publication gravure printers have external tanks for the storage of ink. The liquid inks are pumped from the tanks to the individual printing units. Today, the internal handling is very much easier in the industry, since almost all printing is done with four primary process colours and there is very little use of spot colours. The integration of order/logistics/invoicing of ink supply is another example of a vertical linkage between supplier and customer, which has reduced the administrative work and costs for both parties. On the industrial level, the ISO standardisation of publication printing in 2004 has limited the number of colour shades available, which is advantageous for the ink makers (ISO 12647-4). Another advantage for the gravure printer is that he may just change the type of extender (an extender is a pigment-less ink) in order to optimize the printing on various substrates etc. The offset inks are paste inks, and are not as easy to pump as the liquid inks. Furthermore, if non-standard ink is required, the printer needs to have another set of four tanks or to employ manual handling of drums or canisters.

The linkage with the customer is of even greater importance for the printer. In earlier days when the printer also executed the prepress work for the customer, the links were more obvious and intensive than today. The lead time for the editorial prepress work at the printer – typesetting text, manipulating images and making pages – was counted in weeks. A good collaboration between customer and supplier was essential in order to prevent costly remakes and delays in the chain of processes. For a customer to switch the contract to another printer was not always an easy task. The overlapping time and costs involved could be substantial.

Porter criticizes those companies that are only striving after operational effectiveness. In an article published in 1996 (Porter 1996, p. 62) he argues that the US giants in publication printing are: *"……………..competing head to head, serving all types of customers, offering the same array of printing technologies (web-offset and gravure) investing heavily in the same type of equipment, running their presses faster, and reducing crew sizes. But the resulting major productivity gains are being captured by customers and equipment suppliers, not retained in superior profitability".*

Today, all print jobs are supplied in digital format, i.e. typically in PDF format (Portable Document Format). Hence, the job can be switched to another printer by just pressing a key on the customer's computer. This makes it even more important for a printer to nurture the linkage with the customer. A tight integration between customer and printer avoids errors and delays when the printer is about to execute the digital files. New technical solutions to check the validity of the files supplied, such as the so-called pre-flight systems, have been marketed for some time, and with proper use and handling most problems with the digital content of the files can be avoided (Mills-Davis 1998).

It is important, however, that both parties are involved in the effort to eliminate unnecessary cost drivers in the process chain by re-engineering the business processes involved. Printers need to forge even closer links with customers (Harrison and Hancock 1994). The printers need to learn and integrate manifold aspects of service to the publishing industry (Rose at. al 2002), and workflow management and job tracking are instrumental tools to link publishers and printers. Transparency, i.e. allowing the customer to follow the progress in the manufacturing chain of his particular job, is a key word. Lucas (2006) stated that a partnership with the customer in creating value-added solutions is vital to improve the customer's loyalty, and an opportunity to increase customer value. However, integration is not only valuable for the printer but also for the customer. He can improve his value chain by linking to the value chain of his supplier, which may save both lead-time and unnecessary costs (Ibid.). The printer needs to create strategic alliances with his customers to improve the relations and minimize the future risks for change of supplier

7.4 Substitute products and services

Threats, as seen from the viewpoint of a publication printer, from other printers are very obvious, whether they are coming from a heat-set web-offset or from a gravure printer. These threats of being substituted as a supplier are considered to be an every day routine. Most customers are announcing tenders for new contracts on a regular basis, i.e. annually for a magazine or a catalogue production, and also for individual print jobs. The threats can be seen in the short-term perspective, and the individual printer has to live with these market conditions. In order to be competitive, a printer can adopt several strategies, such as being a cost leader or offering a differentiated mix of products and services to the buyer. The basic principle (Porter 2004) is to understand and identify the buyer's purchasing criteria and the buyer's perception of the potential supplier and his values.

In the medium to long term, it is more important to understand the customer's customer, and his value chain. If the printed product is aimed for the consumer market, as is normally the case the value chain is more complex (Ibid.). Consumer behaviour and consumer preferences are not always easy to understand and/or analyse. Lately, this has become very obvious with the emergence of new electronic media and e-commerce, which has influenced both magazine publishers and catalogue producers in their future strategies (Paper VII).

Another very important factor is advertising spending in the publishing industry, and how changes in the advertisers' pattern of spending may influence the volume of print. In 2001 and 2002, there was a slump in advertising money spent on magazines in the German market, and this directly influenced the volume of printed products, leading to fewer pages, lower circulations and eventually lost readership. Not until 2004 did the German publishers to some extent regain their previous positions (Hohol 2005).

A third segment of print, inserts in newspapers and magazines, also depends on revenues from advertisements from the large supermarket chains. One example is France where from 2006 onwards legislation permits these chains to use television as a new advertising channel. The print sector is said to be losing 20-30% in volume, because the buyers are changing their channel for advertising (Ernst & Young 2007). The Association of German Magazine Publishers has also sent a warning to the EU (VDZ 2006) and regards the new law as "*a threat to media credibility and an unfair competition situation*".

A similar development in the area of new media could eventually take substantial parts of the total advertising budgets and, even if the numbers still are small, the growth rates are high (Paper VII). This effect can be clearly seen in the recent developments in North American newspapers. They have lost circulation and advertising revenues, both display advertising and classified. These events can easily develop into a vicious circle. The publication printers need to investigate all threats whether or not they come from their traditional competitors and also, more importantly, to analyse the effects of the strategies of their customer's customers.

7.5 Potential new entrants

In the publication printing market, substantial investments have been made in Poland and Slovakia during the last decade, Table 7.2. The table also shows the owner or originator (if not revealed by the name). There are, of course, also domestic publication printers in these countries who are not directly involved with foreign investors.

Table 7.2 – East European publication printers

Country/ Company	Name	Production	Origin
Poland	RR Donnelley	Heat-set web-offset	US[37]
	Winkowski	Heat-set web-offset	US(Quad Graphics)[38]
	BDN	Gravure	Bauer Verlag (DE)
	Wydawnictwo Bauer	Gravure	Bauer Verlag (DE)
Slovakia	BSG	Gravure	Burda (DE)

Source: ERA List of Presses 2005

Of these companies the three at the top have the most modern equipment, and possess sufficient capacity and print quality to be serious players on the Euro-

[37] Source: www.rrd.com
[38] Source: www.qg.com

pean markets. In the case of BDN, the new publication gravure plant owned by Bauer Verlag in Hamburg, there have been some consequences at its main plant in Cologne. Consequently the print capacity there has been reduced, and 300-400 of the work force have been made redundant. The new plant, however, will not only print products for its own publisher but will also be active on the open European market competing with other publication printers.

The main advantages of the BDN plant are that it has a very flexible and young work force (not unionized), brand new equipment from the leading suppliers, technical support from the other plants in the group and a location very close to the German border with short access to motorways and railways. If this venture is successful in gaining important future contracts, e.g. major mail order producers in Germany, other printing groups will probably follow suit and move their activities to East European locations.

Hence, the threat to the established publication printers in the West-Europe is not imminent, but it may be a reality in the medium to long terms. Even if the Bauer project was completed in less than 2 years, there is normally a lead time of 3-4 years until completion of such complex projects. It should be noted, however, that Bauer Verlag is one of the last integrated publishers/printers left in Europe, and that it has the possibility of utilizing the new capacity at will. Other entrants without the support from a publisher must rely on work from a very competitive open market.

New entrants from overseas are not likely to make an impact on the European publication market. There are basically two reasons; time to market is one of the top priorities in the publishing industries and overseas printers have little chance of being competitive because of logistical and other constraints. The second reason is that almost all the high quality ink and paper grades are produced in Europe.

It is not likely that these products would be sold at a lower price outside Europe, and the costs of materials are normally about 50-60% of the total printed product (Paper VI). There is very little economy of scale available for an overseas printer, even if his labour costs are small in comparison with the European average. It is different with other printed products, such as text books or children's books with a much higher manual wage content and extended delivery times. The import to Europe (and North America) of these kinds of books from China and other East Asian countries is very large and growing (Ernst & Young 2007).

7.6 Leadership in the industry – is leadership wanted or even asked for?

Until the middle of the 1980's, the road ahead for publication printing companies (and other companies in the business for that matter) was seen as rather stable and predictable (Ertesvåg et. al 1998). It was a world of craft-based businesses where creative thinking about the future was a rare activity, and formalised strategy work was an exclusive domain of a small number of very large companies (Ibid.). The former stability of the markets has vanished and *"these events have shuttled this world into pieces"* (Ibid. page 124). A vicious blend of fierce price cutting, vanishing boundaries, emerging markets and fragmented markets; and last but not least more demanding customers, has changed the conditions for the printer (Ibid.).

The former family-owned or family-dominated large companies in the publication printing industry, dominated by one leader from the family, have been replaced by public (or privately owned) companies with professional management. In Paper II, leadership is described theoretically and practically by one example; Robert Maxwell who with notable success restructured the British publication printing industry in 1980-85. His methods and techniques were not for the faint-hearted, but they were successful when negotiating with the powerful British unions in the printing business.

At the end of the1980's, Maxwell made similar efforts in the US publication printing market. Some of these old holdings are today part of R R Donnelley's and Quebecor in the US. Another leader, but with a different approach, is Rupert Murdoch who in 2007 is still very active. These archetypes of leadership are not likely to be seen in the future, because industrial leadership has been replaced by management committees. Private ownership is still exercised in a few large companies in Europe; companies like Burda Medien, Bauer Verlag, Mondadori Editori, Ringier, Bonnier and Aller. There is almost always a problem with the family successions, which may create ambiguity and uncertainty with regards to its future direction.

The concept of leadership is described in Paper II. Furthermore, leadership and management of innovations in the media industry has been described as follows: *"Fundamental changes are not only to be found in the organizational contexts of media economy; the demands made on leadership and the role concepts practiced by management are changing along with them. ……… ….. Leadership behaviour plays a decisive role in the management of innovation. Leadership is judged today by whether it supports continuous changes.………….. ….. It is no longer technology, which is the point of departure for management, but rather organizational flexibility, the capacity for* *change of the operation itself – Change Management is the new leadership maxim!"* (Rose et. al 2002, p. 145)

Lado et. al (1992) suggests that strategic leadership and a managerial competency have a significant impact on a company's performance and are a source of sustainable competitive advantages. Strategic leadership would have the ability to exploit company-specific competencies.

The challenge of developing or re-establishing a clear business strategy is often primarily an organizational one and depends to a great extent on leadership. With so many forces at work against making choices and tradeoffs in organizations, a clear intellectual framework to guide strategy is a necessary counterweight. Strong leaders willing to make choices are essential (Porter 1996). The leader must provide the discipline to decide which industry changes and customer needs the company will respond to, while avoiding organizational distractions and maintaining the company's distinctiveness (Ibid.). Navigating successfully in the future market requires leadership, commitment and consistency in applying new tools and competitive actions. Pitkänen suggests (2006, p.5) that *"The printing industry in Europe will remain largely unattractive due to low demand growth, except in some segments and technologies, and sustaining fragmented supply and overcapacity."*

To secure the future (Ibid. p.8), the publication printer will need:

- *To define the role he wants to play or exit*
- *To carefully choose the markets he wants to play to enjoy pockets of more attractive segments*
- *To outperform the competition throughout the value chain*

This would require not only management skills but indeed also leadership! Managers do things right, but leaders are doing the right things (Paper III)!

It is not the fittest which survive, not the most intelligent,
but those most responsive to change! ***(Charles Darwin)***

7.7 Strategies for energy and environmental issues – pressure from third parties

7.7.1 Background information

Enroth (2006) has discussed the environmental issues for a sustainable future for the graphic arts industry. In 2002, a survey among some of the leading European publication printers was conducted (Ibid. p.77) and, assuming that there have been no recent fundamental changes in the industry, some of the findings can be combined with recent data (in bold) about paper consumption and number of installations (in bold) in the publication printing industry as shown in Tables 2.2 and 2.3. If the data in these two investigations are combined, it is possible to calculate the total VOC[39] emission in the industry. The result is presented in Table 7.3.

Table 7.3 – Emissions from the European publication printing industry

Emissions of VOC 2002/2005	Gravure	Web-offset
Paper tonnage (ton/install) incl. waste	**95 000**	**15 000**
Paper Waste (% net)	12%	17%
Paper tonnage (net ton/install)	**83 600**	**12 450**
Emissions of VOC kg/ton (net)	1.9	3.0
No of installations	**53**	**526**
Total VOC emissions (tons)	**8 420**	**19 650**

Source: Enroth 2006/Tables 2.2 and 2.3

In 2005, the European Union Environment Network (Implementation and Enforcement of Environmental Law/IMPEL) investigated the VOC emissions from a medium-sized heat-set web-offset printer (VOC Workgroup 2006). The study verifies that the remaining VOC emissions from the catalytic combustion system are as high as 50% of those coming from the dampening and washing solutions (emitted to the ambient air without cleaning) - in these cases 13 and 28 tons per year respectively. Although most of debate in the industry has dealt with solvent emissions (e.g. toluene emissions) in publication gravure, the statistics show that the web-offset industry may be a larger polluter and emitter of VOC.

Unfortunately, no figures are available related to paper consumption in the IMPEL study, and this makes it difficult to make a quantitative analysis and compare it with that of Enroth (2006). The latter is based on the VOC in the printing units only and no emissions from the catalytic combustion systems were included. The emission quotas of VOC from the press room in the Enroth surveys seem very high in comparison to the EC study. Nevertheless, the VOC emissions from the catalytic combustion system must be added to the total figure. The analysis from the IMPEL investigation shows that the total VOC emission may now be as low as 1.5 kg/ton printed paper (net).

The VOC levels in the Enroth study should be reduced by 1/3 due to technical progress and change of working habits in the press room according to IMPEL (2006). It should, however, be noted that the printers have based the input data

[39] VOC = Volatile Organic Compounds

of the solvent content of the inks supplied on information from the ink makers. Data from 2006 made available by ERA (ERA Environmental, Health & Safety Commission) suggest, however, that a modern solvent recovery system installed in the gravure industry is able to reduce the fugitive emissions to about 1 kg/ton paper printed as shown in Table 7.4.

Table 7.4 – Emissions from the European publication printing industry (rev.)

Emissions of VOC 2005	Gravure	Web-offset
Paper tonnage (ton/install) incl. waste	95 000	15 000
Paper Waste (% net)	12%	17%
Paper tonnage (net ton/install)	**83 600**	**12 450**
Emissions of VOC kg/ton (net)	1.0	1.5
No of installations	**53**	**526**
Total VOC emissions (tons)	**4 500**	**9 850**

Examples from the German publication printing industry in March 2007 show that the gravure industry may achieve rather low emission levels provided that the installations are reasonable modern and well maintained (Prinovis 2007 and Schlott Gruppe 2007), Table 7.5.

Table 7.5 – Emissions from selected German publication printers

Emissions of VOC 2005	Prinovis Gravure	Schlott Gravure	Schlott Web-offset
Paper tonnage (ton/install) incl. waste	**224 420**	**76 940**	**46 000**
Paper Waste (%)	6.0%	8%	15%
Paper tonnage (net/install)	**211 064**	**70 784**	**39 100**
Emission of VOC kg/ton (net)	0.10	0.12	4.09

These data, however, have an uncertainty of +/- 2% in weight (European conditions of ink deliveries), which of course will influence the total emissions from the industry.

In 2000, the EU launched a program (European Climate Change Programme or ECCP) to reduce the levels of VOC emissions. The formal decision was taken in October 2003, and in 2008 the second implementation period of the Kyoto Protocol will start. In the new scheme of Emission Trading, the companies have the possibility to trade; if the Assigned Amount Units (the admitted level is too low) are too few, more Units can be bought on the market and vice versa. The present minimum level for the participation of this Trade is set at 20 MW power (EU 2005). Using data from Enroth (2006, p.77) and Tables 2.2 and 2.3 and the same method as described on page 55, a new table can be computed, Table 7.6.

Table 7.6 – Energy usage in the European publication printing industry

Use of Energy 2002/2005	Gravure	Web-offset
Paper tonnage (ton/install) incl. waste	**91 000**	**15 000**
Paper Waste (% net)	12%	17%
Paper tonnage (net ton/install)	**83 600**	**12 450**
Use of Energy MWh/ton (net)	0.89	0.61
No of installations	**53**	**526**
Use of Energy MWh/per install	**74 400**	**7 600**
Hours (annual use approx.)	**7 400**	**7 400**
Total Use of Energy (TWh)	**4.0**	**4.0**
Use of Power/install (MW)	**10**	**1**

The investigation mentioned above from March 2007 (Prinovis and Schlott Gruppe) reveals the energy used in 2005 regarding publication printing production, Table 7.7.

Table 7.7 - Energy usage by selected German publication printers in 2005

Use of energy 2005	Prinovis Gravure	Schlott Gravure	Schlott Web-offset
Paper tonnage (ton/install) incl. waste	**224 420**	**76 940**	**46 000**
Paper Waste (%)	6.0%	8%	15%
Paper tonnage (net/install)	**211 064**	**70 784**	**39 100**
Use of energy MWh/ton (net)	0.62	0.70	0.97
Hours (annual use approx.)	**7 400**	**7 400**	**7 400**
Use of Energy (MWh)	**130 538**	**50 610**	**37 950**
Use of Power/install (MW)	**18**	**7**	**5**
Relative energy consumption/paper printed	**0.6**	**0.7**	**1**

The results show that the total energy used in the publication printing industry is about 8 TWh, equally divided between gravure and web-offset. On the other hand, the average energy used per installation is almost 10 times higher in gravure than in web-offset. The figures in Table 7.7 indicate that the publication printing industry has been successful in reducing the energy consumption in relation to the printed volume of paper, but more importantly the relationship calculated per ton paper printed (consumed net) gravure is 30% more efficient than heat-set web-offset.

Although the scatter among installations is quite high, a few large gravure installations in Europe may use more than 20 MW (corresponding to a paper consumption exceeding 200 000 tons per annum, see Tables 7.6 and 7.7), and at least one of the German plants (Prinovis Ahrensburg, Prinovis 2007) has a boiler capacity exceeding the 20 MW level. In 2006, there is in Europe, to the author's knowledge, no web-offset installation with such a capacity.

The media, particularly TV and evening papers, will most probably push the public opinion forward and make it aware of the perceived climate changes. Most politicians will not be able to resist this pressure, and new legislation requiring further reductions in VOC emission will be a matter of time. Therefore, it is not unlikely that with continued pressure about climatic changes from Non Governmental Organisations (NGO) and the increasing awareness of public opinion in Europe, these limits will be lowered.

New targets for further reductions (substantially lower than the Kyoto protocol) of VOC emissions are being discussed in many political circles in Europe. If, for example the limit of admissible power was to be set to 10MW, the Emission Trading scheme would cover about 50% of the gravure installations and 10-15% of the web-offset installations in Europe. This would probably affect the heat-set web-offset industry more than the gravure printers.

Already in 1994, at an international conference, in't Veld (1994) as the representative for one the largest European publication printers stressed that:

"The distinction between legislation, guidelines, public opinion and pressure groups is blurring!"

7.7.2 Reduction of VOC emissions in the publication printing industry

7.7.2.1 Heat-set web-offset

According to Enroth (2006), most of the VOC emissions come from the dampening and washing solutions, but emissions from the catalytic afterburners are not included in her calculations. The study from IMPEL shows that there are also substantial emissions from the catalytic afterburner of the exhaust gases from the dryer. The ink-making industry is trying to lower the content of mineral oils in inks in order to lower the VOC emissions from the afterburner (VOC Work Group 2005). As has been shown previously, some work remains to be done to further reduce the total volume of VOC emissions in this segment of the industry. This part of the industry is very fragmented with many smaller units and more than 500 installations (Table 2.3) in Europe, and this adds to the complexity.

7.7.2.2 Publication gravure

The discussions about the use of toluene as solvent in the gravure industry have been intensified since 1993/1994. It started in 1993 with a Danish postman in Aarhus who complained of dizziness and nausea when sorting publications printed by gravure at the local post-office (in't Veld 1994). It was all related to the residual toluene in the printed products, and cartoons soon appeared depicting postmen in gasmasks and gloves sorting gravure-printed items. After the initial excitement, the industry soon found some remedies. Those gravure printers with a large Danish market made two changes to the previous working schemes. Firstly, in the pressroom, folders were equipped with improved ventilation (connected to the recovery system), and secondly, the finished products were stored for another 24 hours in a specially ventilated container prior to shipment to the Danish customers (Sundell 2005).

Nevertheless, this was not a panacea. The Danish environmental authorities were not convinced about the use of toluene in a printing plant. Although the war is not over, the latest battle was the proposed legislation of an Eco-label for printed matter which, after a prolonged process, was put to rest (ERA Newsletter 2006). One of the crucial stages in this process was the Danish proposal to classify toluene as R61/R62 (R61= May cause harm to the unborn child/R62=Possible risk of impaired fertility). Such a classification would have meant the end of toluene as solvent in the industry. There have been many battles on the subject between the gravure lobbyists and the legislative bodies in the EU. In the final draft, however, the criteria for publication gravure printing were acceptable to most modern gravure installations (Ecolabel for Printed Matter 2005).

Nevertheless, the environment will continue to haunt the gravure industry and the battle has not yet been won; in the end it is a war which it probably cannot win. Already in 1994, in't Veld (1994) warned that environmental issues in gravure should be taken seriously:

"…and prevention is always better than cleaning or recycling"

Eight years later in 2002, however, according to Bormans (2002, p. 111), the challenge for the gravure industry is the same and he stated that:

"Nevertheless, environmental legislation will confront the gravure industry with new challenges:

- *The reduction of carbon dioxide emissions*
- *The adaptation of the economy to the principles of sustainable development*
- *Increasing EU regulations and directives as consequence of the evolution towards a single market and a political union"*

7.7.3 Environmental strategies for the publication gravure industry

The gravure industry has been very active, and one example is the ERA Environmental, Health and Safety (E, H & S) Commission. The delegates have decided to intensify their work and the Commission meets three times a year. Most gravure printers are now certified either to EMAS or ISO 14001 (ERA E, H & S Commission 2006), which is a demand also from the customers (Paper VII)). Procurement of printing paper is to a large extent done by the customers, and they are very much involved in how the paper is sourced to their products. Most publishers/catalogue producers are demanding that only paper grades with fibres which are certified according to well-known schemes to ensure sustainability of forests may be used (Paper VII).

The ERA E, H & S Commission has been very active in finding pragmatic solutions for gravure printers in conjunction with the EU Eco-label scheme for printed matter. The latest criteria (Ecolabel 2006) would have been acceptable for the gravure industry, and the basic resistance was financial. It should be mentioned, however, that the strongest resistance came from the German publishers, who were of the opinion that their readers did not choose a particular magazine for its environmental issues but for its content (VDZ 2005). The proposed legislation is now put on hold by the EU Commissioner. The EU has commissioned an impact study on the effects of the planned label for "content products" (ERA E, H & S Commission 2007).

According to GFF[40] (2006), it was also felt by the printing industry that in the medium to long term, the certification schemes were not sufficiently financially secured, i.e. the cost of the certification label was expected to increase beyond the control of the printers. This opinion was based on experiences of the Swan Label certificates for printers/publishers in the Nordic countries. The changes in the certification process have led to higher costs and fewer companies are now part of the scheme than initially (Ibid.). On the web-site of the competent body (Svanen 2007) there are only three gravure printers and a dozen heat-set web-offset printers licensed out of a total of about 300 licensees. GFF stated that the criteria would not create any substantial problems for these printers to meet (Ibid.), but the uncertainty of the financial implications remained. On the other

[40] GFF – Grafiska Företagens Förbund, The Swedish Graphic Companies' Federation

hand, these criteria may change over time, and then create unforeseeable problems.

With increasing awareness from the public of energy consumption and VOC emissions, it would be advisable for the industry to develop new strategies. The energy consumption and VOC emissions are closely interconnected, because a large part of the energy is used in the solvent recovery unit to remove VOC emissions from the printing units. A new proposed legislation from the EU is the STS BREF Directives (Surface Treatment using organic Solvents – Best Available Techniques Reference Documents) was reported by Fricke (2006). The general BREF policy recommends balancing solvent emission and energy consumption. The general opinion in the gravure industry is, according to Fricke (Ibid. p. 8), that modern solvent recovery systems are very efficient with a high degree of utilization of the supplied power, and about 95-98% of solvent is recovered. A higher efficiency is obtainable in a modern installation, but with a penalty of very high additional cost of energy (Ibid. 2006).

There are always risks that the legislative bodies are ahead of what is technically achievable. In Chapter 20.4.*3 "Techniques to consider in publication gravure printing"* written by the BREF BAT Working Group, it is argued *that "water-based inks are not considered a viable alternative due to print quality, energy demand for drying and economic reasons". …… "71. It is BAT to prevent the excessive use of energy by using the optimum number of regenerations required to maintain emissions within the emissions value in BAT 70".* These recommendations are, however, subject to constant revision, but there are no participating members from the printing industry in the working group (BREF BAT 2006).

On the European level EPER is the European Pollutant Emission Register established by an EU Commission decision on July 17, 2000. The first reporting year was 2001 followed by a second year in 2004. For the third reporting year in 2007, EPER will be replaced by the European Pollutant Release and Transfer Register (European PRTR). Treshold values have been chosen in order to include about 90% of the emissions of the industrial facilities in an attempt to prevent unnecessary administrative burden on all industrial facilities. All data will be publicly accessible on the internet (EPER 2007). In 2007, however, publication printing is not listed as a separate industry, and there are a few entries from publication printing companies.

Under the prevailing circumstances with an increasing awareness of the human impact on the climate, it would be prudent for the gravure industry to increase its efforts to find substitutes for toluene as the solvent for publication gravure printing. There have been earlier warnings in the subject matter and Rodriguez-Giles (2002, p. 94) stressed that:

"Should it, however, happen that future EU regulations force the elimination of toluene, then radical and cost-intensive technical adaptations would be required on existing machines……. the drying facilities need to be constructed completely differently, and a different ventilation would have to be installed."

Would it not be better to be proactive, rather than reactive in the environmental issues?

7.8 Strategies for the medium-sized publication gravure printers

7.8.1 Markets for medium-sized publication printers

Why is the ability to handle short runs important for publication gravure printers? Since the beginning of the 1990's, the developments with regard to publiccation gravure presses have been targeted to the larger installations and companies (Puri 2003 and Paper VII). Very few smaller gravure presses have been installed in Europe since 2000 (Table 7.8). The market trends, however, as described by FIPP (Annual Report 2005), are not in harmony with these very wide presses, because in the magazine markets the smaller titles are expected to have the highest growth, whilst the larger titles are slowly declining. The statistics from FIPP (Paper VII) clearly shows a strong growth of magazine titles with a circulation less than 200 000– 300 000 copies. Jeschke (2003) shows that, in Germany, publication gravure is dominating only in the segments above 500 000 copies.

Table 7.8 – The German magazine market in 2002/2003

German magazines	**Circulation (print runs)**							
Titles printed	*50-200 000*		*200 – 500 000*		*500 – 1 mill.*		*> 1 mill.*	
Web-offset (titles)	752	97%	148	65%	41	44%	18	32%
Gravure (titles)	20	3%	81	35%	53	56%	39	68%

Table 7.8 shows that there are discrepancies between the statistics from FIPP as presented in Paper VII and Table 7.8 concerning the number of titles in the German market. Nevertheless, this table gives on overview of the German magazine markets and the printing methods used. The perception among the German publication gravure printers (Table 7.9) is that gravure is competitive above 500 000 copies. This is, however, a very small part of the total available market and according to Table 7.8 less than 15% of the printed titles. If the break-even level could be reduced to around 200 000 copies, the available segment would grow with 200 more titles, not taking into account the vast number of titles in the even lower segments. Jeschke suggests that in the segment of 50 000 copies and below (not shown in Table 7.8) there are almost 4 000 titles.

There is, however, considerable confusion about the definitions of medium-sized publication printers and short runs. What is a short run? It largely depends on the geographical market and its requirement. What can be considered as a medium to long run in the Nordic countries might be considered to be a short run in Central Europe or in North America. In the questionnaire used in conjunction with Paper IV, there were a number of questions related to run lengths in various European markets. In addition, a number of interviews have been conducted with some North American publication printers (Coggins 2007 and Dunnington 2007, a compilation of those interviews for North America is in Table 7.9)

In the Nordic countries, gravure is considered to be competitive down to 150 000-250 000 copies on jobs demanding signatures larger than 64 pages. In Central Europe, however, print runs shorter than 400 000 -500 000 copies are not considered suitable for gravure, and in the UK the print runs are typically greater than half a million, even if recent attempts show a willingness to reduce the break-even for larger signatures (Hibbert, 2005). These figures are basically very much the same as they were in 1986 (Bjurstedt 1986, p. 8).

Table 7.9 – Definitions of short runs in gravure

Country/Run length (x 1000 copies)	2006	1986
Nordic countries (Se, Fin, Dk)	200-300	150-200
Germany	500	500
Italy	> 600	500
The Netherlands	500	350
Great Britain	500	> 1 000
France	500	500
North America	750-1 000	> 1 000

Sources: Bjurstedt 1986/PaperIV/Coggins2007, Dunnington 2007

The main difference between 2006 and 1986 is that gravure now needs larger signatures – more than 64 pages – to be competitive. It should be noted that, of those presses installed in Europe since 2000, very few are laid out for less than 96 pages in A4 page size, i.e. 3.6 m paper width (ERA List of Presses 2006).

Paper III shows that since 2000 substantial investments have been made in new gravure cylinder technology by the larger printing companies in Europe. These investments were made to meet customer demands for high reliability, high quality and shorter lead-times. Investments in new technology in the cylinder-processing department are quite large, but the unit cost can be competitive compared with web-offset plate-making, provided that the volume of cylinders is sufficiently high. Corrections on cylinders may only be necessary because of a malfunction in the engraving unit; and a remake may be then the only solution.

The former skill in cylinder correction by the trained craftsman is vanishing very rapidly (Paper III).

7.8.2 A new definition of short runs

In Paper VI, a new definition of short and medium runs is suggested. The main difference in comparison with the more general definitions (depending on the market) is the combination of signature sizes, print runs and total annual print volume (in tons of paper or million of pages). The following definition of short runs is related to an average print run of 200 000 copies (in A4 page size) combined with the pagination of the signature, for example:

- Small pagination < 32 pages
- Medium pagination 48 – 96 pages
- Large pagination > 128 pages

Considering the challenges every publication printer is facing, i.e. running the press room on a 24/7[41] schedule, it easy to compute the annual consumption of paper (grades from 50-65 g/m^2) according to this definition in Table 7.10:

Table 7.10 – Short runs vs. paper volume (tons) – 200 000 copies

Pagination	Paper Volume (tons)
< 32 pages	< 10 000
48 – 96 pages	10 000 – 18 000
> 128 pages	> 18 000

In Paper VI, the annual volumes which can be printed by a modern publication gravure press are also discussed. Table 7.11 shows the annual tonnage of paper which can be printed assuming a 24/7 shift mode (if fewer shifts are used, the volume is proportionally less) with modern wide (width 3.7 m) and superwide (width 4.3 m) publication gravure presses.

It should also be mentioned that in 1986 very few printers were running 24/7 shifts regularly, and there are only a few modern 2.5 m wide presses (ERA List of Presses 2006) installed in Europe (hence, this volume is in brackets), Table 7.11.

[41] 24/7 – 24 hours a day and 7 days a week = 168 hours per week

Table 7.11 – Annual print capacity in publication gravure presses

Press size	Annual tonnage (tons) of paper
1986 – 2.0 m width	14-16 000
1986 – 2.5 m width	18-20 000
2006 – 2.5 m width	(26-28 000)
2006 – 3.7 m width	40-42 000
2006 – 4.3 m width	46-48 000

In the same paper, it is suggested that not only the investment but also the demand from the market have to be taken into account.

7.8.3 Strategies for the medium-sized gravure printer

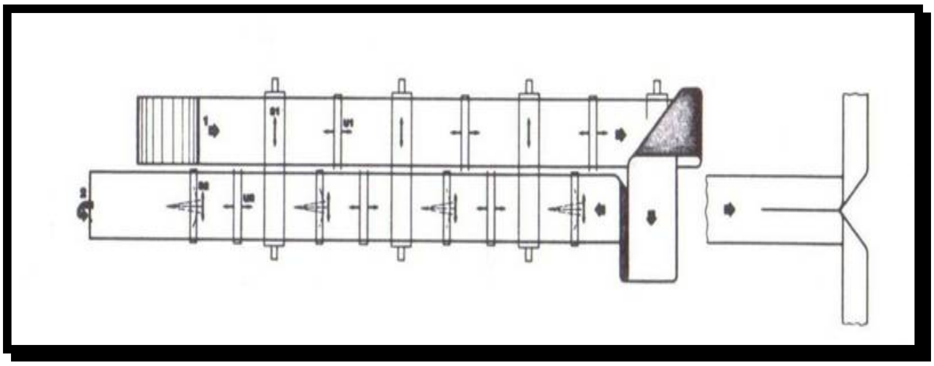
Following the concepts regarding competitive strategies put forward by Porter (2004), the choice for a medium-sized gravure printer is clear: he has to be a cost leader and yet also follow the differentiation path. As has been shown by Bjurstedt in 1986 and 2006, there is one concept which seems to be more promising in this respect than others. The European publication gravure printers have been following the lead by the German printers; going wider and wider in order to keep their competitiveness. This has led to the - maybe unwanted – fact that the capacity step when investing in new modern gravure capacity has more than doubled in twenty years (see Table 7.11). Smaller markets and/or market segments and, indeed smaller printers, do not need such capacities. Hence, a new concept or solution should have capacity steps equal or similar to those for web-offset (Bjurstedt 1986, Paper VI).

In Paper VI, it is suggested that the Double Ender concept would allow smaller or medium-sized gravure printers to enjoy an entry capacity step similar to that of a commercial web-offset printer, but more flexible and competitive, because many different product sizes can be handled. The concept is based on the recommendations from the ERA 1986 report called the PONY press design, although the press manufacturers today prefer to name it a Double Ender, or DE for short. It was suggested in the report that *"The PONY-alternative, where only 4 cylinders are produced, appeared to have more attraction for this type of work, and press room costs and efficiency were computed from known and existing installations."* (Bjurstedt 1986, p. 13 and 14)

In the ERA 1986 report it was also stated (Ibid., p. 13) that *"A PONY press is a press consisting of only four units, where half the cylinder width is used to print the recto side, then turning the web to go back to print the verso on the other half of the cylinder……. The proposed press is designed only for PONY-printing……."*

With modern design, web control and press automation a new DE press has a performance which is similar to or close enough to a standard 8-unit straight gravure press. In Figure 7.4 the web path (½ of a web in relation to the size of the printing unit) of a DE press is shown:

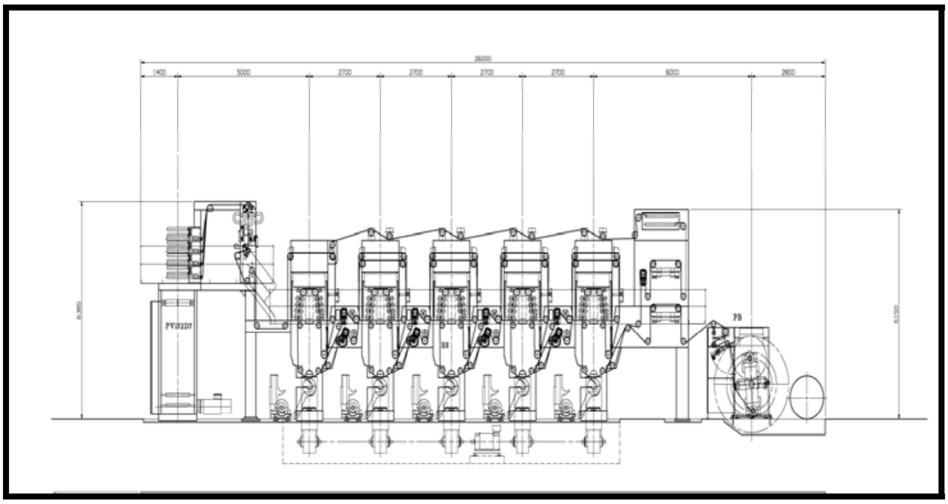
Figure 7.4 – Web path of a DE gravure press



Source: Bjurstedt 1986

(The unwinder is found in the upper left corner; the web then passes through 4 units to print the recto side of the web; the web is then turned twice 45 degrees, the web is turned upside down and then goes back to the first unit; then passes through 4 units to print the verso side of the web and into the folder to the right. In order to obtain perfect colour register, the web can be moved in lateral/ longitudinal directions independently of each other when passing through the two sides of each unit).

Figure 7.5 – DE gravure presses – same level installation



Source: Cerutti 2006

In figure 7.5, a modern DE press is shown, but here with 5 units (normally only 4 units are used). The fifth unit can be used for lacquer (printing covers), any special ink demanded by a customer or to print versioning/zoning editions (when the text needs to be changed frequently). In this configuration, both the reel stand and the folder are on the same level as the units, but the press can be configured on two levels if the floor area is limited (parterre solution).

7.8.4 Break-even levels in 1986

The ERA Report in 1986 stated that gravure was very competitive in all ranges when the DE concept was part of the calculations (Bjurstedt 1986, p. 15). Tables 7.12 and 7.13 show the levels above which publication gravure was more economic to print than web-offset for both the standard gravure press and the DE.

Table 7.12
1985-86 Break-even levels -
standard gravure press and web-offset 32 page press
A4 page format; one gravure proof included

Signatures	Break-even (copies)
32 pages	325 000
48 pages	145 000
64 pages	105 000
96 pages	65 000

Source: Bjurstedt 1986

Table 7.13
1985-86 Break-even levels -
DE concept and web-offset 32 page press
A4 page format - one gravure proof included

Signatures	Break-even (copies)
32 pages	205 000
48 pages	65 000

Source: Bjurstedt 1986

The engraving procedures were basically all manual, e.g. the mounting of the image carriers[42] on the scanning drum and the calibration procedures were time-

[42] The image carrier was called a bromide = a photographic reflection film (either continuous tone or halftone) used as original in the scanning unit of the engraver. Each page (and colour separation) was copied unto a bromide, i.e. for 64 pages in 4+4 colours, 256 bromides were produced.

consuming operations, as well as all transport and logistics of the cylinders to/from the engraving/plating area to the press room. In 1986, the typical lead-time to produce one cylinder was 2-3 hours. Hence, two parallel engraving lines would produce only 4 to 6 cylinders during an 8 hour shift. The print runs shown, Table 7.12 and Table 7.13, were economical in comparison with web offset, but they were not achievable as an average in an industrial sense. It is reasonably easy to simulate the lowest average print run which is possible when data about the lead-time in cylinder processing and press performance characteristics are known. Using the data for the most modern equipment of 1986 vintage, it became apparent that the lead time for producing a sufficient number of gravure cylinders was longer than the total time in the press. There was no automation in the press room to load/unload cylinders, which contributed to rather long make-ready times. Table 7.14 shows the minimum average print runs for the DE concept which were possible in 1986 with two engraving lines.

Table 7.14
Minimum average print runs in 1986 (DE mode)
(using 4 cylinders – 4 kHz engraving heads – 2 engraving lines)

Pages	4U- 32 pages	6U - 48 pages
Print Run	210 000 copies	180 000 copies
No of jobs/24 hrs	3	2
No of cylinders annually	3 600	2 400

It is obvious that it was not possible to achieve the potential break-even level for 48 pages, because the engraving systems in 1986 were too slow. These figures could be slightly improved by adding a third engraving line, as shown in Table 7.15.

Table 7.15
Minimum average print runs in 1986 (DE mode)
(using 4 cylinders – 4 kHz engraving heads – three engraving lines)

Pages	4U- 32 pages	6U - 48 pages
Print Run	175 000 copies	160 000 copies
No of jobs/24 hrs	3	3
No of cylinders annually	3 600	3 600

The potential annual capacities of two and three engraving lines from 1986 were about 6 000 and 8 000 cylinders respectively in 24/6 mode. This capacity was sufficient for two or three more presses with a similar capacity. The number of jobs on an annual basis was still rather limited – about 900.

A similar simulation can be carried out for an 8-unit standard gravure press from 1986 with three or four engraving lines, Tables 7.16 and 7.17. The capacity in the engraving area is 8 000 cylinders, which means that there is sufficient capacity for almost two additional presses running slightly higher average runs.

Table 7.16
Minimum average print runs – standard press in 1986
(using 8 cylinders – 4 kHz engraving heads – three engraving lines)

Pages	4U- 64 pages	6U - 96 pages
Print Run	400 000 copies	345 000 copies
No of jobs/24 hrs	< 2	< 2
No of cylinders annually	3 600	3 600

Table 7.17
Minimum average print runs – standard press in 1986
(using 8 cylinders – 4 kHz engraving heads – four engraving lines)

Pages	4U- 64 pages	6U - 96 pages
Print Run	230 000 copies	200 000 copies
No of jobs/24 hrs	< 3	2
No of cylinders annually	3 600	3 600

Hence, from the tables above and the break-even tables, it can be concluded that there were considerable discrepancies between what was theoretically and practically possible to achieve, and these facts were overlooked in Bjurstedt (1986). Nevertheless, to the author’s knowledge, there were no further discussions in the industry about the subject matter, and the mechanical engraving system did not develop further, with the exception of direct digital interfaces, until about 15 years later (Paper I).

In 1995, when almost all engravers were digitally interfaced, the modern gravure presses were equipped with automatic loading/unloading of cylinders and they were considerable faster than in 1986. The reason for this became obvious when the modern design of gravure presses allowed wider webs with a web width of 3.3 m in 1995.

The cylinders became too large and heavy (about 50% added weight in comparison with those in 1986) for manual transport and handling. Although digital engraving was considerably faster than the previous models, the new and improved press performances were paradoxically contra-productive in terms of the lowest average print runs, Table 7.18

Table 7.18
Minimum average print runs – standard press in 1995
(using 8 cylinders – 4 kHz engraving heads – four engraving lines)

Pages	4U- 64 pages	6U - 96 pages
Print Run	250 000 copies	220 000 copies
No of jobs/24 hrs	3	< 3
No of cylinders annually	3 600	3 600

It is obvious that during the first half of the 1990's, even when gravure presses were getting faster and more automated, the engraving technology did not match. Nevertheless, the publication gravure printer could produce more jobs and be more productive than before on even wider presses. This was the method for maintaining the competitiveness in publication gravure in the middle of the 1990's. Not until the beginning of 2000, when the HelioSprint II (Hell Gravure System) heads became available allowing the engraving speed to be increased from 4 kHz to 7.5 kHz, did the average minimum print run decrease.

7.8.5 Break-even levels in 2006

The following tables have been computed from the data in Paper VI, where it was also stated that publication gravure had lost its previous cost advantage in relation to heat-set web-offset, not only in the smaller paginations but also in 64 page signatures. Table 7.19 shows the situation in the European publication printing market in 2006 in relationship to the different sizes of heat-set web-offset presses.

Table 7.19
2006 - Break-even levels - A4 page format - no wet proof

Signatures	Web-offset press	Break-even (copies)
64 pages	32 page	225 000
64 pages	64 page	550 000
96 pages	48 page	95 000
96 pages	64 page	150 000

Source: Paper VI

The data and formulae in Paper VI have a rather high sensitivity, and an analysis shows that small changes in the fixed costs for any of the web-offset or gravure alternatives may lead to considerable changes in the break-even levels. Furthermore; the fixed costs in gravure are, to a very high degree, dependent on the cylinder-processing costs and any reduction in these costs would have a dramatic effect on the competitiveness of gravure printing. A printer should use his own data when computing the break-even level of a particular pagination and/or printing method. This is, of course, also relevant for a supplier of printing presses and/or cylinder- and plate-processing. Table 7.20 is a summary of the data (Ibid.) for a Double Ender (DE). In Paper VI, it was suggested that the performance of a DE press would fit into the definitions of short runs for the small and/or medium paginations.

The DE concept is very competitive, particularly when the most modern 64 page web-offset press is the alternative and, paradoxically, the DE concept is always more advantageous up to 300 000 copies.

In Table 7.20, the relationship between the press speed for the DE and that for web-offset is shown in the right-hand column. Only for 64 pages, printed as 8U[43], the DE press somewhat slower. On the other hand, the press speed is of secondary importance in comparison to the make ready times when very short runs are considered (press time - 1-2 hours).

Table 7.20
2006 - Break-even levels - A4 page format DE concept - no wet proof

Signatures	Web-offset press format	Break-even copies	Press speed Relationship DE : web-offset
32 pages (4U)	32 page size	110 000	1.4:1
48 pages (6U)	48 page size	115 000	0.9:1
64 pages (8U)	64 page size	> 300 000	0.7:1
96 pages (2 x 48 pages)	64 page size	30 000	0.9:1

Source: Paper VI

A DE press for 32-64 pages would process 12 000 -15 000 tons of paper annually, depending on the product mix (pagination and print runs), paper grades and shift mode.

In Paper VI, the print quality for gravure using SC grades was compared with that of web-offset using LWC paper grades. It was found that gravure printed on SC paper is considered to be comparable with web-offset on LWC in print quality and appeal. Hence, the break-even levels in Tables 7.19 and 7.20 could be lowered even further, if the data for gravure printed on SC paper and web-offset on LWC are used, as shown in Figures 7.6, 7.7 and 7.8.

These three graphs show that publication gravure printing can be competitive down to very low print runs provided that the best available technology is used.

[43] 8U = eight pages around the cylinder (landscape mode)

The limiting factor is, for the time being, the lead time in the engraving and plating departments.

Figure 7.6
2006 Break-even levels - A4 format - no wet proof
32 pages Gravure SC vs. Web-offset LWC

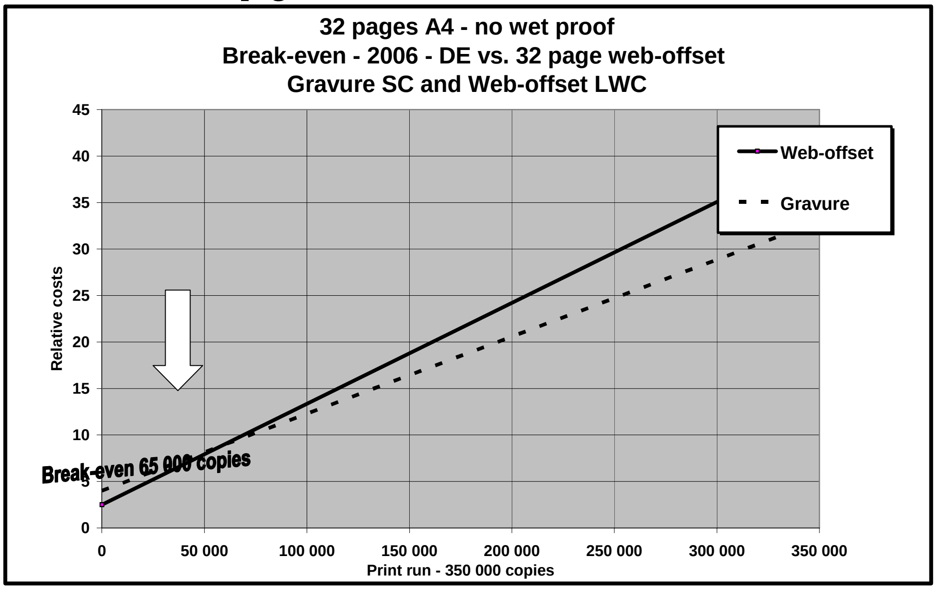


Figure 7.7
2006 Break-even levels - A4 format - no wet proof
48 pages Gravure SC vs. Web-offset LWC

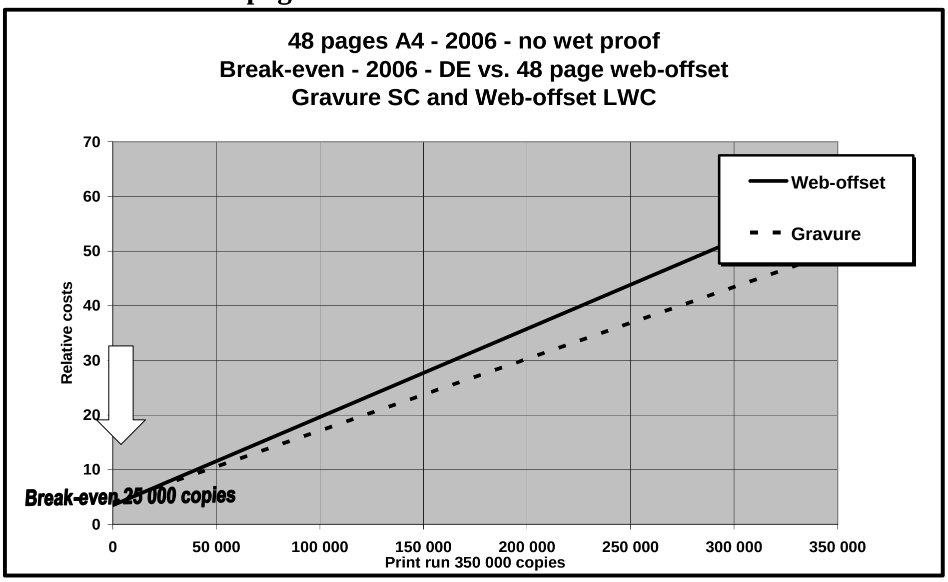
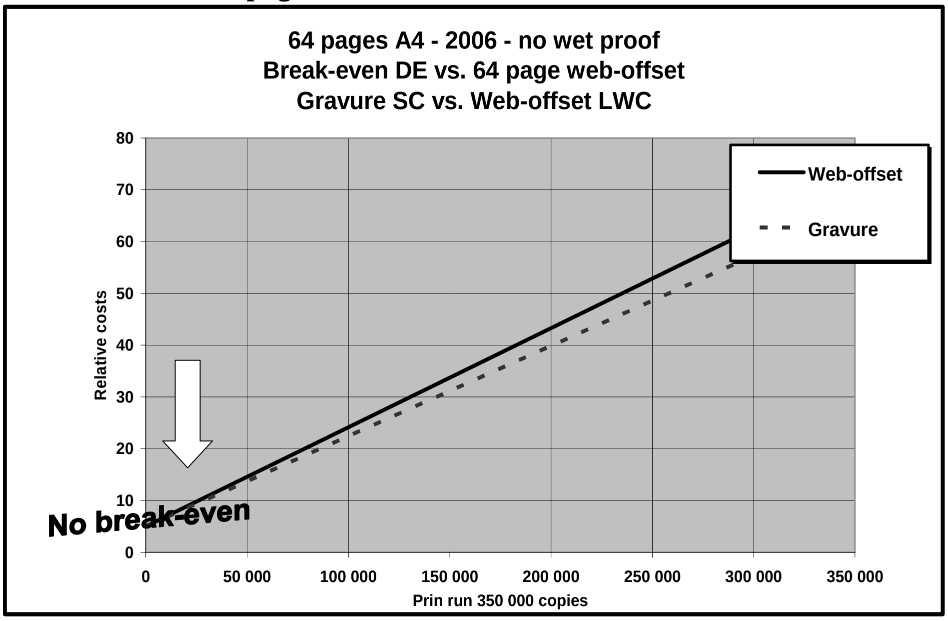


Figure 7.9
2006 Break-even levels - A4 format - no wet proofs
64 pages Gravure SC vs. Web-offset LWC



In the Tables 7.21 and 7.22 respectively the nominal engraving times are shown for the currently most modern engraving units, the DLS (direct laser engraving on zinc) from Dätwyler AG and the K6 engraver (mechanical engraving on copper) from Hell Gravure Systems. These two engraving systems are fully automated and need no manual operation. All data in the tables have been generated from data provided by each supplier. It should be explained, however, how these systems work.

The DLS engraver is an area-dependent unit, because the laser engraves a certain area[44] per second. In addition to the engraving time, loading/unloading and calibration times are added independent of the size of the cylinder. The K6 engraver is also area-dependent with the addition that the number of engraving heads is equal to the number of pages[45]. The engraving time is the number of heads multiplied by the mechanical frequency of the engraving stylus in each head. Added to the engraving time are calibration (test cuts) and loading/unloading of the cylinder.

When plating is concerned, whether it is zinc or copper, the time required is directly related to the chosen thickness of the deposit and the maximum current

[44] number of cells per m^2 depending on the resolution
[45] the number of pages positioned along the face of the cylinder

applied. The time is basically independent of the size or area of the cylinder. Degreasing and polishing of a cylinder are surface-area-dependent processes in both circumference and face length directions,. Typically, the deposit for a copper-based cylinder is 80-100 microns, while the zinc deposit is about 50 microns (since the cell structure is shallower).

Hence, the plating time for the zinc plating is somewhat faster, and the process cycle is about 8-10 cylinders per 8 hour shift per line. In both cases, two parallel lines have been used in the calculations (each engraver line is equipped with post-engraving units, such as a degreaser, a chromium plating tank and a polishing/lapping unit).
The size used is for an 8 ribbon cylinder (a cylinder face width 2.45-2.75 m for 32/48 or 64 pages in A4 size to be engraved; 4U means 4 pages around the cylinder etc.). All engraving and plating units are fully automated and need no manual intervention. It is assumed that cylinders in a colour set can be engraved simultaneously in two parallel lines without any register problems, Table 7.21

Table 7.21
Engraving lead time with Direct Laser Engraving (140 kHz)
incl. calibration and loading/unloading of cylinders

Colour	4U- 32 pages	6U - 48 pages	8U - 64 pages
Y, M, C cylinder – 75 screen	26 min	33 min	39 min
K cylinder – 112 screen	36 min	48 min	59 min

Source: Dätwyler AG

Assuming a slack time (calculated in minutes) of 5-10 minutes between operations, i.e. engraving, degreasing, chromium plating and polishing and logistics in transporting the cylinders from the engraving department and the press room, the average minimum print run (for 24/6 shift mode) can be calculated.

Table 7.22
Minimum average print runs in DE mode
(using 4 cylinders engraved by DLS)

Pages	4U- 32 pages	6U - 48 pages	8U – 64 pages
Print Run	75 000 copies	70 000 copies	65 000 copies
No of jobs/24 hrs	11	9	7
No of cylinders annually	13 200	10 800	8 400

It is assumed that the average time to process four cylinders, including engraving, chromium plating and polishing must not exceed the time in the DE press (make ready and print run time for the average job), Table 7.22, otherwise the press would be idle and waiting for jobs.

The maximum number of cylinders which can be plated in 24 hours is 48-60 cylinders running two parallel lines. This means that occasionally even shorter runs than those shown in Table 7.22 would be possible with proper planning of the logistics.

The corresponding data using a K6 mechanical engraving unit are shown in Table 7.23. The yellow cylinder is engraved with a coarser screen to accommodate the necessary screen angle difference to the magenta/cyan cylinders in order to avoid a colour shift (a kind of moiré effect).

Table 7.23
Engraving lead time with K6 Mechanical engraving (8 x 7.5 kHz) incl. calibration and loading/unloading of cylinders

Colour	4U- 32 pages	6U - 48 pages	8U - 64 pages
Y – 58 [46]	46 min	57 min	68 min
M, C cylinder – 70	51 min	64 min	77 min
K cylinder – 100	84 min	113 min	142 min

Source: Hell Gravure Systems

Table 7.24
Minimum average print runs in DE mode (using 4 cylinders – K6)

Page	4U- 32 pages	6U - 48 pages	8U - 64 pages
Print Run	160 000 copies	125 000 copies	110 000 copies
No of jobs/24 hrs	6	5	4
No of cylinders annually	9 600	6 000	4 800

In order to accommodate the potential for using the DE-concept for short runs in gravure, the K6 needs to be very much faster than it is today. When comparing the data in Tables 7.22 and 7.24, it is obvious that the DLS offers a higher productivity in the press room and 40-55% lower minimum print runs depending on the signature size. The K6 from Hell Gravure System needs to be very much faster than today, otherwise the potential of the DE-concept for short runs in gravure can not be fully exploited. If future developments of laser technology were to allow higher frequencies, up to 100-125 kHz, or if a more efficient and faster plating technology were to be developed, even shorter runs would be economically and technically feasible in publication gravure.

[46] screen ruling in lines/cm

7.8.6 The Double Ender concept vs. narrow presses

In (Bjurstedt 1986, p. 12), the high speed narrow gravure press was discussed as an alternative to the DE concept in producing short runs. The report suggested that the high-speed narrow press concept should be investigated, but it was, after lengthy discussions in the project group

"decided not to proceed with the cost examination of the high-speed narrow press option, because of the relatively high initial costs in cylinder-making for short run work. The cylinder costs are not linear with the face width of the cylinders although Tandem-engraving is an established procedure……there is no advantage to be had in the capital investment required."

The investigation of modern cylinder processing equipment described in Paper III confirms the conclusion from 1986, i.e. that the linearity of investments in cylinder processing equipment vs. the cylinder face width is very weak. The conceptual constraints remain today, as can be seen in Tables 7.25 and 7.26. Note, that in this model 8 cylinders have to be processed for any print job.

Table 7.25
Narrow gravure press – 32 pages
Engraving lead time with Direct Laser Engraving (140 kHz)
incl. calibration and loading/unloading of cylinders

Colour	4U- 32 pages	6U - 48 pages	8U - 64 pages
Y, M, C cylinder – 75 #	19 min	22 min	24 min
K cylinder – 100 #	25 min	30 min	36 min

Source: Dätwyler AG

Table 7.26
Minimum average print runs in a narrow press (using 8 cylinders)

Pages	4U- 32 pages	6U - 48 pages	8U - 64 pages
Print Run	270 000 copies	225 000 copies	190 000 copies
No of jobs/24 hrs	3	3	2
No of cylinders annually	7 200	7 200	4 800

When comparing Tables 7.22 and 7.26, it is very clear that for producing short runs in gravure, the narrow press alternative is not viable, and it is also evident that the lowest possible average print run is almost four times higher using a narrow gravure press than a DE press. Hence, the narrow press concept can be discarded on a techno-economic calculation. Twenty years ago, in Bjurstedt (1986), the concept was discarded on economical-technical assumptions rather than on factual data. More importantly, more jobs can be printed with a smaller number of cylinders processed with the DE concept.

7.8.7 Best available technology (BAT)

It has been shown in Table 7.22 and Figures 7.7-7.9 that gravure can be very competitive against web-offset down to around 65 000 -75 000 copies, and this concept utilizes not only the DE press capacity but also the engraving capacity to its maximum, and perhaps, more importantly, more jobs can be printed with a low piece cost of the cylinders. The number of jobs has been calculated to be 10-11 per 24 hours which is about 15-20% more than it is possible with comparable technologies.

These new data would open up new markets where the demand of capacity (in terms of paper consumption) is limited to 10 000 – 20 000 tons a year per press. Existing gravure facilities would need to be modernized to the Best Available Technology[47]. As a demonstration of this solution, the break-even zone and the associated "optimum total cost efficiency" press investments can be shown in a table for either the same paper grades (SC and/or LWC) or with SC grades for gravure and LWC for web-offset.

In Table 7.27, the data from 1986 are shown (data from Tables 7.12 and 7.13) comparing a standard gravure press and a 32 page web-offset press (the real break even, i.e. above the point which a print run gravure is cheaper, is shown in brackets in the middle column).

Table 7.27 – Summary of 1986 break-even levels
Gravure vs. Web-offset
Same paper grade for both processes

Pagination	< 100 000 copies	100 – 350 000 copies	> 350 000 copies
16-32 pages	N.A.	DE (> 175 000)	DE/8 UNITS
48 pages	N.A.	DE (> 160 000)	DE /8 UNITS
64 pages	N.A.	8 UNITS (> 230 000)	8 UNITS
96 pages	N.A.	8 UNITS (> 200 000)	8 UNITS

Note, that in 1986 the web-offset presses were limited to 32 pages (single web). It was probably also possible to use the DE concept presses for shorter runs in 64 or 96 pages by running two print runs, and then collating two 32 page (or 48 page) signatures in a post-press operation.

[47] BAT = cylinder processing equal to laser engraving on Zn or K6 engraver (with comparable speed) with fully automated cylinder plating and handling; in the pressroom a modern DE publication gravure press

However, this is only a mathematical consideration, because it has been shown that the cylinder processing was far too slow for these runs. In practical terms, the average minimum levels were about 150 000 - 200 000 copies. It would, of course, occasionally have been possible to run shorter runs, mixing short and medium runs, with proper planning and adherence to tight schedules.

The following table is a summary showing BAT in short runs using the data from 2006 as shown in Tables 7.20 and 7.22. Please note that the left and middle columns only refer to cylinders engraved by laser, Table 7.28 and 7.29.

Table 7.28
Summary of 2006 break-even levels Gravure vs. Web-offset
Same paper grade for both processes

Pagination		**< 100 000 copies**	**100 – 350 000 copies**	**> 350 000 copies**
16-32 pages (32 page press)		N.A.	DE > 110 000	DE
48 pages (48 page press)		N.A.	DE > 115 000	DE
64 pages	(32 page press)	N.A.	DE < 300 000	DE (8 UNITS)
	(64 page press)	N.A.	(DE > 300 000)	8 UNITS > 550 000
96 pages	(48 page press)	N.A.	8 UNITS (> 300 000)[48]	8 UNITS
	(64 page press)	N.A.	8 UNITS (> 300 000)	8 UNITS

It should be noted, however, that these tables show indicative rather than absolute levels. Any printer who intends to invest in short run technology has to evaluate his own market situation, and how the most common signature sizes may influence the break-even levels. Further, the perception of what print quality is expected by the market must be evaluated.

It should also be mentioned that versioning/zoning might be considered also in publication gravure using this concept, because the minimum zoned edition can be about 80 000 copies (for a 16/32 page signature). Zoning, meaning a special geographical or demographic edition, is not yet widely used in Europe, but it is very often used in the US (Coggins 2007 and Dennington 2007).

[48] Estimation (all 96 page alternative) of the average minimum print run for all eight unit gravure presses

Table 7.29
2006 Break-even levels Gravure vs. Web-offset
Gravure using SC grades vs. Web-offset using LWC grades

Pagination		**< 100 000 copies**	**100 – 350 000 copies**	**> 350 000 copies**
16-32 pages (32 page press)		> 70 000 DE	DE	DE
48 pages (48 page press)		> 65 000 DE	DE	DE
64 pages	(32 page press)	> 60 000 DE	DE	DE/ 8 UNITS
	(64 page press)	> 60 000 DE	DE	DE/ 8 UNITS
96 pages	(48 page press)	DE	8 UNITS (> 250 000)	8 UNITS
	(64 page press)	DE	8 UNITS (> 250 000)	8 UNITS

A publication gravure printer specializing in short runs using the DE concept in combination with the fastest available engraving system would be able to produce 15-20% more jobs than using the mechanical engraving systems typically used today by the industry. The advantage of being able to produce signatures economically down to 60 000 -70 000 copies would open up new market opportunities, and achieve a sustainable competitive advantage. A publication gravure printer would need such as system as a complement to the existing equipment.

Further, it should be emphasized that when printing 60 000 -70 000 copies as an average, such as press would “consume” about 13 000 cylinders, which constitutes a complete cylinder processing department adjacent to the press. The total investment (press and cylinder-processing equipment) is estimated, however, to be in the same vicinity as that of a 64 page commercial heat-set web-offset press (with the ancillary equipment included).

The data in Table 7.29 suggest that gravure is competitive using any paper grade, LWC or SC grades. Gravure has the advantage of having a greater colour gamut, even though the present ISO standard uses a more limited colour gamut (i.e. the offset colour gamut) (ISO 12467-4). In the gravure press room, in contrast to to a heat-set web-offset press, one may use LWC, SC or even MF grades with standard inks in combination with alternative extenders (pigmentless inks). In most web-offset printing operations, all the inks have to be changed when going from one paper grade to another, with extensive and time-consuming cleaning between each job.

7.8.8 Plant layout and staffing considerations

However, in order to be successful in running very short print jobs in gravure, it is necessary to have a tight integration between the engraving department and the press room. Logistics demand that the distance between the two departments is limited, and that they are for example located in adjacent rooms. This might be simplified by the fact that the space needed for a 2.5 m, 4 unit DE gravure press is quite small in comparison with a standard gravure press or a 48-64 page web-offset press. Hence, it should not be impossible to plan these departments to be adjacent to each other. Other considerations are planning, staffing and management. The department could be run by a common management having an integrated computerized planning system and a crew trained in both areas. Staffing of such a combined department should not require more than 3-4 persons per shift, assuming that suitable cross training is provided.

There are only a few manual operations in the entire gravure process of both cylinder processing and press operations. In the cylinder-processing department, the manual operations are limited to the occasional control of cylinder surfaces and measuring tolerances. In the press room, there are a few more manual operations; paper reel handling prior to the press including splicing preparations and paper feeding into the folder, and finally proper cleaning of the units from time to time. The full automation of paper handling is the same and independent of the printing method used. It can be assumed, however, that with very short print jobs in gravure, cleaning can be done at suitable intervals, i.e. once per shift rather than between each print job.

7.8.9 Make ready procedures in short runs

The second important issue for short runs in gravure is related to press make-ready time. There are schemes used in other industries, e.g. machine tools and associated industries, which may be relevant to the printing industry. The schemes, QCO[49] or SMED[50], are helpful if the printer has older equipment without automation of cylinder loading/unloading and/or automatic presetting of colour register and folder. Single Minute Exchange of Dies (SMED) is an approach to reduce output and/or quality losses due to changeovers. The method has been developed by Shingo (1985), and has proven its effectiveness by reducing changeover times from hours to minutes in the automotive and machine tool industries. *"The flow must go on"*, was Shigeo's reaction when he witnessed change over times of more than 1 hour. He developed a method to analyze the change-over process, enabling local personnel to find out for themselves why the change over took so long, and how this time could be reduced. In those many

[49] QCO – Quick Change-Over
[50] SMED – Single Minute Exchange of Dies

cases, when change-over and setup times can be reduced to less then ten minutes, the change-over time is expressed with a single digit. Hence, the method is called *"Single Minute Exchange of Dies or SMED"*.

Already in the middle of the 1980's, a KBA gravure press equipped with automatic loading/unloading of cylinders was commissioned by Dai Nippon Printing in Japan (ERA List of Presses 1986). The print-ready cylinders were stored in an automatic cylinder rack, and when the new job was called by the press crew, cylinders were retrieved and loaded into the press without manual intervention.

The situation with modern publication presses, both gravure and heat-set web-offset, is quite different. Since 1995, most installed publication presses are equipped with automatic loading/unloading of cylinders and plates. Running occasional short runs[51] with the Double Ender is, of course, possible without automatic loading/unloading of cylinders less than 2.75 m face width. Data provided on make-ready times by the press manufacturers can be found in Table 7.30.

Table 7.30

Press room activities	**Activity (min)**
Loading/unloading cylinders	< 5 min
Cleaning	10 min
Register settings (automatic)	----
Folder settings (automatic)	----
Doctor blade change	< 5 min
Webbing up – new paper grade	5-10 min
Press acceleration (ramp up)	< 5 min
Subtotal – total change	**< 30 min**
Subtotal – partial change	**< 20 min**
Subtotal – consecutive signatures	**< 10 min**

However, if short runs are to be the norm rather than the exception, an automated process is indispensable. Table 7.30 suggests that it may be possible to change a printing job in less than 10 minutes provided that some activities are done in parallel (and others omitted for very short runs and/or consecutive signatures). The most difficult activity to automate is the cleaning process, both from inks in the units and from paper dust in the folder. The frequency of cleaning depends on the quality of the inks (ink dust) and on the paper grade used.

[51] Short runs - see definition in Table 7.10

Available industrial data on short make-ready on a non-automatic eight unit gravure press, 2.5m web width or 64p/96p, suggest about 1.3 hours for a quick change over (Sundell 2006). This represents change of format, paper grade, fresh inks and new doctor blades in all units, as well as cleaning of impression rollers etc. These activities require a very flexible and well trained press crew with occasional support during the make-ready process from members of other press crews.

Change-over schedules may, however, if there are consecutive signatures (of the same title/product), be somewhat shorter, about 30-45 minutes, and changing only the two text cylinders might take less than 10 minutes. There are, nevertheless, very little open data available (Ibid.). Is it possible to achieve a job change in less than 10 minutes in publication gravure? Probably, but there are some preconditions:

- Predictable and repeatable cylinders – the most important feature
- No cleaning between short jobs
- No change of doctor blades between short jobs
- Same paper grade (width and grammage)
- No waiting for customer acceptance
- Automatic product size settings adjustments (e.g. from 4U to 6U) in the folder
- Five minutes ramp up time of the press to first saleable copy

7.8.10 Press variables in 1987 and 2006

From a study in 1987 (Wilkinson 1987), some quantitative data are available concerning the gravure press variables of that time. Corresponding data have been collected (Paper VI) for modern gravure presses, and the following tables have been computed – Tables 7.31 and 7.32.

Comparing the two tables, it is noticeable that considerable improvements in press automation and process control have taken place in 20 years. Waste figures have been reduced by 40-50% depending on the print runs, and the make-ready time has been reduced by 75%.

All these factors have contributed to improving the up time in the press room. More importantly for the short runs in gravure, however, is that the performance of the DE press is equal to a straight eight unit gravure press, which clearly was not the case in 1986.

Table 7.31 – Press variables in 1987

Configu-ration	Web width (cm)	Make Ready (wasted copies)	Printed waste (%)	Speed revs/hr	Effici-ency (%)	Make ready (hrs)
Narrow press (16p-2up or 32p)	120	5 000	6	42 000	80	3
Standard press (32p-2up or 64p)	240	5 000	6	42 000	80	3
Standard press (96p and 6U)	240	5 000	6	28 000	80	3
DE (16p-2up or 32p)	120	6 300	8	42 000	75	3
DE 48 pages (6U)	120	6 300	8	28 000	75	3.5

Wilkinson 1987

Table 7.32 – Press variables in 2006

Configu-ration	Web width (cm)	Make Ready (wasted copies)	Printed waste (%)	Speed revs/hr	Effici-ency (%)	Make Ready (hrs)
Narrow press (16p-2up or 32p)	120	1 500	2.5	56 000	85	< 0.5
Standard press (32p-2up or 64p)	240	1 500	2.5	56 000	85	< 0.5
Standard press (96p and 6U)	240	1 500	2.5	37 000	85	< 0.5
DE (16p-2up or 32p)	120	1 500	2.5	56 000	85	< 0.3
DE 48 pages (6U)	120	1 500	2.5	37 000	85	< 0.3

KBA (standard press)/Cerutti 2005/2006

Considering printing short jobs with an average of 80 000 copies in a modern DE press, the waste figures in Table 7.32 indicate a paper savings on an annual basis of more than 1500 tons of paper in comparison with those achievable in 1987. In monetary terms, it would mean savings of close to 900 000 € in paper waste (in January 2007, the German market price for 56 g/m^2 SC grades was approximately € 590 per ton – Euwid 2007), which does not include additional losses in ink costs and/or press capacity in comparison with 1986.

7.9 Towards a totally integrated industrial process!

Ollech (1993, p. 36) described the process of automation and computer-integrated manufacture in gravure technology. He suggested that the gravure process was a printing technology which would in a few years be computer-controlled and to a large extent automated. He also stated that gravure was probably the only printing process which lent itself to advanced automation. This might have been true in the beginning of the 1990's, but with the developments in personal computers and software technology and with cheaper and more powerful processors, all printing technologies have benefited from automation and computer-controlled workflows.

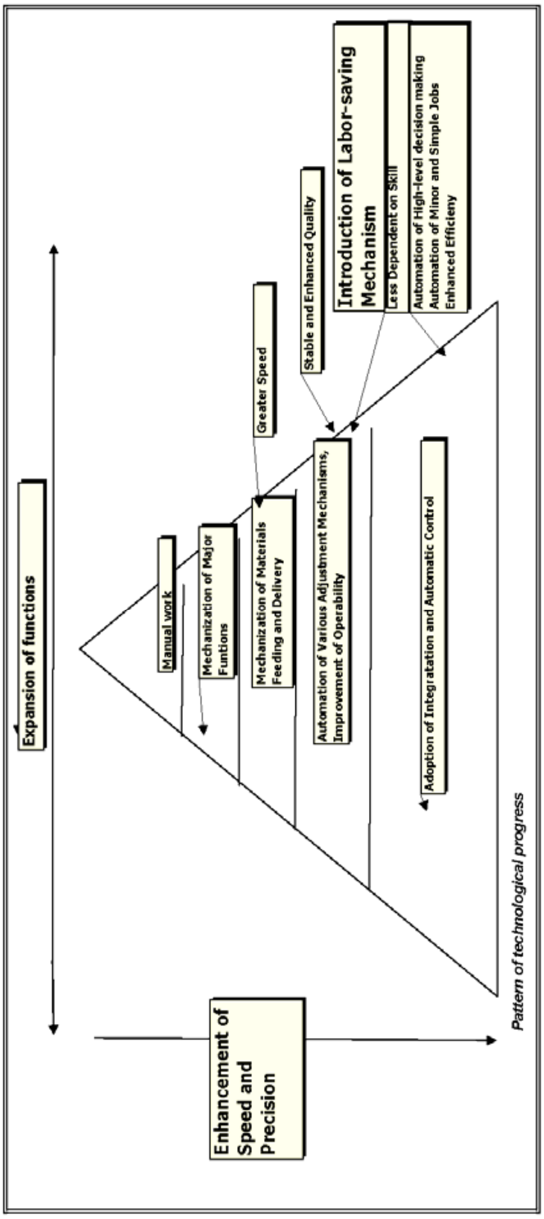
Yamauchi (1991), describes the process of automation in any industry going from manual working practices to a higher and higher degree of automation, until the fully automated factory is implemented, Figure 7.10.

There are – as shown in the previous section - only a few steps missing in the integrated industrial printing process, although heat-set web-offset is currently slightly behind contemporary gravure technology. Lithography still lacks the control of the water-ink balance, whereas keeping the colour values constant during a gravure run has always been a simpler problem. In both the gravure and web-offset press rooms, full automation of a loading/unloading of cylinders/ plates has been available for considerable time (Paper IV and VII), and the automatic change of printing forms is standard procedure.

All equipment in the cylinder processing department is networked, and the network should be extended to include the press control systems. A major step forward in the gravure process would be an integrated software solution which includes both the engraving and the press room operations. There is very little time available between the jobs, and this means that automation and advanced computer process control are necessary.

It is, however, questionable whether all paper reel handling can be automated, i.e. removal of the packaging and reading/checking the manufacturer's barcodes.

Figure 7.10 – The steps to full automation



Source: Yamauchi 1991

The same must be said about cleaning the press units (and folder) and occasionally changing the doctor blades. Even if some of the cleaning, i.e. cleaning[52] the

[52] Cleaning means in this context removing the residual ink from the cylinder faces

cylinders after finishing the job, can be automated, there are other elements in the press which still need manual intervention. Hence, there is still more work to be done before the publication printing process, whether web-offset or gravure, can be fully automated.

7.10 Final remarks on competitive strategies

In Paper VI, it was shown that gravure print quality on SC grades can be at least as good as heat-set web-offset print quality on LWC grades. It is of course an important economic advantage for both print buyers and printers to be able to use an uncoated stock instead of an LWC grade. This is also supported by comments from the magazine publishers and catalogue buyers in Paper VII. Furthermore, it was stated in Paper VI that the key to future success for shorter runs in gravure printing lies in the cylinder-making process.

One may add that not only are low investment costs necessary, but more importantly, a technical solution which is automated, reliable, predictable and repeatable is needed. Such a solution would also enable the smaller and/or medium-sized gravure printers to process gravure cylinders almost as inexpensively as web-offset plates, provided that the volume is there.

The main question is; does such a solution exist? The DE concept in combination with Direct Laser engraved cylinders is worth exploring not only for the small and medium-sized printers but also as a complement to larger printing companies to meet the demand for smaller signatures, covers or other speciality products printed in gravure. In 1986, the ERA Working Group concluded by saying (Bjurstedt 1986) that *"These figures obviously prove that there is large untapped market available to gravure printers, provided they are prepared to organize themselves to attack these sectors. We have shown that gravure can be cost competitive for short print runs, but in addition we should not forget that gravure gives the print buyers other advantages."*

It is important for the future of the gravure process that there is a close cooperation and understanding between the gravure press and the cylinder equipment manufacturers, for example for press manufacturers to understand the economics of gravure cylinder processing. In 1987, the following statement was made. It is still valid and possibly of great interest for smaller gravure printers:

"In those cases where only a small capacity in gravure is required, then the DE machine is the most economical investment. It also permits the lowest possible next investment step that is, retrofitting to 8 units when the extra capacity is needed." Wilkinson (1987, p. 10)

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8. Conclusions and discussion

The research questions in this study are:

- How has the European publication printing market changed between 1985 and 2006?
- How has the balance between the two competing publication printing techniques, gravure and web-offset, changed between 1985 and 2006?
- What have been the main driving forces determining the developments of these processes and their competitive strengths?
- Is gravure a printing process suitable only for very large runs, for huge volumes and for large markets?
- How can the competitiveness of publication gravure be improved?

Based on the results of the investigations reported here, the research questions are discussed in the following:

8.1 How has the European publication printing market changed between 1985 and 2006?

The investigations reveal that the total volume of the publication industry has grown about 2.5 times between 1985 and 2006 from 5 million to almost 13 million tons of paper, and this volume is divided into three large segments, magazines, catalogues and inserts. The total publication market in Europe is estimated to be €38.2 billion in 2006, of which magazines and catalogues are about 65%. Detailed data about inserts and other commercial products is, however, very scarce.

The magazine market is the largest of the European publication markets. In 2006, the estimation of the magazine market was 45% of the total publication market or €16.5 billion. Since 1991, the magazine market has grown substantially with about 30% more titles in the segment of medium to large titles compared to 2005. In the smaller circulation segments, however, there has been an even higher growth of titles, but these segments have traditionally been of low interest for the publication gravure printers. Since 2002, however, the segments of medium to large titles have shown a decrease in print runs and volume, and the growth of new magazine titles is in the lower circulation segment. Magazine publishers can create new titles and/or editions at substantially lower costs than in the past, thanks to desktop publishing and digital photography. Time-to-market has become very important – the shortest possible lead-time from the last editorial page until the first saleable copy at the retailers or subscribers.

The second important publication market, the catalogues, had in 2006 a volume of €6.4 billion. During the 1990's, the volume of catalogues grew substantially, particularly in Germany, when the former East German state was integrated. The consolidation process among the mail-order catalogue producers has been very strong during the 1990's, and the major companies in the market are now fewer but larger. Hence, their buying strength has improved, and these groups are already substantially larger than their printers/suppliers.

Since the beginning of the 2000's, the large-run and high-volume catalogue titles have, with some important exceptions, stagnated. Some of the major catalogue producers have decided to split their products into smaller but more frequent editions.

Hence since 1986, the publication industries have increased substantially in both volume and number of titles and/or editions, but the average print runs have been reduced.

8.2 How has the balance between the two competing publication printing techniques, gravure and web-offset, changed between 1985 and 2006?

In 1986, the estimated market share of publication gravure was 65%, and was dominating the European markets. The balance has swung from this distinct advantage for publication gravure printing at the end of the 1980's (or the beginning of 1990's) to a total domination of heat-set web-offset during the second half of the 1990's. In 2006, the estimated volume of heat-set web-offset was €27.7 billion or 61% of the total publication market, but there is unfortunately no data available on the corresponding value from 1986.

The commercial heat-set web-offset market in Europe is, however, very fragmented. Due to over-capacity in many markets, a consolidation process has just begun, e.g. in Germany with the Arquana AG who in 2005/2006 has acquired a number of small to medium-sized German web-offset printers. There are only a few large companies in the commercial web-offset market in Europe, such as Arvato (Bertelsmann) in Germany, Quebecor in the UK, France, Spain, Austria and Sweden, Donnelley in the UK and Poland and Pozzoni in Italy.

The consolidation efforts in the gravure printing market were substantial in the 1980's, e.g. when Robert Maxwell personally restructured the British publication printing market and created the Maxwell Communications Corporation (MCC). Part of this group forms the Polestar Group Ltd, which in 2006 was the second largest publication printer in Europe. Maxwell's influence of power was instrumental also in the US publication market, and part of the former MCC operating in the US was taken over by Quebecor.

Since the end of the 1990's, however, there have been further consolidations in the publication gravure industry, in particular in Germany with the creation of Prinovis. Late in 2006, the schlott gruppe acquired the Dutch gravure printer, Biegelaar & Jansen, and the group is said to be the number two in Europe, taking over this position from Polestar. The ten largest publication gravure printers in Europe cover 75-80% of the publication gravure capacity, and some of the older press capacities have been shut down in an attempt to improve the supply/demand balance in the market. There is still, however, old and ageing gravure equipment which needs to be replaced by more efficient, but not necessarily higher, capacities. This need is very apparent in the cylinder-processing departments. The European publication gravure market would need strong leaders in order to achieve this long needed consolidation and changes.

8.3 What have been the main driving forces determining the developments of these processes and their competitive strengths?

There are many driving forces which have influenced the rapid development of commercial heat-set web-offset. In the prepress area, heat-set web-offset has been supported by other segments of the lithographic printing industry – cold-set web-offset printing for newspapers and sheet-fed offset press for general purpose printing – which accounted for 55-60% (or €233.5 million) of the total volume of printing in 2005. This makes offset four times as large as gravure, which means that the main efforts for most equipment suppliers are linked to lithographic technologies. This is very obvious in the North American markets with their large domestic prepress suppliers in this segment, but also to a large extent in Europe and Japan. Considerable competition in offset printing with large international markets, including newspapers and general purpose print, has lowered the investment barriers for those printers and allowed a more frequent renewal of existing lithographic press units, prepress and plate processing equipment.

Postscript Level 2, (in 1992), Postscript 3 as well as the PDF file formats have made it possible to produce high-quality colour using desktop publishing software programmes outputting to large film-setters with imposition and pre-flight programmes. Desktop publishing, allowing the easy composition of colour pages for magazines or catalogues titles was a prerequisite for the transformation of heat-set web-offset. The use of UCR and GCR has made it possible to increase the speed in all offset printing without being hampered by ink trapping. From the middle of the 1990's, CTP technology, with new lithographic plates suitable for very long runs, has been instrumental in the design of larger web-offset presses up to 64 and 80 pages in A4. New pre-proofing standards are based on low priced standard ink-jet printers with advanced colour management programmes, simple and rather inexpensive.

One of the most important drivers has been the rise of a new generation of heat-set offset presses. In the beginning of the 1990's, the Sunday Press, designed and developed by Harris Corp. in the US, made it possible to increase web speed by 100% (from 1 500 to 3 000 fpm ??? what is fpm? feet per minute). The main design feature was the elimination of the blanket gaps, as the old design of the blankets was replaced by sleeves. The competition developed other solutions such as the mini-gap. New folder designs, emulating the gravure folders with grippers rather than pins, reduced the paper trim margins significantly, and these folders made it possible to print at much higher press speeds with reduced waste.

Furthermore, the vast majority of research efforts in media and print technologies in the academic world are devoted to lithographic printing. The second largest area is flexographic printing followed by digital printing methods. Gravure technology is taught in very few universities and colleges in Europe and North America, and the research area is rather limited. The two major suppliers of cylinder-engraving and cylinder-plating equipment for publication gravure are very small in comparison to the major global companies present in the lithographic markets. Hence, the investments in lithographic technologies have been and are substantially higher than those in gravure technology, even when packaging gravure is added to those investments. Nevertheless, in the cylinder processing business, packaging gravure is about three times larger than publication gravure and the major investments in new laser technology have been carried out by gravure cylinder service companies in Europe and overseas. These companies are working in a very competitive market segment and are serving the packaging gravure printers and their need for high quality ready-to-print cylinders.

8.4 Is gravure a printing process suitable only for very large runs, for huge volumes and for large markets?

The investigations presented here indicate that these perceptions are widespread and the dominating opinion both in the industry and in the literature for higher education. Modern gravure press designs are made for those printers working on the larger European[53] markets, and there are no commercially viable alternatives for small or medium-sized gravure printers with a limited demand of increased capacity. The only alternative is to find a second-hand gravure press which is relatively inexpensive, 10-15 years old, runs slowly and is less productive. A new publication gravure press is typically configured to print 96 pages in A4 format (360-370 cm width), and very few smaller publication gravure presses have been sold since 2000.

[53] In the markets outside Europe, the most modern publication gravure presses installed since 2000 all have a web width of less than 300 cm

The capacity for a 96 page gravure press is about double in paper volume in comparison with a 64 page commercial web-offset press running similar paper grades with a similar shift structure. However, in the segment of the commercial web-offset press market there are several large manufacturers, and the competition between these is fierce. A strong competitive market means emphasis on improvements in technical performances and pressure on the pricing policies. There are also many different alternatives for the potential buyer, the printer. For example, there are at least five different steps in capacity, from a 16 page to 80 page configuration going in increments of 16 pages, and the printer has the possibility of choosing the capacity he needs to meet the demand of his particular market.

Markets such as those in the Nordic countries, Switzerland and other smaller European countries seem to be on the verge of becoming void of publication gravure printers, as the gravure printers still active in these markets either go out of business or switch to heat-set web-offset. Hence, this belief that gravure is only for large markets and large printers may be self-fulfilling, as no alternatives for a small or medium-sized gravure printer are available.

Unless the publication gravure industry realizes that the once dominating printing technology must change very rapidly, there will be only a few large companies serving the European markets. Hence, the supplying industry will of course recognize such signals, and future investments in publication gravure technology will be scarce. Heat-set web-offset, on the other hand, may enjoy a further expansion at the expense of gravure.

8.5 How can the competitiveness of publication gravure be improved?

There may, nevertheless, be an alternative for those printers working in the smaller markets to make publication gravure competitive on very short runs, which have previously been the exclusive domain of heat-set web-offset printers. The combination of fully automated Double Ender publication gravure presses and Direct Laser Engraving Systems has the potential to produce print runs as low as 70 000 – 80 000 copies which is almost unprecedented in the modern history of gravure[54]. If the Direct Laser Engraving Systems could improve their productivity by 30-40% and become almost as fast as offset plate-making per square meter, publication gravure could become the printing technology of choice and the state of art technology in the printing world[55].

[54] Prior to the 1970's, such runs were not uncommon in the Nordic countries
[55] Such a performance may be possible in 1-2 years

Other favourable developments for publication gravure printing would be to find a more environment-friendly (and energy-conserving) substitute for aromatic solvents. With such developments, which it is not impossible to achieve, publication gravure could open up completely new markets in Europe, the Far East and the Americas, and old and new customers in the market would enjoy:

- Flexibility in choosing the right format for the product to be produced
- Flexibility in choosing the right printing substrate ranging from newsprint to coated grades
- Superior image quality with continuous tone (=photographic) properties
- Short lead-time to the first printed copy
- A “green” printing process with a minimum of waste, little or no emissions of VOC, low level of energy used and recyclable end products

For the publication printer there are yet further benefits, such as:

- Gravure is technically the most simple printing method and the most consistent with only minor deviations during the print run; hence a consistent product and print quality can be assured
- Gravure may offer a higher web-speed than heat-set web-offset
- Print runs in gravure down to 35 000 - 40 000 copies can be both financially and technologically competitive to heat-set web-offset
- Publication gravure might possibly even be a serious alternative for medium-sized newspapers. Newspapers could use their excess capacity for many commercial high-quality products which it is not possible to print in an ordinary cold-set offset press.

8.6 Discussion

The European publication printing industry has undergone profound changes since 1986. The total volume of the publication printing market has grown almost three times, and there has been a strong technical development in all production processes. The starting point was digitalization in preparing the pages for magazines, catalogues and other printed matter. In the past, prior to the 1990’s, these preparations were the domains of the printers. With the emergence of desktop publishing software products in the early 1990’s, this process became so much more simplified that it was transferred to the customer.

The relative ease of creating new editions of magazines and catalogues has changed the way the publishing industry used to work, and impacted the relationship between the publication printing industry and its most important customers. The lithographic printing industry, including newspapers, sheet-fed offset printers and commercial heat-set web-offset printers, has gained the most of these processes, because prior to the desktop publishing revolution only the relatively large publication gravure printers could afford the investments in turning the previous analogue processes in prepress and engraving to an all digital process.

The publication gravure industry was still strong in the beginning of the 1990's, and not until the emergence of a new generation of commercial heat-set web-offset presses in the middle of the decennium did the pendulum swing in the other direction. However, the gravure industry was rather slow to respond and, in order to become more competitive, gravure printers invested in wider and faster presses, going from 300 cm to 360 cm during the second half of the 1990's. Paradoxically, it has been shown that the minimum average print run increased during 1990-2000. When the production time to produce a certain print run in the new gravure presses became shorter and shorter, the lead-time for producing eight cylinders was still the same. Hence, the minimum average print run increased, although it was possible from time to time to produce shorter runs – but only if those were compensated for with correspondingly longer runs. This became the state of art although the digital engraving process became much more stable and made the gravure proof obsolete. It was until the beginning of the 2000's that faster engraving heads and more automated plating equipment became available for the publication printer. Nevertheless, the publication gravure presses simultaneously also increased their productivity, which in effect meant that the minimum average print run could not decrease.

However, in the offset field things were quite different. Simultaneously, the CTP technology in combination with long run lithographic plates became a reasonably inexpensive and a superior solution for those printers active in the publication printing business. The ease of handling a CTP plate-setter and ancillary equipment for web-offset plate-making in comparison to that of managing a gravure cylinder-processing department should, from a user's perspective, not be underestimated.

Since 2000, investments in commercial web-offset have been huge, and only 20-25% of the total investments in the publication printing industry have been devoted to gravure. The major beneficiaries of all these investments have, however, been the customers, publishers and catalogue buyers. The cost of producing a 64 or 96 page signature has been reduced by 30% in gravure and almost 50% in heat-set web-offset since 1986 in nominal values (not taking inflation into account), and customers of the publication markets are expecting similar reductions also in the future. There has been a buyers' market for quite some time, and this situation will not change in the short or medium terms. The balance between the demand and supply is, and will continue to be, in the favour of the customer. Although many of the small to medium-sized commercial web-offset printers are family-owned businesses, it is expected that professional leaders and managers will supersede the family interests when these companies are growing. It is also expected that further consolidations among gravure printers will take place, because it is suggested that company size has to balance the improved buying strength of the customers, but what will happen to the very fragmented web-offset market?

The buying pattern and habits of the general public are of great interest. Emerging technologies from electronic media, the Internet, will most probably have an impact on consumer behaviour and their buying pattern. Targeting and versioning of magazines may become important also in Europe (as it has been for a long period of time in the US). Although the forecast for European magazine publishing suggests a moderate growth, there are other factors to consider. Spending on media advertising will be one of the most important factors affecting future magazine publishing activities. Will printed matter keep its attractiveness to the general public or will reading habits decline? All these changes will affect the magazine printers, and enable those printers specialized in handling smaller runs and split editions to be successful. The catalogue market, as a whole, will most likely show a modest to stagnant growth. Will the printed catalogue lose in importance in relationship to the Internet? These changes are very new, since 2005, and it is premature to forecast the medium to long-term impact on the publication printing market. Printers, active in the catalogue printing markets, will have to be very adaptable and flexible in their production processes, and it is questionable whether the new superwide gravure presses will be flexible enough to meet those demands.

The third segment of publication printing, inserts, is heavily dependent on advertising revenues from the larger retail chains. Changes in advertising legislation may change the media blend of the larger retail chains, which would mean moving some part of the printed volume to commercial television and/or mobile media channels. It is then likely that the major change will be in the pagination of the printed inserts rather than in the frequency of the print runs.

A substantial over-capacity in print will, nevertheless, continue and it is likely that the publication printing market will be more fragmented with strong demands from its customers for much shorter lead-times, on high print quality and further pressure on prices. The competition between publication printers will be fierce, but there is, however, a window of opportunities for those printers offering expanded services in logistics and/or enhanced price/performance ratios. It seems, however, that the future growth will be very limited at best. To survive in a printing market with more supply than demand, a printer must continuously invest in faster processes and/or new equipment to maintain his competitive advantage. Investments in new technology and/or equipment have to be financed, and both printers and investors must have faith in the future of the industry. The decline of the European publication gravure industry since the beginning of the 1990's is strongly related to the slow and expensive processing of gravure cylinders, which does not compare favourably with that of lithographic plates. In order to cope with the demands from the customer for shorter lead-times between submitting the data to the printer and receiving the first printed copy, the manufacturers of engraving and plating systems have to develop both faster and yet less expensive engraving processes. There is a need in the European gravure publication printing industry for a strong leadership with entrepreneurial skills who can turn these ideas into reality now when they are becoming available. Forecasts for 2010, however, made by several consultancy organizations suggest that the dominance of web-offset will be even stronger, close to 75% of the European publication printing market.

The Direct Laser engraving in combination with a Double Ender gravure press is a starting point, financially and technically in the right direction. Nevertheless, more efforts towards a further reduction of the lead-times are needed to become even more competitive on even shorter runs. The Double Ender gravure press has other advantages, because it can be configured to fit the need of the customer very precisely e.g. from 32/48 pages, 40/60 pages and 48/72 pages and up to 96 pages in 8U, very much like the heat-set web-offset alternatives. Finally, the capacity can of course be doubled, at a reasonable investment, when four more units are added making an 8 unit straight gravure press.

One customer has already been offered this solution. It is, however, premature to say whether the concept is going to be accepted; it has to be tested and proven in an industrial environment, both economically and technically. If it is proven to withstand those demands, the competitiveness of publication gravure in shorter runs will be restored. The small and medium-sized gravure printer then has an alternative to commercial web-offset.

Are we soon going to witness a paradigm shift in the technology of producing magazines or catalogues? The publication gravure industry will have to change *"from skilled craftsmanship to an industrial process"*, and the re-engineering of the value chain must be addressed and solved. The aim of the production process is to produce the first saleable copy without manual intervention – faster and with less waste than ever!

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CONVERGING TECHNOLOGIES IN PREPRESS FROM 1980 TO 2003

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Keywords: Computer, Composition, Desktop, Postscript, Digital, Analogue, Prepress, Colour scanner, Typesetting, Paradigm

Abstract

The author suggests that there has been three paradigm shifts during the 20th century. The first shift was at the turn of the 19th and 20th century, when the first modern typesetting technology was introduced. The new technology, the first major step since the invention of loose types by Gutenberg in the 16th century, became the most important contribution to mass market circulation of newspapers, magazine, textbooks, books and other publications during the years to come. This paper presents the major shifts in prepress technology during the last 30 years and in particular what happened during the last decade. The line casting technology was more or less unchanged during the first half of the 20th century, and only a few technical changes, such as the introduction of punched paper tapes after WW II, improved the productivity of the technology.

A major step forward came when the first affordable computers were introduced on the market, such as the PDP-8 from Digital Equipment Corporation (DEC) in 1965. But there were many forces who wanted to suppress the new technology. Despite strong union opposition, however, the second paradigm shift became a reality when computerized front-end systems for newspaper and other publications were introduced in the end of 1970s.

At the end of the 1980s, publishers were looking for cheaper and more efficient production methods, and the third paradigm shift happened with the introduction of DTP (desk top publishing), which soon became the only possible front-end technology. To-day, the Apple Mac is still the most popular technology in the publishing market, but Adobe Systems Inc. – the inventor of PostScript and PDF-technology – is the new giant.

Previously, many customers were complaining about the lack of competition and industry standards in the front-end market. Now, Adobe has created a de facto world standard with the PDF-process, which is also backed by the ISO. A new monopoly in the front-end technology has been created by default. Never before has one single company been in a similar position in the graphic art industry. For this industry it is like falling from the frying pan into the fire!

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1. Introduction

The author suggests that there are three paradigm shifts during the 20th century. The first paradigm shift was the invention and patenting of the first line casting machine by Otto Mergenthaler in 1884 (Fuchs, 2001). His invention had a slow start but made a significant change to the industry. When later the first large customer – The New York Tribune editor-in-chief saw the machine he exclaimed: "you just cast 'A line of type' " which later became one of the most well-known trade-marks in the printing industry. Its impact on the mass media production at the turn of the century should not underestimate. The invention made typesetting less a craft for a few skilled craftsmen and more of an industrial process producing text for the graphic art, and it was the single most important invention since the loose types were introduced by Gutenberg in the 16th century. With the Linotype machine the output of composed text increased by a factor of ten.

The second paradigm shift started with the emergence of computer technology in the industry in general in the beginning of the 1960's. The technical convergence started going from analogue to digital processing, but up to this point there were no straight lines of development. All production processes in the printing business were entirely analogue. Letterpress technology still dominated; and more than 50% of all printed matters were produced by this technology. Soon industry leaders were looking for new technologies, in particular in the composing area, as faster, more productive and cheaper methods for text production were needed. Another important factor was the need for better quality of images – both b/w and colour – hence the demand for more modern printing technology was growing. The industry was looking for new technologies, in particular phototypesetting, as higher production capacity for text production was needed as well as the need for more advanced printing methods than just letterpress. These new methods needed photographic based originals rather than lead, and new typesetting methods were invented to respond to the demands. Some inventive Americans realised that the newly invented computer technology could also be used in the composing area.

Up to this point the most limiting factor for the productivity of composing was the input of either keying in characters manually or using punched tapes (including formatting instructions) controlling the typesetters. The first applications emulated the old technology (line casting) and were used only for very complicated text (tables etc). The latter could increase the speed by a factor of 1.5-2 at a maximum – still emulating the old line casting technology. Many new composing systems were developed using the newly marketed mini-computers, such as the PDP8 from Digital Equipment (DEC) and others. These computers could process raw text input and produce hyphenated and formatted text for the phototypesetters. Without the need for manually formatting composing instructions, the speed could now be more than doubled, but basically these could only produce galleys of text. More important, however, the use of typeset text for other purposes, such as directories and price lists being manipulated by computers, was now viable and economically possible.

The third paradigm shift started in 1985, when the Apple Macintosh was introduced to the graphic art market. The information flow was already to a great extent digital even if film was still the preferred media as an intermediary process to produce plates or gravure cylinders. In the middle of 1980's, when large newspapers started to produce many more colour pages, the demand for systems which could integrated both colour and text, became urgent. The reason was mainly the growing markets in colour TV and hence colour advertisements, to which publishers had to respond. New press capacity was added and the colour content increased quickly. Some publishers invested in high-end colour system, but they soon found out there was a lack of integration between the editorial text systems and the colour systems. They started to investigate other and cheaper solutions.

What Apple and Adobe could offer the publishing world at the end of the 1980's was not entirely clear to most contemporary industry leaders. What they overlooked was that the main emphasis for the newcomers was not the very top of the professional graphic art market, but the major part of the publishing markets as well as the consumer and industrial markets. This single factor made the development of this new technology a completely different business, and contrary to what most other competitors in the graphic art industry were used to. Suddenly these key suppliers to the graphic art market did not have only a few hundred customers, but they could be counted almost in the millions. With these vast markets in sight companies like Aldus, Adobe, Quark and others began to improve the quality of their product line, and they grew fast. Within less than a decade these companies were dominating prepress market and most of the traditional graphic art suppliers were defeated and gone. The converging technology was here!

2. Paradigm shift in the early 80's – analogue vs. digital technology – analogue film vs. digital technology– diverging technologies

The invention of the line casting machine made a great impact on the industry. It made it possible to produce the real mass communication media – newspapers, magazines, books and textbooks etc. – for several decades at reasonable cost and speed. The technology and indeed the fonts (types) produced by Linotype (Linotype Library, 2005) made a virtual standard and per se monopoly. The production output in comparison to the previous manual method was increased by a factor of ten, and tens of thousand of units were sold world-wide in a few years.

Among a few competitors were Monotype (basically for headlines and more advanced composition) and Intertype, which essentially was a copy of the Linotype unit ("invented" after the patent protection ran out). All these used, of course lead (or more accurately a blend of lead, antimony and tin), or hot metal composing which became the correct expression. Both Linotype and Monotype could still earn much more money because the matrixes which formed the types in the composition processes wore out after a certain time and needed to be replaced. Servicing and maintaining hot metal typesetters became an industry of its one. Sometimes new type faces were introduced which also added to the investments in the industry.

Some concerns about the occupational health of the workers sitting close to hot metal fumes of heavy metals (lead is very dangerous to the health) in the composing rooms were raised with increased awareness in the early 1950's. The high costs of service and maintenance of the typesetters added to the efforts to break the monopoly of Linotype. Hence, the second paradigm shift came about with the growing use of computer technology in the beginning of the 1960's for industrial purposes. The graphic art industry was slowly coming into the digital age – using digital data instead of previous analogue working methods – which was a necessity for the convergence of the present technology.

Would phototypesetting be the answer to these problems? Many leaders in the industry were looking for new technologies, in particular phototypesetting, as higher production capacity for text production was needed as well as the need for more advanced printing methods than just letterpress. Letterpress was still the dominating process, and more than 50% of all printed production was produced by this technology. Nevertheless, the quality of images and indeed the speed which could be managed by letterpress technology were very limited. Simultaneously, the fast growing TV industry challenged the traditional publishers of printed media, and the need to improve the printing processes became a very important factor. They were competing fiercely in the mass media markets both in Europe and overseas.

The first attempts to produce a phototypesetting device were made by companies like Lumitype (later Photon), Linotron and others (May, Wrightson, 1986). These responded to two demands – to increase the possible output by a factor of ten or more, and more importantly to break the monopoly of Linotype. A third fact was the growth of other printing processes than letterpress such as offset and gravure, in particular web fed production, for the emerging mass circulation markets for magazines and catalogues. These two processes both demanded photographic film as output.

The productivity of the phototypesetting was limited by the input of either manual direct keying in the individual characters or the speed of punched tapes

(including formatting instructions) into the systems. The first attempts emulated the old technology (line casting) and was used only for very complicated composing. The latter could increase the current speed by a factor of three or more when formatting instructions were stored in the computer. Of even greater importance was the fact that customers could now use information stored by computers, such as directories and price lists, input directly and typeset without manual intervention or work (Linotype Library, 2005).
Suddenly, there were many companies working in this area in the end of the 1960's and early 1970's. Hyphenation and formatting the input of raw text to instructions which could be understood by the system in question were marketed, and several companies – in Scandinavia and in the US – were established. The Nordic and in particular the Finnish language were among the most difficult to hyphenate, because these languages have more characters than in English, which made phototypesetting more complicated in those languages. Industrial acceptance was achieved about a decade later when more advanced computers were available and spread quickly in the industrial world.

During the 1970's many system developers discovered the new vast markets for text processing systems for newspaper, publishers, books and textbooks and others. Some technical universities in Scandinavia – in Helsinki and Trondheim – are the founding fathers of companies in this particular area – Typlan in Finland and Comtec in Trondheim. Comtec started using the PDP-8 mini processor (Jones, 2005) but was later bought by Norsk Data in 1980 (Oddene, 2005) and they preferred of course their own hardware first used in the training kit for the F16 fighters. Typlan was founded in 1970 and was one of the first developed text processing systems for the Scandinavian newspapers. Typlan was later taken over by Nokia and finally by ICL in the UK. Most newspapers and book publishers quickly adopted the new technology. Some of the more popular fonts were adapted for the new technology, but there were some legal struggles in the US concerning copyright and immaterial rights of the font library of Linotype and Monotype. These legal issues were later solved by cross licensing agreements between the parties concerned.

The software companies in Scandinavia were somewhat restricted in the development of new editorial software, as their potential customers could not come to terms with certain union activities, in particular the graphic union members, on how to rationalise the new prepress production work-flow. These union problems, however, were very severe the UK. Not until 1984 a new labour legislation was introduced by the Thatcher government, and the new technology could then be introduced in the British newspapers. The new legislation, however, was the result of the miners' strike a couple of years earlier.

The largest system integrators, however, were founded in the US with its large market of newspapers. Companies like Atex, Hendrix (later Hastech), CSI and other quickly became dominant players in the US and in Europe. In the US, labour legislation was less strict, which made the US newspapers very early adopters of new technology – front-end systems – in the newsroom. This gave these companies a head start in the international competition. Soon some consolidation started in the industry, and in 1986 Crosfield Electronics acquired both Hastech and CSI and formed the Publishing Systems Division. Later also Muirhead – manufacturer of telephoto and facsimile transmission equipment – was bought and became part of this division. The single vendor (One stop shopping) concept was born, but the concept never became a commercial success, at least not in Europe.

Simultaneously, the processing of high quality images was very important for many publishers and advertisers. The growing TV industry in the beginning of the 1950's created a demand for new and faster technologies for image processing than the old manual fashion cliché technology. The first attempts were made by a mechanical engraver – the Vario-Klischograph (Fuchs, Onnasch, 2004), and it became widespread in letterpress production.

But the demand for using film rather than hot metal in modern printing technology spurred numerous inventors. When more advanced computers (using the Neugebauers's equations for colour separations – first published in 1937) were available at the end of the 1960's, a number of electronic colour scanners came to the market, among them the Time-Life PDI scanner manufactured in the US. These scanners were in principle all analogue and used either transparencies and/or reflection copies as original, and all of them produced sets of same size negatives or positives depending on the printing process used.

The first real digital scanner was the Crosfield Electronics Magnascan 450 which was first shown at the GEC exhibition in Milan in 1969. This model could use transparency or reflection copy input, and output, either sets of continuous tone separations in positive or negative mode and later, with the use of contact screens, halftone separations for offset printing. The main expansion of colour scanners came some years later with the introduction of the laser generated dot scanner by Dr Hell in 1974 (Fuchs, Onnasch, 2004). With the laser dot, the DC 300 scanner was able to produce halftone separations directly either on positive or negative films without the use of expensive contact screens. There were many scientific problems to solve in colour scanning and many patents were held by either Crosfield or Dr Hell companies. Through cross licensing agreements between the parties the most advanced technology could be used by both companies, to the benefit of the users. (At the time a colour scanner was an investment of about US$ 175 – 225 000 – not to mention a change of a faltering laser exposure unit, which was in the magnitude of US$ 10-15 000).

During the 1970's the colour drum scanner slowly saturated the market used by companies with high volumes and/or high quality demands. The scanner operators needed to be very well trained – in general the training period lasted for several weeks. Colour scanners were used by high quality magazine publishers, advertising agencies or in mail order production. But the normal output was still less than one set of separation per hour and in order to increase the output and avoid manual planning (=montage) of several images on one page – in particular in the mail order business – the use of colour duplicates became very popular. Advanced photographic equipment was developed and the operator could enlarge a single colour original and superimpose several of those onto one photo duplicate (a second original copy) – hence the duplicate was used as input on the colour scanner. The output was a set of separations with all the images on the page in the right position and in perfect register (which not always was the case when manual planning was involved). Second originals were also used to distribute colour originals for advertising purposes to all magazine publishers in a particular market. This was the ideal material input for the electronic scanner, but the process was quite expensive, slow and the integration of text and line works was also technically very limited.

Many craftsmen in the printing industry during the 1980's maintained the opinion that manual photographic techniques were superior in quality to electronic scanning, and those photographic techniques were still in some use. Colour separations by electronic scanners were still thought to be too expensive and sometimes not good enough quality. But, that opinion was about to be changed, because the digital revolution was not to be stopped. New and more advance electronic scanners offered many more options to the users, such as batch scanning and improved operator control of the colour adjustments.

There were two remaining problems of page make up of colour separations, i.e. the manual planning of all elements of a page after scanning, and the process of producing second originals. On the occasion of the Print 80 exhibition in Chicago in 1980 an Israeli based company – Scitex Corp. – showed the first colour page make up system for the graphic art market called the Response System. The system attracted immediate attention in the market. The company came from the textile industry (hence the name Scientific Textiles) and had successfully computerised pattern/colour rendering technology for the textile industry. Then Scitex quickly adapted their system to the needs of the prepress area of the graphic art industry. Under the management of Efi Arazi, founder and CEO of Scitex, the company quickly established themselves as the preferred vendor of colour page make up systems or CEPS (Colour Electronic Page Make up Systems). (Mr Efi Arazi, who was educated in computer science at MIT in Boston, left Scitex in 1989. Soon thereafter he started Electronics for Imaging (EFI); now a public company which is very successful in the colour server market).

The success of Scitex did not leave the main competitors – Dr Hell of Germany and Crosfield Electronics of the UK – idle. They were both major manufacturers of colour scanners, and could not leave Scitex alone on the colour system market. Two years later at the 1982 Drupa Exhibition in Düsseldorf, both companies launched their colour systems, called Chromacom and Studio Systems respectively. Whilst Scitex used Hewlett-Packard hardware, Crosfield preferred Digital Equipment (DEC) and Dr Hell used Siemens hardware (Dr Hell was at that time part of the Siemens Group in Germany).

In 1983 Scitex became famous for the first large installation of a networked solution at Gutenberghus (now called Egmont); the first truly integrated filmless system, called EMROC, outputting digital data to the Helioklischograph, the engraving system from Dr Hell, used by gravure printers. Gutenberghus was using the Scitex system downtown Copenhagen, whilst the engraving and printing was done in Skovlunde, a suburb to Copenhagen. However, the transfer of data was carried out by couriers, not electronically because, at the time, it was too expensive.

In the end of the 1980’s there was a large number of typesetters available on the market – ranging from Linotype, Monotype, and Compugraphic to the high-end Digiset from Dr Hell. The burden for systems engineers to write driver software all the various typesetters was immense and very time consuming. I can remember the price book concerning drivers for one of the more popular display ad systems – it was immense and became never complete enough to cover all versions of the available devices.

The demand for integrating colour and text became urgent when large newspaper in the end of 1980’s started to produce many more colour pages. The reason was the fast growing markets of colour TV and hence colour advertisements, to which the publishers had to respond. New press capacity was added and the colour content increased quickly. Some publishers invested in high-end colour systems but soon found out there was a lack of integration between the editorial text systems and the colour systems.

3. Paradigm shift in the late 80’s - the introduction of Adobe PostScript 1

One of major obstacles in the 1980’s was the lack of the integration between different text processing systems and colour page make up systems. Several attempts were made by the major vendors to integrate the contemporary text processing systems but none was very successful. The limitations in the current technology became indeed obvious, and the use of proprietary hard- and software made life very difficult for systems integrators. Many attempts were made by different companies, Atex front-end to integrate with Scitex Response, various attempts by Crosfield integrating the Studio systems with their own text editing systems. Nevertheless, newspaper publishers – except a few large ones – were reluctant to invest large sums in new proprietary systems, which only could be operated by very skilled operators – nota bene, graphic union members. Such a step would be a return to recent years when union shop stewards kept management on their toes.

Newspaper publishers began to look elsewhere for new systems to suit their needs. A few years earlier at the very end of the 1980's some new players decided to join the attractive colour market. A new concept and slogan had just been coined – Good enough quality – which made perfect sense for newspapers and other media in the lower quality colour market (lower in the sense that printing on newsprint or similar substrates limited the possible colour gamut). The use of the expensive high end colour systems became quite impossible, as the true potential of high colour quality of the system was never utilised!

With the slogan "Good enough quality" and a completely new marketing concept, the Apple Macintosh made a head start in the end of 1980. However, the prime target for its marketing efforts was not the top end of the graphic art market, even if this market was reasonable large, but the lower end of the prepress market, as well as the industrial and consumer markets. These markets are huge, and with the right price, the volume of sales and the profits, even with modest margins, would be of a quite different magnitude as compared with a "normal" supplier to the printing industry. With this in mind Apple started its crusade into the world market of graphic art. But they would never have succeeded, if some other important developments were not simultaneously in place. Apple first agreed with the newcomer Adobe to license its Postscript technology to the Apple LaserWriter – the first affordable laser writer with the engine from Canon. Remember that one of the limiting factors in the early days of phototypesetting was the struggle of digital typefaces – fonts. But together they managed to strike a cross license agreement with Linotype in 1985, giving them full access to the digitized font library (Fryd, 2005) of Linotype, and Linotype licensed the Postscript technology driving their Lino 100 and 300 high resolution phototypesetters, which turned them into the newly coined expression - Imagesetters. Another piece of very important software was the Aldus PageMaker, which made page make up not only possible but really cheap, now from the desk top (Aldus 2005). Cut and Paste were the new commands, and the experienced user could now output composed and neatly typeset pages directly from the desktop, either to the LaserWriter or to the more advanced Lino units.

Already in 1985 Adobe published the first specifications of PostScript in the Redbook ("The PostScript Language Reference Manual"), which gave software developers all over the world the possibility to license and build their own applications. With these huge volumes the extensive work of third party systems integrators, programmers etc made business sense, offering off the shelf products –

shrink wrapped in a box– available to all potential consumers at a reasonable price.

This agreement with Linotype was the first of a series of very important agreements, and with the backing of Linotype and its profound ties and good name in the industry, the new technology was quickly accepted by the graphic art industry (Pfiffner, 2002). The Apple Mac with its new graphic user interface with its intuitive set of commands was very appealing to the news editors, who were used to proprietary terminals with an unlimited number of special commands. Remember that in 1986 Linotype would celebrate the 100th Anniversary of the Mergenthaler patent, and as a consequence of the new technology they stopped manufacturing the old typesetters only a few years later.

As mentioned earlier the Macintosh quickly became the preferred working tool for the editorial departments as well as in the academic world. The management of Apple also quickly realised – before many others – that another key to success factor in the corporate market was networking. The AppleTalk network was not very sophisticated, but it worked. The network connectors/interfaces were built in, and the only thing to worry about was the cabling, which was done by normal telephone cables – easy and cheap. But there was more to come:

Apple and Adobe soon had another idea, which was unheard of in the industry. They started to openly publish the programming specifications of the Macintosh and how to interface third party applications. It is not easy building a critical mass market alone, and by opening up specifications and encouraging other system integrators, it would do the trick. Soon enough there were a number of important software packages such as PageMaker, FreeHand from Aldus and Adobe Illustrator available for the customers. Third party applications were made to enhance the number of different approaches for the customers and by doing so, the customer almost always found something he was looking for. The customer acceptance grew quickly as well as the volumes, and the concept became quickly very appealing to the customer

These new software packages on the Apple Mac gave the operator full control in the sense that you could "see" what you were getting before output - the WYSIWYG concept. – "What you see is what you get!" (Not always quite true in the beginning of the evolution of new technology on the market). The DTP – the desk top revolution – was born. Already in the beginning of 1990 the number of licensees to third party vendors exceeded 100 – going from the ordinary laser printers to high resolution Imagesetters.

All these developments led to the third paradigm shift in less than a century. The printing world would never look the same after this profound shift – and it will never be the same again. Of course, the supervening necessity was simply that affordable systems were suddenly available. The fact what made them affordable was the numbers. The buyers were not a few large and highly sophisticated companies, but there were hundred o f thousands of consumers. By these numbers the soft- and hardware solutions became affordable and cheap, but needed new marketing tools. But it was a not a swift shift, because the graphic art industry is quite a conservative industry. Nevertheless it took less than a couple of years until the new systems had proved their level of quality and productivity. The Law of Suppression of Radical Potential (Winston, 1998) was indeed in place for some years.

Apple made everything right at the time, but with one exception. One of the ironies of its time was that Apple never published or licensed their own hardware technology to third party manufacturers. This strategy, not giving the manufacturing rights to third parties, has severely limited the impact of the concept in the world market. Apple management felt that it would limit its financial success and progress, but the policy almost led to a financial crises and bankruptcy. Unfortunately this policy is still in place, and it is one of the reasons why Apple still has a total market share of not more than 5-6%.

4. The struggle for dominance of the market in the early 90's – Adobe Postscript vs. ROW -

In 1989 Aldus proposed and succeeded in convincing the major vendors to support the OPI format (Open Prepress Interface), which defined how to handle low and high resolution images. The technique described how to use low resolution images on the desktop, while the high resolution images were stored on the server. This meant an enormous benefit to the desktop user, and allowed system integrators to interface and use the Ethernet protocol between networked servers and clients (Porter, 1999). By using the OPI technology it was now possible to create high quality colour pages with desktop solutions on the Apple Macintosh. Late in 1989 there were several competing packages, like Ready Set Go from Letraset (then owned by Esselte of Sweden), Lightspeed from Crosfield Electronics, the original Aldus PageMaker, Scitex DTP software and finally Quark Xpress from the newcomer Quark Inc.

During the Drupa Exhibition 1990 these companies all demonstrated the virtues of desktop publishing and with those programs customer could create high quality colour pages on the desktop, which up to this point was only possible with the high end solutions. The implications were severe, and in 1992 there were virtually very little sign of the high end systems at the very important prepress exhibition, Imprinta in Düsseldorf. Those who have survived ported their software to common workstation hardware platforms like Sun, SGI (Silicon Graphics) and others. The development of proprietary hardware was too expensive, and the sales volumes (and manufacturing costs) could never match the common servers available on the computer market. During the exhibition Postscript Level 2 was launched, and then an entire new digital world to the printing industry was introduced. Until then the major vendors would have had time to come to a joint agreement about a common data file format for the graphic art industry. But they failed miserably.

Both the managements of Crosfield, Scitex and Esselte failed to exploit the virtues of the desktop publishing software they had at hand during these years. Although there were several installations of those packages, the sales never really took off. Marketing was slack, and not enough development power was available. The management of Crosfield Electronics was afraid of the impact on its high end colour systems! I had my own experience of the first installation in Sweden. It was Grafiskt Forum – the magazine for the Swedish Federation of Printers - who used the software for several years until the lack of support and product development made it impossible to continue. Instead, Quark Inc. (About Quark, 2005) embarked on the same route as Apple and allowed third party developers to create and sell plug-ins to the Quark package. A year later, by 1993, Quark was more or less alone on the desktop market for editorial applications, in particular at the news desks.

In the end of the 1990's the number of Quark Xpress users could be counted in millions. These were volumes never before heard of in the colour page make up market. Quark has lately had some miserably years because the company developed a "fat cat" mentality to their customer – in particular in the newspaper market. (Not until almost a decennium later was Quark challenged by Adobe. Aldus were taken over by Adobe already in 1994, and Adobe InDesign, as the new Xpress killer application, was created on the Aldus PageMaker basis).

5. The introduction of PostScript Level 2 - market dominance is imminent - technology is starting to converge

By 1991 Adobe had managed to sell its license to more than 100 commercially available printers and typesetters, and more than 4 000 different applications were outputting to PostScript units. PostScript Level 2 was launched the preceding year and became the answer to all those who wanted four colour printing with reasonable quality and cost, in particular the newspaper industry and other media with medium to low quality expectations. Equipped with Postscript Level 2 typesetter manufacturers renamed their units to Imagesetters, because now the customers could integrate text and colour images on the desktop, and output finished and composed pages in four colours (=separations).

Adobe quickly licensed their technology to all who wanted to implement it – software developers and various manufacturers of Imagesetters. The company had recently developed a new software package, Photoshop, and colour image manipulations could now be done on the desktop. Previously such retouching and image manipulations could only be done on the high end systems, but now Photoshop enabled the user to produce manipulated and retouched colour separations with a reasonable quality using the OPI interface for storing the high resolution colour images on the server.

In 1992 Photoshop 2.5.1 version coincided with Postscript level 2, and Photoshop software soon became an industry standard per se. Again Adobe had an open view and gave their specifications to third party developers and quickly a series of plug-ins and filters to various scanners were available on the market. This made the software extremely popular. In reality Postscript Level 2 was launched by Adobe much earlier than it was really ready. One reason was that some of the licensees, such as Harlequin, Agfa, Hyphen Inc. and others, were quicker and more agile than Adobe, and managed to ship and install the new software before Adobe had finished their work. But the customer benefited on their actions, to some embarrassment to Adobe and other competitors. Somewhat later Adobe published the second edition of its Redbook on Postscript, and with the new version of the software Adobe had addressed some of the more serious problems with the earlier version related to colour separations and colour printing.

Some of the high quality aspects of colour printing were not quite solved in the Level 2 software. Some examples were the lack of trapping (expanding colours when printing negative text), suppression of moiré and some colour banding/colour shifts. Despite these shortcomings Level 2 attracted more and more users, because these systems were affordable. Slowly but surely, these systems started to outperform the high end systems in particular in those markets where Good Enough Quality was really good enough, such as newspapers, flyers, low end DM products and business forms. Many older union members were unable to retrain or were less adaptable to desktop publishing. The old skills were not asked for and most of them went out work during the first years of 1990's. Then number of union members dropped quickly during the Desk Top revolution.

Some of technical problems with Level 2 were addressed by third party suppliers. One obvious problem for newspaper in tabloid or broadsheet formats was the page files became very large, and hence slow and cumbersome to RIP (RIP = raster imaging processor, which converts the page image files to the Postscript format in order to output on Imagesetters). Sometimes the RIP would even crash. Another common problem was that the low resolution images were not properly replaced by the high resolution versions at output, which created very fuzzy and jagged images in the printed copy. The fast growing and highly competitive computer industry added to this development, and hardware became faster and cheaper day by day. Many corporations started to move away from mainframe computer to the client-server technology, and companies like Novell and Sun grow quickly. Later Microsoft (with its NT Server technology) made things easier and indeed cheaper for all customers. Moore's law really helped the development of desktop publishing. (Moore's law suggests that the chip capacity is doubled every 18 months). As new general industry standards became available, the technology became more affordable for more and more users. Simultaneously, international cooperation in digital networking decided that Ethernet-technology should be the new international standard for networks, stating first the standard for 10 Mbit/s on standard copper cables, but soon even100 Mbit/s with optical fibres. Hubs and switches for the rapidly growing telecommunication industry strongly supported the graphic art industry and overcame many of the previous bottlenecks. The graphic art industry was in no way different.

Adobe Photoshop became the poor man's image manipulation and correction tool. Although most of the high end scanners would through the OPI-concept interface with the desktop, many newly developed desktop scanners emerged on the market. Some were still using the drum technology, but most of the new scanners were flatbed using CCD (charge coupled devices) technology. Most scanners manufacturers would develop interfaces directly to the software – so called plug-ins – and Adobe – true to its policy – openly published the links to their programmes. Although the Good Enough Quality was the answer to most complaints, some of the separation algorithms in the earlier versions of Photoshop were quite awful – in particular in the richer tones of the magenta separation where detail definition completely disappeared. But, the price and performance did match the expectations of most customers, and the sales volumes of the Photoshop package grew quickly.

The introduction of Level 2 was very successful even with very modest expectations. The supervening necessity was based on economy of scale, and for other suppliers in the market there were no other choice than to bite the bullet. Earlier versions of Postscript had limited success as the Law of Suppression of Radical Potential meant that quality and productivity were important issues, which gave some room for the conventional high end systems in the market. But, with Postscript Level 2, this was no longer true. Those of the high end manufacturers, who were still in the market, started concentrating on developing OPI-servers and RIP solutions, and quickly licensed PostScript-technology from Adobe. With their knowledge and experience from earlier installations, they added important elements to the PostScript technology.

These solutions to known problems addressed some of the more obvious quality problems in Level 2. The customers could now migrate from the high end to lower cost solutions without sacrificing the quality level. Among these solutions were:

- New advanced screening algorithms improved print quality
- Trapping problems were solved
- Other minor quality issues were improved
- Better control of ripping process
- Earlier version of pre-flight control were introduced - preproofing of digital data prior to output
- Last but not least – control of the process and output/productivity was greatly enhanced

Suddenly, the new technology was embraced by everybody, which had a profound impact on the graphic art market. In a very short time many suppliers in the prepress area disappeared, when they not fast enough embraced the new technology. Other merged and a few new players entered the market. By adding the last component to the prepress puzzle – the imposition of pages - the last piece of the puzzle was laid. Imposition means that all the individual pages were laid out in correct order for output on film (later plate), colour by colour. Imposition is quite complicated, and it took developers quite some time to exploit all aspects of imposition to the benefit of the users.

The Level 2 version became soon an unprecedented success, and it became the leading software for process control and output and with an abundance of extensions and/or plug ins it became the obvious choice. Slowly the owners of the high end suppliers were forced to change strategy:

- Crosfield Electronics was bought by DuPont and Fuji Film in 1989, but already 1994 only the latter remained as owner and the Crosfield name disappeared
- Dr Hell was bought by Linotype in 1991. Linotype was taken over by Heidelberg 1995, and the name disappeared
- Scitex made a joint venture with Creo Inc in 1998 divesting the prepress, and in 2002 the name disappeared, when Scitex sold the remaining shares

The new owners concentrated their efforts on client-server technology and more enhanced PostScript solutions. For many, the disappearance of the names Crosfield and Dr Hell was quite sad. Both companies were founded after the war (the inventors were both engaged during WW II in inventing electronic devices and anti-devices in the submarine war in the North Atlantic), and were among some of the very early developers of electronic scanning and phototypesetting. Together they dominated the electronic scanning and image manipulation market for more than 25 years! Scitex embraced the new technology somewhat faster and managed to survive longer. The company sold its last holding in Creo Inc. (the Canadian manufacturer of workflow software and CTP equipment - computer to plate) some time ago. Scitex Corporation Ltd. is now concentrating their efforts in financial holdings in companies producing inkjet systems. Nevertheless, last year they sold back to Kodak Scitex Digital Printing in the US.

Finally there was no important supplier in the market, who did not rely on products which one way or another were licensed from Adobe. The convergence of prepress technology was indeed here.

But Adobe never rested on their laurels. Already in 1990 Mr Warnock, one of the co-founders of Adobe stated that Postscript had a very strong support as the new standard for output devices. This was the turning point for Adobe. What Mr Warnock for some time had realised, was that the corporate world needed a new universal way of communicating documents across a wide variety of machine and devices and communication networks. The fax concept which had a strong growth during the 1980's could not be the answer, because they were slow, with low quality and needed dedicated phone lines (Warnock, 1991).

With a new technology any document should be viewable on any display terminal and/or be printed on any modern printers attached to the terminal. This concept would fundamentally change the way people would work, alone or in a network. PostScript was developed as a device independent page description language, and in 1991 there were more than 100 commercially available printer products and 4 000 different applications. Later the same year the Adobe Acrobat program and the PDF-file format were launched (Acrobat is a kind of subset of Postscript and requires a rather simple interpreter).

PDF, Portable Document Format, is a file format for representing documents in a manner that is independent of the original application software, hardware and operating system in use creating those documents. Such a file can describe documents containing any combination of text, graphics and images in a device independent and resolution independent format. There were several advantages to the PDF-format, such as there is only a single small file to transfer and the font-substitution technique ensures that the document will be readable even if the end-user does not have the "proper" fonts installed on his computer. First, not only did the only PDF creation tools cost money, but so did also the software to view and print. Hence, the new technology was slow to catch on.
After some time and internal struggle Adobe made a drastic change of their strategy. The management of Adobe realised that the Internet and the use of electronic mail over the Internet would soon be the new communication strategies for most of corporate and indeed also the home users. Soon the PDF-technology was integrated with the most popular Internet-browser programs, such as Netscape and eventually Explorer. The Acrobat Reader was to be distributed free of charge. Competing formats eventually died out, and PDF became a well-accepted "standard". To-day, the Adobe Reader is the single programme most used in the world with more than a billion users.

Soon after, a license agreement was struck with Microsoft integrating the Acrobat technology into MS Office software offerings. Now, every user of the popular Word, Excel or PowerPoint applications could create PDF-files for easy distribution by e-mail or through internal networks.

6. The introduction of Postscript 3 and Adobe Acrobat technology

Almost seven years after Postscript Level 2 was introduced, the Postscript 3 became available. With the new version Adobe addressed some of the more obvious flaws of the Level 2 version, and among some of the more important features were support of more than 256 graylevels which was needed to avoid some quality issues, and improved support for in-rip separations. The in-rip means that the RIP can handle composite Postscript files (RGB composite) and RIP on the fly. Further, new and enhanced screening algorithms allowed higher and more consistent colour quality of the output. But more importantly, PostScript 3 could also handle and rip PDF-files, which was the first step in a PDF-based workflow.

Many printers (Braswell, 2001) had realised that creating PDF-files and submitting those files (=pages) to the customer for approval, would save both time and cost. In particular, this would be useful in a distributed networking area, such as the distribution of ready made advertising material. New standards for submitting pages to the newspaper industry are based on PDF technology, lately PDF 1.5 based on the latest version of Adobe Acrobat. Hence all products, which are going to be printed, can use PDF technology. Most service bureaus will handle such files, impose them, pre-flight and send to the RIP for output. All manufacturers selling workflow and/or output solutions must be able to handle a PDF workflow. Some actually convert all jobs (=files) to PDF prior to printing. This may allow them to see errors in a file before wasting paper, film or plates. A PDF file contains not only all information about fonts, images, printing instructions, keywords for indexing etc. which is necessary for the job, but also contains a job tickets in the newly developed JDF format – Job Definition Format. JDF is supported by all manufacturers in production chain and will ultimately assist in making the workflow smarter and faster. For example, a JDF-file contains information how to automatically set the ink keys in the press and other important make ready features.

We can now conclude that there is no other important company in the area of converging prepress technology than Adobe. Apple started the desk top revolution about 20 years ago, but over time Apple is no longer controlling the technology as it used to do. It is quite ironic, however, that the founder of Apple – Steve Jobs – actually helped Adobe with considerable funding in the start, in order to develop the Postscript technology. Otherwise it is questionable whether there would have been an Adobe and a desk top revolution at all.

What we have to-day is a new set of rules –no official standards – which all are controlled by only one company. After its initial success with Postscript and the large volumes of the Apple LaserWriter, already in1986 Adobe went public with its first public offering (IPO) with a revenue of 12 million $US and less than a score of staff. Today Adobe Systems Inc. is a huge company with revenues of close to 2 billion $US and some 3 500 employees. During the last decade about two score of competing and supporting companies were acquired, and through Adobe Venture seed capital for new emerging technologies is available. There are some interesting acquisitions during this period such as Aldus Corp. (as previously mentioned), the core of Hyphen (printer software) and last but not least Accelio (former Jetform), the leading provider of electronic business form solutions. With this acquisition Adobe will soon integrate electronic business forms into the Acrobat family of software. Soon Adobe will be the only and dominant player on this enormous corporate and government market. Adobe and Microsoft have quite close ties, as the PC market is by volume the most important one with over 90% market share. Hence, all DTP applications have been available in a PC version for long period of time.

Previously with a number of players in the prepress area, there was stiff competition, but no “standards” for the integration between different vendors. To-day we have only one supplier! We – the users –may have been happy with lower costs and less demanding capital investments, but on the other hand the graphic art industry now depends on one single company. One last observation which may have been lost! The technology now is quite “easy” and comprehensible – which means that thousands of jobs have been lost in the graphic art industry. All of these jobs, which previously were done by trained graphic art craftsmen, are now done by the customer. Not always, but mostly without any formal training in typography, lay-out or any sense of colour manipulation. This is really Good Enough Quality! Was this really what the customer of the 1980’s wanted?

7. Adobe PDF technology and the future (JDF etc)

Adobe has stated that the PDF –technology is one of the most important of its future direction. More than a billion copies of the Reader (previously called Acrobat Reader – now Adobe Reader) have been downloaded from the Internet, and the Reader has made the company visible and well-known world-wide. In 2002 The International Organization for Standardization (ISO) announced that it has formally approved the first of a series of PDF/X standards for digital data exchange, based upon Adobe PDF, for the exchange of digital data in the graphic art industry. Yet, the ISO made a virtue of a de facto standard in the industry. This standard is based on PDF 1.3 and one might expect that in due course the future standard will be migrating to future versions.

Concerning the PDF-technology one might also expect, that it will replace the Postscript programming language. Rather, I would think that future versions of these programmes will be developed even tighter together to enhance future prepress workflows. Recently Adobe Inc. announced that the PostScript 3, version 3016 was now available to their partners who are building high performance printing systems and print workflow solutions. This version is supposed to be the only interpreter that supports the latest version of PDF 1.5 as well as the PDF/X standard. Adobe stated that they have pushed the technology close to the limits.

CIP4 – computer integration of prepress, press and finishing units – is the latest developments in the industry. The CIP4 consortium is a joint venture in the industry embracing almost all suppliers in order to automate future work flow in the industry – from the prepress area to the final finishing stage. The consortium has chosen the JDF-file format as the common platform for communication between all units in a given workflow. One might expect that the use of JDF-technology will be used extensively and may be the only alternative in the next few years. JDF as a job-ticket device is based on the new dynamic the mark-up language XML and is of course controlled by Adobe.

8. Conclusions

Fifteen years ago many industrial leaders in the graphic art complained that there were only too few companies on the market and no standards for the exchange of digital data were available. With the developments during the last decade the industry has got a new standard – even embraced by the ISO – but this standard is the immaterial property owned by only one company – Adobe Systems Inc.

Adobe Systems Inc. has a very solid position in the graphic art industry, and it is very difficult to envisage a competing technology replacing the present Postscript and PDF-technologies. The only alternative would be, if Adobe themselves, for some reason, would come across something better. In my opinion it would be highly unlikely; as a public company, management would rather protect its present technology they possess, than enter into something new and uncertain; in particular with a market share of 100% in the prepress market. Management normally tries to avoid financial risks! Hence, the technical convergence has come to an end with the present technologies from Adobe.

To-day the corporate and government markets for documents and electronic forms are probably much more important for Adobe than the graphic art industry. One might only hope that they will not misuse its dominant position, and continue to support the poorer cousin. The graphic art industry needs new innovations and cost efficient solutions for more automated workflows.

A new monopoly in the front-end technology has been created by default. One may say that the convergence of technology in the prepress has come to an extreme! The technology has been converging to one single supplier! Never before has one single company been in a similar position in the graphic art industry. This is like falling from the frying pan into the fire!

Finally, some says that the Internet is the first paradigm shift in the 21st century. The web may have a great impact on the graphic art industry, but this has yet to be proven.

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POWER IN THE MEDIA

– ROBERT MAXWELL -

A STUDY OF POWER IN LEADERSHIP

"Power tends to corrupt; absolute power corrupts absolutely!"

Lord Acton (a British historian 1834-1902) in a letter to a friend on the 5th of April 1887

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Abstract

The concept of Power in Leadership and Management has been much debated in recent years. Nevertheless, power in both public and private companies is still much in use, although disguised in other aspects of Leadership. Power is the capacity to influence the attitudes of people in the desired direction, and to make them execute orders they might not otherwise obey. The concept is needed to understand how people or managers may influence each other in organizations. Leadership is related to power because it is dependent on the level of influence a person might have in an organization. A leader with little power will have little or no influence or authority, and authority is the right to influence others in a specific way. Thus, it is an important basis for influence in formal organizations.

This paper attempts to show how the late Robert Maxell, between 1980 and 1991 regarded as one of the leading publishers and media owners in the world, used power to overcome most of the obstacles on his path to success. Maxwell was always regarded as an outsider by the establishment in the UK, but he managed by his sheer energy, personal charm and persuasion to be financed by the leading banks, financial institutions in Europe and overseas.

During 1991 his debts grew and finally became too large, and he was obviously unable to repay his debtors. On November 5th 1991 he was found dead floating in the water off the Canary Islands, apparently having fallen overboard from his personal yacht the Lady Ghislane, but the real cause of his death has never been fully established. Soon afterwards, his empire collapsed and it was discovered that for several years he had illegally used the pension funds to pay off debtors. In May 2001 some of the leading financial institutions and audit offices were fined for gross negligence in dealing with these matters, and about two thirds of the total embezzled money was repaid to these pension funds.

Despite being considered a thief and a fraud, he should nevertheless be remembered as someone who was, between 1980 and 1989, personally very much involved in the restructuring of both the publication printing and newspaper industries in the UK. In the end he was given a state funeral in the state of Israel attended by some of the most influential leaders in the country.

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1. Introduction

The use of power in corporate leadership is a very well established concept. The use of personal or inherited power in private companies is unavoidable, as a legitimate way of controlling the business. In the media industry private enterprises are quite common, and even if many are also public companies, the family owners are still in a controlling position. Public media companies give the public, in particular financers, analysts and governmental bodies such as tax authorities, much more access to information on the media business, and on how marketing, accounting and personal relations are managed than is normally the case for private companies.

Global public media companies are part of the global media scene, and thus create a huge public interest in their owners, performance and business in general. Unfortunately, the media business also attracts other types of personality than "a person who can be relied on to exercise proper stewardship of a public quoted company" (DTI 1973 about Robert Maxwell). This paper attempts to show how the late Robert Maxwell (1923-1991) used power to become one of the most influential media leaders in the 1980s. The darker side of the concept of power will show how he misused his position as Chairman of two very large public companies – Maxwell Communication Corporation and the Mirror Group – for his greed and personal satisfaction. The misuse of power led him to use the pension funds of the Mirror Group to finance both his personal and corporate debts.

The first part of this paper describes the concept of power, which is the basis of leadership and how power is used to influence people. Furthermore, there is a short description of the global media industry and those companies which are controlled either directly or indirectly (by using trusts or foundations) by a family or an individual. Then Robert Maxwell's life and career is described, which must said to be quite phenomenal going from a childhood with extreme poverty in a small Czech village to the most extravagant living with expensive food and drink, and socialising with the most powerful men and women in the world. Hence, most of his private debts can probably be attributed to his private life: several mansions, private pent-houses in London and New York, a helicopter, two private jets and a large yacht in the Mediterranean, as well as a number of private secretaries, personal assistants, a butler, several drivers and servants. "He has been accused of being a thief of the pension funds and committed fraud against a large number of banks and a record of borrowing, lending, transferring, converting, and tax evading" (Media in our lives 2005).

The second part of the paper concerns his leadership in the media business in more detail, and the ways and means power was used. Finally, the events leading to his demise and fall are described. Nevertheless it should be mentioned that, despite all the criticism, Robert Maxwell is to be remembered as someone who was instrumental in changing publication printing and the newspaper industries in the UK in the middle of 1980s. However, he was not alone, and his main rival, Rupert Murdoch, was simultaneously playing a very important role in the profound changes taking place in the newspaper business in the UK.

2. The Concept of Power – the basis of Leadership and Power Approach to Influence

Power is the capacity to influence the attitudes of people in the desired direction, and to make them carry out orders they might otherwise choose not to obey. This concept is needed to understand how people or managers may influence each other in organizations. People have power when they have the ability to affect others' beliefs, attitudes, and courses of action (Northouse 2004, p.6). Another way of defining power involves the ability of one party (the "agent") to influence another (the "target") (Mintzberg, Pfeffer cited in Yukl 2002, p.142). Hence it can be assumed that power is a function of exchange relationships between two parties; that is, for a power balance to exist there must be an exchange of resources. Resources, in this case, are defined very broadly and may include symbols of acceptance and positive reinforcement of one's self concept, as well as more tangible resources such as products or money. Sometimes power is defined in relative rather than absolute terms, in which case it means the extent to which the agent has more influence over the target than vice versa (Yukl 2002, p.142).

Leadership is related to power because it is dependent on the level of influence a person may have in an organization. A leader with little power will have little or no influence or authority, and authority is the right to influence others in a specific way; an important basis for influence in formal organizations. Authority involves the rights, prerogatives, obligations, and duties associated with a particular position in an organization or social system. A leader with direct authority over a target person has the right to give orders consistent with his authority and the target person has a duty to obey (Yukl 2002, p.142).

It is important to view power as a balance, that is, both parties have some power over the other. The party with the greater power over the other in this balance is the one that may exert influence over the other. Power is the inverse of dependency and the power of an agent over a target person is a function of the importance of the resource the agent is providing to the target and the replacability of the agent providing that resource to the target. The target can always reduce the agent's power by thus eliminating the need (reducing importance) or finding or developing alternatives to the agent in satisfying that need. The outcome of attempts to influence may differ depending on the target's willingness and/or level of acceptance. Northouse (Northouse 2002, p.143) defines three different levels of influence:

- Commitment
- Compliance
- Resistance

Commitment is the most successful outcome of an attempt to influence, whereas compliance means that only a minimal effort will be made by the target person. Resistance is of course the most negative response to a request and the target person will do everything possible to avoid the request being accomplished.

French & Raven (cited in Northouse 2004, p.7) developed a taxonomy1) to classify different types of power according to their source:

- Reward power
- Coercive power
- Legitimate power
- Expert power
- Referent power

According to Yukl (2002, p.146), reward power is defined as "…the perception by the target person that an agent controls important resources and rewards desired by the target person…." But, the agent needs the formal authority to allocate resources and rewards, such as pay increases, bonuses etc. and/or other status symbols. Basically, reward power depends also on a manager's actual control over resources and rewards and on the perception that the agent is willing to pursue his/her intentions vis-à-vis the target.

Legitimate power comes from the formal authority over activities in an organization, and the level of legitimate power is normally related to the perceived amount of authority in a given situation. Hence, a high level manager usually has more authority than a lower level manager, but the acceptance is sometimes also dependent on whether the agent is perceived to be the legitimate holder of his/her leadership position. Hirschhorn (cited in Gebhart 1997, p.102) suggests that in a modern flat organization with a system of collaboration in decision-making and control, the individual has to become his own authority who "……. can no longer rely on their bosses to be authority figures. They must rely on their 'own personal authority'."

A leader's coercive power over subordinates is based on authority and control over various levels of punishment and/or rewards. This particular power is sometimes obvious in privately owned companies, and is probably also used in corporate management. It is still used by political and military leaders. However, there seems to have been some decline in the use of legitimate coercion by many types of leaders, except for military and political leaders or dictators in various non-democratic countries.

Expert power in an organization is based on the knowledge and personal skills of the individual. Having unique knowledge about the best way of performing a task or solving an important problem, gives the person in question a great potential influence over subordinates, peers and even superiors. However, this is very dependent on whether other people in the organization are dependent on the agent for advice. Dependency is of course increased when an alternative source cannot readily be found, and perceived expertise is more important than real expertise. It is essential for leaders to develop and maintain a reputation for technical expertise and credibility (Yukl 2002, p.151). Some people may try to protect their expert power by keeping procedures and technology clouded in secrecy, and by using technical jargon to make the task more complex and difficult than it needs to be.

Referent power is derived from the desire of others to please an agent towards whom they have strong feelings of affection, admiration, and loyalty (French & Raven cited in Yukl 2002, p.150). People are usually willing to do special favours for a friend, and they are more likely to carry out requests made by somebody they admire. The strongest form of referent power involves the influence process called “personal identification” where the target identifies with the agent. Another view of leadership is, according to Northouse, the concept of power and the potential to influence. In his opinion there are two kinds of power: position and personal. Position power, which is much like assigned leadership, refers to the power an individual derives from having an office in a formal organizational system. Personal power comes from followers. It is given to leaders because followers believe leaders have something of value (Northouse 2004, p.11).

Personal power can also be said to combine Export power, Referent power, and Legitimate power, but Position power might be restricted to Reward and Coercive Powers. ”Managers do things right, but leaders do the right things.” Effective leaders incline towards personal rather than position power, and exercise it when they are able to analyze the correct situation and adapt their style accordingly. The success of a manager, however, depends greatly on the manner in which power is exercised. However, Pitcher thinks that there is a third element in leadership, the Craftsman, and hence there are three basic types of manager/leader: Artist, Craftsman, Technocrat (Pitcher 1997, p.30). There is a place for all three in most -

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1) Taxonomy (from Greek ταξινομία (taxinomia) from the words taxis = order and nomos = law) may refer to either a hierarchical classification of things, or the principles underlying the classification.

organizations, but the Technocrat should never be number one. Her message is that "Every manager is not a visionary and no amount of training will make them one" Make use of their talent for managing things, but don't give them 'any authority over people or dreams'" (Pitcher 1997, p.31). You may be a manager, but that does not imply that you are a leader. Vecchio (Vecchio 2001, p.17) stated that "there are almost as many different definitions of leadership as there are persons who have attempted to define the concept." Kotter holds that the difference between management and leadership is the element of setting a direction "......developing a vision of the future along with strategies for producing the changes needed to achieve that vision "(Kotter, in Pfeffer 2001, p.26), and he stated that managers are doing things right, but leaders are doing the right things.

The strength and weakness of the Power Approach is more related to the way Power is used in a particular situation. It is weak in that ".......leaders who exercise power in an arrogant, manipulative, domineering manner are likely to engender resentment and resistance" (Yukl 2002, p.170). On the other hand, a capable leadership will use power in a gentler and more careful manner, which will enhance the target person's attitude and willingness to carry out the request or task in question.

Further types of power in leadership are mentioned by Dyer (1979, p.85) such as:

- Physical power
- Charisma
- Persistence

"One person's ability to influence another is due to his possession of a commodity or condition that allows the influence" says Dyer (1979, p.85). Physical power is seldom used, even if a person's size (and perceived strength) may intimidate a sub-ordinate into obedience or to fulfil a request. Both charisma and persistence in a case are used on many occasions, in particular in business negotiations, but these additions come very close to another theory of leadership – the traits concept.

The power of position and the use of that power is more than just formal authority. It entitles building and maintaining a reputation for being effective, and it entails the capacity to get things implemented (Pfeffer 1994, p.128). There might be a greater sin than making mistakes and influencing others – the sin of doing nothing, of being passive in the face of great challenges and opportunities, and even great problems (Pfeffer 1994, p.300). Pfeffer defines power as "the ability to overcome resistance to get others to do what you want" (Pfeffer 1994, p.176), or more explicitly as "the potential ability to influence behaviour, to change the course of events, to overcome resistance, and to get people to do things they would not otherwise do" (Pfeffer 1994, p.30).

Northouse writes about leadership and the use of coercion (Northouse 2004, 2002, p.7): Leaders who use coercion are only interested in their own goals, and very seldom in the wants and needs of subordinates. Leaders are described as wielders of power, as individuals who dominate others. In these instances, power is conceptualized as a tool that leaders use to achieve their own ends.

The darker side of leadership has been described by Conger (in Vecchio 1997, p.217). He does not, however, state anything about the power of leaders (or leadership) in relation to the dark side of leadership, which could be regarded as a rather obvious step. Conger differentiates between management and leadership, where the latter is the ability to create a vision for the enterprise or organization for everybody to follow.

Conger (in Vecchio 1997, p. 217, 225 and 228) defines some sources of failures and/or traps a visionary leader may fall into, which can also be attributed to the darker side of his leadership:

- The vision reflects the internal needs of leaders rather than those of the market or constituents
- The resources needed to achieve the vision have been seriously miscalculated
- There is an unrealistic assessment or distorted perception of market and constituent needs
- There is a failure to recognize environmental changes prevents redirection of the vision

Potential liabilities in the leader’s communications and impression management skills are:

- Exaggerated self-descriptions
- Exaggerated claims for the vision
- A technique of fulfilling stereotypes and images of uniqueness to manipulate audiences
- A habit of gaining commitment by restricting negative information and maximizing positive information
- Use of anecdotes to distract attention away from negative statistical information
- Creation of an illusion of control through affirming information and attributing negative outcomes to external causes

Potential liabilities of a leader’s management practices

- Poor management of peoples networks, especially superiors and peers

- Unconventional behaviour that alienates
- Creation of disruptive “in group/out group” rivalries
- An autocratic, controlling management style
- An informal/impulsive style that is disruptive and dysfunctional
- Alternating between idealizing and devaluing others, particularly direct reports
- Creation of excessive dependence in others
- Failure to manage details and effectively act as an administrator
- Attention to the superficial
- Absence from operations
- Failure to develop successors of equal ability

The ultimate use of power in an organization may be regarded as Machiavellism, and Vecchio states that “In general, Machiavellian individuals are thought to be socially domineering and manipulative, and they are assumed to engage in political behaviour more often than other organizational participants” (Vecchio 1997, p.88). Those considered to be Machiavellians are said to use their skills in face-to-face settings and are able to control personal interactions and manipulate people. This seems to be the darker side of the power concept, and there is no doubt that Machiavellism and the use of power are closely interrelated on many occasions. And as Kets de Vries asks “Shall we conclude that power leads to excessive behaviour with all its repercussions in the form of grandiose fantasies, boastful and pretentious behaviour, arrogance, feelings of entitlement and self-centredness” (Kets de Vries 1993, p.174). Robbins argues that those in power would create a structure that maintains and enhances their control (Robbins 1983, p.74). He goes on to say that many management concepts fail to make the transition from textbook to practice because they are not compatible with the realities of corporate realities. One major reason may be that these concepts are incompatible with the power-control perspective.

A further analysis of the leadership of Robert Maxwell, and the concept of power he used, will be found in Chapter 6.

3. The Media Industry

Leadership in media companies is often split between business and editorial management. This is very common in the Nordic countries, where the Editor-in-Chief has the total responsibility for the editorial department and the content of the media in question, whereas the business part is managed and controlled by the Managing Director. However, a dual leadership is less common in the Anglo-Saxon countries, where a Publisher controls both the editorial and the business part of the media company. The concept of power in relation to the media industry is very relevant; in particular the power balance between the managing director and the editor is extremely interesting. The owners (or more specifically the board of directors) have to be very observant and lay down the rules of conduct, in relation to the power balance, particularly for budgetary issues. Then the interesting question is; who is the real leader and how much power should the leader have? The amount of necessary power depend very much on what has to be accomplished and the financial situation of the particular business.

Many companies in the media business are family controlled and/or owned. This is particularly true in the more traditional media businesses, such as publishing of newspapers, magazines and books and printing. The other sectors of the media industry, such as film and video production, and broadcasting of radio and television have since the Second World War – at least in Europe – been state controlled and/or regulated, making them less interesting or even possible for private enterprises. However, this has changed during the last decade, when deregulation of the previous governmental control has inspired many private media houses to enter into the broadcasting media, not only in Scandinavia but also in most European countries like Germany, France, the UK, Italy and Spain.

The corporate structure of the family-controlled media company may differ, although today most companies are limited corporations. If they have chosen to be public, the family (or the principal owner) still controls the operations by having a controlling part of the shares. In those family-controlled and -owned companies, the power approach concept is probably the prevailing management theory. The term 'power' refers sometimes to the potential influence over things or events as well as attitudes or behaviour ………"the term power is usually used to describe the absolute capacity of an individual agent to influence the behaviour or attitudes of one or more designated target persons at a given point of time" (Yukl 2002, p.142).

When a family business grows over a substantial period of time or by generations, the way in which power is exercised will be quite different depending on the experience gained over time and on the size of the company. Power may vary quite a lot depending on whether the agent (belonging to the family) is the first or second generation or even a third generation owner. Reward and Referent Power are mainly used in later generations, but in addition Expert Power can be used when necessary. The expertise in the family when the business has grown and prospered during several generations is not easy to dispute for an outsider.

Among privately controlled international media, the best well-known in Europe are the Rupert Murdoch empire News Corporation and Silvio Berlusconi's involvement in news-media and television in Italy. But there are other individuals, who may have less international flair such as Richard Mohn, the founder of Bertelsmann and in Scandinavia one cannot forget the Bonnier or the Aller Group. In the USA there are also many very well-known families involved in newspapers, magazine publishing and broadcasting – names such as Graham, Gannett, and Turner should be mentioned (cited by Koulouvari 2004, p.24).

The longest tenure involvement in media among family-controlled groups must be the Bonnier Group, which now has the 5th or 6th generation of executive managers directly operating in the business. From time to time, however, the top executive is taken from outside the Bonnier family. In the publishing business in Sweden there are several very influential families controlling newspapers but also expanding outside their core businesses, such as the Hamrin family (Herenco with Hall-pressen, many local papers, real estate, printing and other affiliated businesses), the Ander family (Nya Wermlands-Tidningen with a chain of local papers) and the Hjörne family in Gothenburg (Göteborgs-Posten with interests in printing and many local newspapers) (cited in Koulouvari 2004, p. 24).

Some of the larger corporations have gone public, and the reasons can be many. However, one should not underestimate the financial motive; selling out a part of the shares while still maintaining control is very tempting. The other side of the coin is the demands of greater openness and the election of non-executive directors to the board. The present rules of public companies have over time become very rigid, and some of the new rules have been set because previous misuse of power has proven the need. One example of the misuse of power in this respect was Robert Maxwell.

4. About Mr Robert Maxwell – his path to power

1923-1940

Robert Maxwell was born Jan Ludwik Hoch on June 10th 1923 and was the seventh child of a poor Jewish agricultural worker family in the Czech village of Slatinske Doly, situated on the border between Czechoslovakia and Romania. When Germany invaded the country in 1938, he first fled to Budapest and later to France; when France was invaded in 1940 he managed to escape to England. In England he joined first the Czech Free Corps and later the British Army as a private.

1940-1945

He took part in the second wave of the Normandy invasion, was promoted to second lieutenant in 1944 and honoured with a Military Cross for bravery, and was later promoted to Captain. He changed his name several times – first to Ivan de Maurier (after a favourite brand of cigarettes), then to Leslie Jones and finally to Robert Ian (i.e. for Jan) Maxwell (Greenslade 1992, p.24). In Paris, he met his wife Elisabeth Meynard, who worked for the allied forces as an interpreter (Greenslade 1992, p. 23), and they married soon after.

1945-1950
After the war he was moved to Berlin, where he was engaged in different capacities for the British forces, because he was quite fluent in German and many other languages (Greenslade 1992, p.26). It has been said that he was able to speak nine languages fluently (English, German, French, Czech, Rumanian, Polish, Russian, Yiddish and Hebrew and some Slavic languages). He soon established himself as the sole UK and US distributor for the Springer Verlag, one of the major pre-war publishers of scientific journals. In 1949, Maxwell and Herr Springer founded Pergamon Press which became the cornerstone of Maxwell's future empire. The basic business idea was to publish scientific journals and proceedings from various scientific conferences.

1950-1960
In 1951, he bought Butterworth (a competitor) and merged the company with Pergamon Press, and later the same year he bought out the Springer participation from the company. During this period he moved the company to Oxford, where he shared his head office and personal dwelling in a large mansion not far from the university campus. He managed (or persuaded) many important scientists from the UK and US to participate in various editorial boards, which were given the task of peer-reviewing the articles and giving a serious scientific flavour to the company (Johnson 1987, p.71) He also managed to persuade the Eastern Bloc including the Soviet Union to give him the publishing rights in the West, which after the launch of Sputnik in 1959, became most interesting for western scientists.

1960-1965
In 1964, the Pergamon Press became public and a part of the shares were sold (Greenslade 1992, p.38). Nevertheless, Maxwell retained control of the company as the major shareholder and Chairman of the Board of Directors. Even though the company became public, it was still run as a private enterprise by Maxwell. He alone had the full control of the business and the daily operations. In the early 1960s he entered the political world and after some struggle he became the Labour candidate for North Buckinghamshire. In the 1964 elections he won a seat in the British Parliament.

1965-1970
When the Labour Party lost to the Conservatives in the 1970 polls, he also lost his seat in Parliament. In 1969 a financial scandal emerged, when he tried to sell Pergamon Press to Leasco Data Processing owned by the American businessman Steinberg. Leasco specialised in main-frame computers, both software and hardware, and was among the top performers on the New York Stock Exchange. However, the due diligence process initiated from the buyer was not allowed to check the accounts of Pergamon Press until very late in the acquisition process, when the buyer discovered several major discrepancies in the accounts of the company and its subsidiaries. In the aftermath of the dealings, the London Stock Exchange and

the UK Department of Trade and Industry (DTI) set up an inquiry investigating why the merger collapsed, and how it was possible that a public company with chartered accountants could obstruct a due diligence process and disguise profits and sales, and who was responsible for the situation.

1970-1980

The report from DTI published in 1973 stated that "accounting is not a science but an art", which was very true in this particular case. In the public hearing when the inquiry was presented, Maxwell was severely damaged as a business man and eventually lost his control over Pergamon Press. Further on in the report he was condemned saying that "he was not a person who can be relied on to exercise proper stewardship of a publicly quoted company". (DTI 2001, p.v). However, because of a minor technical flaw on the part of the chairman of the inquiry, Maxwell was able a year later to regain the managerial control of Pergamon Press. Later Maxwell publicly stated that he was going to be an important publisher of a daily newspaper in the UK.

1980-1985

An opportunity of acquiring a major paper on the Fleet Street emerged when the prestigious titles of The Time and The Sunday Times were up for sale in 1980. However, Maxwell was never considered as a serious bidder. He then concentrated his efforts on the next opportunity and the same year he bought a 29.5% stake in the British Printing Corporation. This public company was at the time one of the largest printing companies in the world (Bower 1991, p.341). A year later he gained total control of the company and announced that he was not only the elected chairman of the company but also the chief executive officer. Although he always said he was a socialist and a friend of trade unions, one of his first tasks, after gaining control of the company, was to confront the print unions in the company. The first battle concerned all the printing plants in the group; Maxwell asked for concessions and reduction of manning from the unions.

This fight was seen as a test of whether Maxwell would be able to successfully negotiate with the unions or, like most other owners/managers, would succumb to their power. He did it in a very unusual way. After several weeks of continuous negotiations he managed to bring the negotiations to a successful end, and he was hailed as the saviour of the British Printing Corporation (Bower 1991, p.342). In 1981 BPC was renamed and henceforth called the British Printing & Communications Corporation or BPCC.

The largest gravure printer in the UK was Odhams Printers, also located in Watford, and owned by Reed International, the large publisher of weekly magazines and newspapers. In 1982 the management of Reeds international had had enough and sold the company to Maxwell. The print unions went on strike, but could not prevent the takeover. Again Maxwell took his time with the central print unions and successfully negotiated a deal, as a result of which the two companies were merged and Odhams Printers closed. The print unions were outraged but could not do much about it, and more than 2000 people were made redundant.

Reeds International was also owner of the Mirror Group of Newspapers. The Daily Mirror, located in Fleet Street, was a badly run newspaper riddled by very strong print unions. The management of Reeds International was not able to control the situation and decided to concentrate their efforts on the publishing business of magazines. Maxwell agreed to pay a mere £93 m for the ownership of the group. It has been estimated that the premises at Holborn alone were worth more than £100 m. At last Maxwell had gained control over a major newspaper in the UK and named himself the publisher of the Daily Mirror.

1985-1990

With the new legislation presented by the Thatcher government, Maxwell gained control over the print unions, because their previous strike strategy was no longer permitted (Bower 1991, p.399). Hence, new technology was quickly introduced, and in 1989 he was the first publisher to introduce four-colour offset printing on Fleet Street. He was the first to undertake a constructive change to the newspaper industry in the UK by changing old working habits and breaking the print unions demoralising grip on editors, management and owners.

He became very involved with editorial matters in the Daily Mirror, which was contrary to what he had previously stated (Greenslade 1992, p.68). Once he was in the publisher's seat in the Mirror Group, a completely new era began in Maxwell's life. He boasted that in a couple of years he would be the owner of a conglomerate of companies in publishing and printing worth more than a billon pounds. He purchased stakes in various newspapers, in the UK and abroad, and cable television companies and other publishing or printing companies. Starting in 1985 and 1986 he made a new deal every second month, but this pace was only the beginning. From 1987 onwards a new deal was made every third week, up to 18 new deals every year. Despite its being a public company, its business and accounts were very cloudy and difficult to analyse. In 1987 he also renamed British Printing & Communications Corporation (BPCC) the Maxwell Communications Corporation (MCC). As many witnesses have stated, although they were both public companies, Maxwell ran them both very much as his own private business.

In 1987 he made an unsuccessful bid for the largest textbook publisher in the US, Harcourt Brace Jovanovich. Despite the very bad press he had got in the US during this fight, in July 1988 (Bower 1992, p. 479) he made a bid on the shares of one of the largest American publishing companies, the US Macmillan. Eventually Maxwell bought the company for a staggering sum of $ 2.6 bn, but at a price which was probably at least 50% too high. Hence, Maxwell fell very much into debt to most bankers and financial institutes in Europe and in the US. Maxwell was driven by the desire to expand and accelerate the realisation of his visions without considering the immense burden of debts to be repaid.

Maxwell appointed himself Chairman and Chief Executive Officer of US Macmillan, and his interest in both the Daily Mirror and MCC came second hand. Realizing the burden of debts, Maxwell started to disinvest and sold a number of companies in the Macmillan group as well as in Pergamon Press. The international depression began to have an effect on Maxwell's empire, and the companies generated much less earnings and profits than before. Hence, the shares of the public companies fell. Most of these shares, however, were held as collateral for these huge debts. In order to calm the financiers, more shares were deposited as security for the loans, and the whole group soon became caught in a vicious circle. The value of the shares was diminishing, and more shares were then needed to cover the collateral. Until this time Maxwell had managed to keep his bankers and financiers happy by always paying the interests and amortizations of all the debts on time.

1990-1991

In 1990, he started the pan-European newspaper The European with editorial content covering not only the old Europe, but also the new Eastern European countries just coming out from the Iron Curtain. The idea was to build a concept similar to the USA To-Day, but the commercial side of The European never became successful (The paper started off as a weekly, but it never reached the critical mass needed to become a daily newspaper). In 1990, the first series of investigating journalism hinted that there was a possible misuse of pension funds in Maxwell Communications Corporation. Other journalists were trying to investigate the links to the personal trusts in Luxembourg, and how they were financed and controlled.

Early in 1991 he acted as a "white knight" (Bower 1992, p.510) and accepted taking over the New York Daily News. Maxwell was given $ 60 million by the previous owners, but inherited all debts and other obligations. Very soon it was seen as a very unsuccessful acquisition, and the paper continued to lose money. During the rest of 1991 Maxwell had to fight hard to keep his creditors happy as well as finding new creditors who were willing to lend him money. These new loans were used to pay off earlier creditors, and so it went on in a vicious circle.

A more comprehensive description of his career in the media business with the relevant references can be found in Appendix A.

5. Maxwell's demise and fall

Robert Maxwell was always treading on a very thin line, and he soon learned how to charm and use the people he needed to pursue his business ambitions. The beginning of the end was during the Annual General Meeting of the British Printing and Communications Corporation held in the Mirror Group building at Holborn on June 17th 1987 (Bower 1991, p.8), where it was announced by Maxwell that "the corporation had passed important milestones on its way to becoming 'a global information communications company before the end of the decade, with annual revenues of £3-5 billion and earnings per share to match'".

Maxwell started buying too many companies in a very short time, and he never had the possibility to consolidate the new ventures into the existing. In his endeavours to become the world's leading publisher, not only did he personally fall deeply into debt, but MCC as well and later also the Mirror Group. The true picture of the total debts of MCC, the Mirror Group and his personal borrowings became evident only after his death, but it is estimated that in the middle of 1991 the total debts were about £ 3bn and with interest to match and pay on a regular basis. Most of the loans were secured by taking shares from either MCC or the Mirror Group as collateral.

These debts were the result of some of the largest corporate raids in the US in 1988-91, when he first acquired US Macmillan and later the New York Daily News. The debts from those amounted to the staggering sum of $ 3bn and in the end almost 30 international banks were involved in lending huge sums of money to Maxwell and his myriads of private companies, trusts and financing schemes, using the same collateral to different financiers.

By the end of 1990 it was decided to change the accounting year of MCC from the calendar year to a 15-month period ending March 31st 1991. The official reason was to make the accounting more transparent to the other companies in the Maxwell sphere including the Mirror Group, but the real reason was that the profitability of MCC at the end of the normal fiscal year was very small. Hence, Maxwell would face a situation where the value of the shares would diminish, and the collateral value be undermined, which would lead either to loans being called in immediately or to even more shares being used as collateral. Neither of these alternatives was acceptable and, by prolonging the fiscal year, the true financial situation could be disguised for some time.

In the beginning of 1991, Maxwell decided to float the shares of the Mirror Group, and 49% of the shares became public a few months later on the 30th of April. The float produced net £ 210 m. of which about £ 18 m went to Maxwell privately. The main winners of the flotation were undoubtedly the bank and financial institutions. Nevertheless, the outcome was only a third of what was previously anticipated, and almost none of the City institutions bought any shares. Although Maxwell was not allowed by City legislation to buy the shares of those public companies he controlled, he was using proxies in buying substantial volumes several times during 1991 in order to maintain the value of the shares. It is estimated that he spent some £ 400 m on shares in either MCC or the Mirror Group, and the reason for this was the previous loans with collaterals in the shares. If the stock market valuation of the shares had become too low, the loans would no longer have been secured.

In order to secure more cash, some of the major holdings were sold off, and in particular Maxwell sold his former flagship, Pergamon Press, to Elsevier in March 1991 for £ 440 m. This event was later seen as the turning point for the future of his empire. During the 1980s the Pergamon Group had been profitable every year and generated a healthy cash-flow, and in 1990 the pre-tax profits were £ 27 m (Greenslade 1992, p.276). The need for a large lump sum must have been pressing.

This situation deteriorated rapidly, and in the autumn some of the banks were becoming more and more concerned. In particular the Swiss Bank Corporation and Lehman Brothers in the US both demanded that either their loans should be repaid or new collateral be found. If not, Lehman Brothers threatened to sell some of the stock in order to recover some of the deferred payment of interests, and the bank threatened to take legal action against Maxwell (Greenslade 1992, p.346). Actually, only a few days before Maxwell's death, the Swiss were told that they were going to be paid in a couple of days. Lehman Brothers managed to sell off some the shares, before the suspension of trade shortly after the announcement of Maxwell's death.

On November 5th 1991 Maxwell was found dead, floating in the ocean off the Canary Islands, where he had been cruising with his private yacht, the Lady Ghislaine, named after his favourite daughter. Despite two independent autopsies, one by the local Spanish authorities and the other by British specialists asked for by the family, the real cause of his death has been questionable and never truly established (Thomas and Dillon 2002, p.401). He was awarded a state funeral in Israel and is buried in Jerusalem.

The series of events which happened during 1990 and 1991 were very well covered in the Investigation of the Mirror Group Newspapers plc by the Department of Trade and Industry, which was first published in 1995. A final report was published in 2001 (DTI 2001). In brief, the investigation concluded that the Mirror Group Newspapers was not fit to be public and the company lacked the financial and accounting procedures which were necessary at the time. Further, the companies involved in producing the prospectus, Goldman Sachs in the UK and Lehman Brothers in the US together with the major accountants Cooper Lybrand were found to be guilty of gross negligence when compiling the facts and figures for the prospectus. They were all fined and obliged to repay some of the missing funds to the pension schemes of the Mirror Group and Maxwell Communication Corporation (Zachary 2001, p.A.18) and (Cowell 2001, p.C.2). In the end about two-thirds of the missing funds were repaid. The sons of Maxwell, Ian and Kevin, were acquitted of both responsibility and criminal charges, which were raised after the collapse.

Now almost 15 years after the death of Maxwell some of his ventures are still operating profitably, such as the Mirror Group (now part of Trinity) and the Polestar Group (the remains of the British Printing Corporation). Some of the other ventures, such as the European and the New York Post did not last. The European was sold to the Barclay brothers in 1992 and it finally folded in 1998. The New York Daily News was more fortunate, and is still running, owned by Mortimer Zuckerman, the publisher and editor of US News and World Report. Presently Elsevier is the largest scientific book and journal publisher in the world and it is very possible that Pergamon Press could have continued being a major player in this market, if Maxwell had not decided to use the assets of Pergamon to invest in the British Printing Corporation in 1980.

6. Robert Maxwell and Power

Any leadership needs power to be effective, which is really very obvious. One only needs to think about a political leader who has not been re-elected. He or she is very often referred to as a lame duck, meaning that he/she has no real power and his/her position of power – both the legitimate and reward power - has vanished. Hence, power is not something static. It changes over time due to circumstances which an agent may not be able to influence. Hence, power may be acquired or gained by personal skills/traits or by promotion. Subsequently, power can be lost if a person is too weak in his/her leadership and/or loses his/her position in the organization.

Power is the ultimate way of exercising influence and getting things done. It does not, however, ensure that the power given to a special individual is used in the right way. History has taught us that many great political leaders have misused or even abused their power by acting as dictators. In the industrial world there is not really any difference, only that the means of disabling adversaries and opponents are quite different even if the changes may have far reaching consequences for the individual in terms of having a secure position and/or retirement. Robert Maxwell learned leadership and management the ultimate hardest way possible – during the Second World War – and during wartime there is seldom any time for comprises. He fought his way up the ranks, from a private to an officer’s position as second lieutenant and was soon promoted to captain in the British Army. Although it is not mentioned anywhere in the current literature about Maxwell, it can be assumed that there was not much leadership training during the war, when somebody was promoted to the rank of officer.

Nevertheless it is important to investigate the life and career of Robert Maxwell in order to understand his personal background and how this might have influenced his concept of leadership and his use of power. His army background and the military reward (Military Cross for Bravery) were important factors in the early days of his career and lent him much prestige and appreciation in his business circles:"….any man of foreign birth who had fathered nine children and who was decorated in the field must be exceptional …. tremendous organising capacity … An explosive, enormously dynamic man…" (cited from Crossman, a labour politician, in Bowman 1991, p.124). Nevertheless, the financial, banking and industrial circles in the City were less impressed and always regarded Maxwell as an outsider even if lawyers and accountants more than willingly accepted his checks for services rendered.

The only leadership training was probably on the job itself. If you were not good enough, it would certainly show up very quickly – either you were killed by the enemy or you were decommissioned (if you were despised by your own men, an "accident" could easily be arranged). In the army you quickly learnt to obey authority, and to use this authority to your best benefit. The concept of "need to learn know only" is also very obvious in military organisations, for security reasons. The less you know outside your own position the better, if you are caught by the enemy. This concept was used by Maxwell during his entire career, and this became very obvious in the financial and accounting departments. He was the only one who knew the details and the whole picture.

When Reed International had had enough of the problems with the unions of the Mirror Group, Maxwell became the publisher he had always wanted to be. Although the Mirror Group was a very well established company, he always ran it as his very private company. In this context it can be stated that Maxwell's appetite for power and control was huge, and those who were not with him were against him and in most cases they were fired. Kets de Vries calls this behaviour Self-Destruct (Kets de Vries in Vecchio 1997, p.238).

He certainly achieved a great deal, but he never was or even pretended to be a democratic leader. He was adamant that when he got involved in a new company that he should be given unlimited authority by the board of directors and should control the accounts and cash flow. He ruled the companies he was involved in with a very heavy hand; this became very obvious when he commenced his career in the newspaper business. He said during the negotiations with the previous owners of the Mirror Group that he would never get involved in editorial matters. He said the same to the representative of journalist unions (National Union of Journalists -NUJ), but the honeymoon for the editors was very short. Immediately after the takeover, he stated that he was the publisher of the Daily Mirror and for quite some time he used the front page for his own personal stunts (Greenslade 1992, p.57).

There is sometimes a darker side to leadership, and those issues are certainly most valid in the concept of power in leadership. Maxwell was a master of deception, and used his power to compartmentalise every organization to the extent that most employees in the accounting and financing departments were hardly trusted with sufficient information but had to work on a “need to know” only basis. In most cases he was the only person authorized to sign checks and payments of payrolls, which meant that he had the ultimate control of the cash-flow in all respects (many suppliers found it difficult to get paid at all for their services).

Nevertheless, there are very few theories and little discussion about the darker side of leadership to be found in the traditional scientific literature. However, in recent literature the concept of a darker side of leadership is reflected by Pfeffer (“We are perplexed that ‘bad’ people sometimes do great and wonderful things, and that ‘good’ people sometimes do bad things, or often, nothing at all”) (Pfeffer 1994, p.343). Conger (2001, p.225) also describes some of the potential liabilities for a leader such as the following points, which can also be attributed to Maxwell’s way of exercising leadership:

- Exaggerated self-descriptions
- Exaggerated claims for the vision
- A technique of fulfilling stereotypes and images of uniqueness to manipulate audiences
- A habit of gaining commitment be restricting negative information and maximizing positive information
- Use of anecdotes to distract attention away from negative statistical information
- Creation of an illusion of control through affirming information and attributing negative outcomes to external causes

The question of strength and weakness is essentially the question of how much power is needed in a given situation. Leaders do need power to be effective, but it does not mean the more the better. Less power may be needed by someone who can use his/her skills more effectively, and who is able to prioritize and concentrate on the most important issues. Leaders with a great deal of position power may be tempted to rely on it instead of developing the personal power and using other approaches (Yukl 2002, p.158).

Hence, the way Power is exercised by the individual leader makes all the difference, whether The Power Approach is the right course of action in a given situation. This reflects closely the opinion of Broom (in Scontrino 2003, p.767), where Power is defined as Power = Vision x Energy/ Resistance. It can easily be derived that with sheer energy and very little resistance one can achieve great power in any organization ripe for a takeover, even if the vision content is rather low. When Maxwell announced himself as the publisher/owner, he felt he could do whatever he wanted and there was no nonsense about sharing responsibilities and/or power. All departments were run on a 'need-to-know only' basis (DTI 2001, p.v), and Maxwell frequently used the front page as his own personal page (Greenslade 1992, p.69). The concept did not change even when the Mirror Group went public at the beginning of 1991.

He could indeed be very charming when he wanted to persuade customers, regulators or print union representatives during negotiations, meetings and just normal conversation. Yet, these liabilities would fit perfectly into the scheme of Maxwell and one may only wonder why so many, so often, for so long, were fooled by him. Not only business men, but bankers, financial experts, media managers, political leaders, all were conned by Maxwell. As one of his former colleagues told him after ending their business connection: "Mr Maxwell, you're the sincerest liar I have ever met!" (Greenslade1992, p.39).

Finally, Kets de Vries writes (1993, p.173) that in "Maxwell's world you are either be with him or against. He was not a person to forget or forgive enemies' 'crimes' and he had a memory like an elephant. He would go to great lengths to get even." He goes on writing about what we know about Maxwell to-day and points to the fact he was a "dynamo, wheeler-dealer, anything but a man able to take it easy. He was constantly on the move, be it by Concorde, helicopter, private jet, limousine or private yacht, and constantly talking on the telephone. He was an incredibly action-oriented individual."

Maxwell's public notion that his (public) company Maxwell Communications Corporation would be the leading publisher/printer in the world by the end of 1989/90 was a vision that certainly reflected his personal needs rather than those of the market or MCC. This vision caused him to make some very obvious and fatal mistakes, and in the end both Maxwell Communications Corporation and he himself were overburdened by debts which ultimately led to his fall and eventually his death.

The life of Robert Maxwell and his leadership is an excellent example of using power in all its available facets – mostly coercive, but also legitimate, expert and sometimes even referent power.

7. Conclusions

Early on, Robert Maxwell recognized the need for a more organized forum in the scientific world after the end of the Second World War, although he was taught the discipline by Herr Springer in Berlin. He clearly saw the opportunities in Eastern Europe, when the first Sputnik was launched and later when the Russian space programme created a lot of interest in the West. Translating textbooks from Russia and other Easter European states was quite easy, but getting the copyrights was more difficult. However, for a man with multi-linguistic skills like Maxwell, it was a treat. After he had regained control of Pergamon Press in 1974, he certainly learned his lesson. Pergamon became the vehicle for the expansion of the Maxwell Empire in the 1980s, and was making a profit and a steady cash-flow every year until he sold it to Elsevier in 1991.

Nevertheless, he would have been rewarded for creating a great company out of Pergamon Press, if he had been content to let the company prosper and continue in the scientific business. When reading the accolades from previous editors of Pergamon Press (Johnson, 1988 p.71), it is obvious that he had a good sense of how to manage that particular business, and did so with a light hand. He left it to the editors to decide what to do and what to publish, and took their advice seriously and without any further discussions. In this respect, his leadership in this medium might not have been without flaws, but he was certainly respected and even liked by some of his editors.

There are, finally, some very definitive positive industrial changes in the British printing and publishing industries which can be attributed to Robert Maxwell. He soon learned to use his dominant positions to his best advantage, and he is certainly the archetype of the power concept in his management style – autocratic, dominant, using all aspects of coercive and rewarding power, and with an egocentric view of his own capacities.

One may say that this is a good example of power in management and leadership. The darker side of power was certainly shown by the print unions in the UK for almost 30 years, when they virtually controlled all aspects of print production by abusing their rights, grotesquely overstaffed, overpaid and not willing to use modern technology (Bower 1991, p.359). In this context, both Maxwell and Murdoch should be credited for their willingness to put their companies at great risk, when dealing with the forceful UK print unions. Without them, and the legislation introduced by the Thatcher government, the UK print media to-day would probably be in a very difficult situation (see also appendices B and C).

Needless to say, Maxwell was a very good example of management with power. He reached his position by manipulating people in politics, banking, corporate financing, and in the printing and publishing business and bending them to fit his own personal perspectives. He was of course a social climber and he always felt or considered himself to be an outsider and not part of the establishment in the UK. He was very vain, had unlimited stamina and had very little respect for different opinions voiced by colleagues and/or co-workers. His managerial style was typically influenced from his early days in the ranks of the army, where obeying given orders was the only priority. He certainly learned the power of leadership in the hardest way one can imagine – during the war – and he later used it to his own advantage. It is unfortunate, however, that the darker side of the power concept became the dominant role for Robert Maxwell from 1986 onwards.

Finally, there is certainly a situation where more research on the power approach in relation to the darker side of leadership is needed. Recent events in corporate business in the US as well as in Sweden underscore this statement. A few examples in the US are Enron and WorldCom, where executive officers have been sentenced to life-long imprisonment for fraud, tax evasion and deceitful behaviour against stockholders and employees. In Sweden, there is the case of Skandia, one of the most well-known insurance companies in Scandinavia, where some of the former top executives are facing the threat of prosecution.

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Appendix A

About Mr Robert Maxwell – his own path to a position of power

Robert Maxwell was born Jan Ludwik Hoch on June 10th 1923 and was the seventh child of a poor Jewish agricultural worker family in the Czech village of Slatinske Doly, situated on the border between Czechoslovakia and Romania. When Germany invaded the country in 1938, he first fled to Budapest and later to France. When Germany invaded France in 1940, he managed to escape to England. In England he joined first the Czech Free Corps and later the British Army as a private. He took part in the second wave of the Normandy invasion, was promoted to second lieutenant in 1944 and honoured with a Military Cross for bravery, and was later promoted to Captain. He changed his name several times – first to Ivan de Maurier (after a favourite brand of cigarettes), then to Leslie Jones and finally to Robert Ian (i.e. for Jan) Maxwell (Greenslade 1992, p.24).

He met his wife Elisabeth Meynard in Paris, who worked for the allied forces as an interpreter (Greenslade 1992, p. 23), and they married soon after. After the war he was moved to Berlin, where he was engaged in different capacities for the British forces, because he was quite fluent in German and many other languages (Greenslade 1992, p.26). It has been said that he was able to speak at least seven languages fluently (English, German, French, Czech, Rumanian, Polish, Russian, Yiddish and Hebrew and possible also Bulgarian).

During the chaotic post-war times in Berlin, Maxwell met Herr Ferdinand Springer (not related to the more famous Axel Springer), the publisher of the Springer Verlag, a German publisher of scientific journals. He soon established himself as the sole UK and US distributor for the Springer Verlag. During several years to come he was occupied with various barter trades of commodities to/from the occupied Germany and the Allies, and he developed certain skills in overcoming the most precarious bureaucratic obstacles. The commodities could be anything from ink, paper and spares for printing presses to delicatessen.

In 1949, Maxwell and Herr Springer founded Pergamon Press which became the cornerstone of Maxwell's future empire. The basic business idea was to publish scientific journals and proceedings from various scientific conferences. He managed (or persuaded) many important scientists from the UK and US to participate in various editorial boards, which were given the task of peer-reviewing the articles and giving a serious scientific flavour to the company (Johnson 1987, p.71) He also managed to persuade the Eastern Bloc including the Soviet Union to give him the publishing rights in the West, which after the launch of Sputnik in 1959, became most interesting for western scientists. These rights were given to him without any claims of compensation or royalties, which later was considered rather remarkable.

1951 he bought Butterworth (a competitor) merging the company with Pergamon Press, and later the same year he bought out the Springer interests from the company. During the 50s the company grew and became an important international player in the scientific world. During this period he moved the company to Oxford, where he shared his head office and personal dwelling in a large mansion not far from the university campus. In 1964, the Pergamon Press became public and a part of shares were sold (Greenslade 1992, p.38). Nevertheless, Maxwell retained control of the company as the major shareholder and Chairman of the Board of Directors. Floating the stock gave Maxwell and his family a considerable profit, but it is not evident today how much the flotation gave Maxwell. Even though the company became public, it was still run as a private enterprise by Maxwell. He alone had the full control of the business and the daily operations.

In the early 1960s he entered the political world and after some struggle he became the Labour candidate for North Buckinghamshire. In the 1964 elections he won a seat in the British Parliament, but he was never successful in his political endeavours, even though he managed to be re-elected in 1965. When the Labour Party lost to the Conservatives in the 1970 polls, he also lost his seat in Parliament. He then tried to be re-elected, but eventually also lost the representation of his constituency to a local competitor in the Labour Party.

His drive and energy as an outsider in the British media industry became obvious when he made an unsuccessful bid for the News of the World in 1968-69. The Carr family, who were the owners of the News of the World, called for a “white knight”, and suddenly Rupert Murdoch came from Australia and eventually became the owner of this newspaper (Greenslade 1992, p.56). Although Murdoch was an Australian, he was raised in private schools in the UK and knew the British way of thinking. He was quite acceptable to the establishment which was indeed contrary to its opinion of Maxwell, who was always regarded as an outsider and a social climber. Murdoch became Maxwell’s main competitor in the UK (later also on the world market), and this acquisition was not the last where Maxell was outbid by Murdoch.

In 1969, a financial scandal emerged, when he tried selling Pergamon Press to Leasco Data Processing owned by the American businessman Steinberg. Leasco specialised in main-frame computers, both software and hardware, and was among the top performers on the New York Stock Exchange. Maxwell wrote in the statement about the merger that Pergamon’s profit would be around m£ 120 (or above) for the financial year 1968 (Greenslade 1992, p.40). However, the due diligence process initiated from the buyer was not allowed to check the accounts until very late in the acquisition process, when the buyer discovered several major discrepancies in the accounts of the company and its subsidiaries. There were also many inter-company dealings with companies owned by Maxwell personally (or by other members of the family), which later proved to be an obvious move by him to disguise both the ownership of the companies he controlled, and the source of some sales and profits (Bower 1991, p.221). In fact Pergamon did not show any profit at all for 1968, when all the creative accounting had been corrected.

In the aftermath of the dealings, the London Stock Exchange and the UK Department of Trade and Industry set up an inquiry to investigate why the merger collapsed, and how it was possible that a public company with chartered accountants could obstruct a due diligence process and disguise profits and sales, and who was responsible for the situation. In the report it was stated that “accounting is not a science but an art“, which was very true in this particular case. In the public hearing when the inquiry was presented, Maxwell was severely damaged as a business man and eventually lost his control over Pergamon Press. In 1973 he was condemned by the UK Department of Trade and Industry, which wrote in its report that “he was not a person who can be relied on to exercise proper stewardship of a publicly quoted company”. However, because of a minor technical flaw on the part of the chairman of the inquiry, Maxwell was able to regain the managerial control of the company a year later.

In 1974 Maxwell had regained full control of Pergamon Press, and he publicly stated that he was going to be an important publisher of a daily newspaper in the UK. After first having been outwitted by Murdoch in his first attempt to gain control of a metropolitan newspaper, the News of the World, another chance emerged when the prestigious titles of The Times and The Sunday Times were up for sale in 1980. But, also this time Rupert Murdoch became the winner, and Maxwell was never considered as a serious bidder. He then concentrated his efforts on Pergamon Press, and when the next opportunity came he was ready and the same year he bought a 29.5% stake in the British Printing Corporation. This public company was at the time one of the largest printing companies in the world (Bower 1991, p.341). A year later he gained total control of the company and announced that he was not only the elected chairman of the company but also the chief executive officer.

Although he always said he was a socialist and a friend of trade unions, one of his first tasks, after gaining control of the company, was to confront the print unions in the company. The first battle concerned all the printing plants in the group; Maxwell asked for concessions and reduction of manning from the unions. This fight was seen as a test of whether Maxwell would be able to successfully negotiate with the unions or, as most other owners/managers, would succumb to their power. He did it in a very unusual way. He summoned all union representatives including the national representatives to the company and put them into different rooms. After several weeks of continuous negotiations he managed to bring them to an end, and he was hailed as the saviour of the British Printing Corporation (Bower 1991, p.342).

Despite the undisputable victory there was one plant, where the weekly The Radio Times was produced on behalf of the BBC, which resisted the central agreements. The equipment used for typesetting was both old and outdated, and there was a need for modern computerized typesetting systems. The local print unions rejected the idea and despite several negotiations did not move on the matter. The final result was that one day some heavy men equipped with sledgehammers smashed the equipment to pieces. The premises were closed, and the title printed elsewhere in the group. This event was the first of a series of clashes with the print unions at the British Printing Corporation.

The next fight came when new technology in the prepress area was about to be introduced in the second largest gravure printer in the UK, Sun Printers located in Watford north of London. Eventually, some of these new investments were moved to new premises which were outside the control of the local unions at Sun Printers. In 1981 BPC was renamed and henceforth called the British Printing & Communications Corporation or BPCC.

The largest gravure printer in the UK was Odhams Printers, also located in Watford, and owned by Reed International, the large publisher of weekly magazines and newspapers. As in most other printing works in the UK the owners were always bullied by the print unions, and at Odhams Printers the situation was worse than most other places in the UK, perhaps with the exception of Fleet Street. In 1982, the management of Reeds international had had enough and sold the company to Maxwell. The print unions went on strike, but could not prevent the takeover. Again Maxwell took his time with the central print unions and successfully negotiated a deal, where the two companies were merged and Odhams Printers closed. The print unions were outraged but could not do much about it, and more than 2000 people were made redundant. In the end both Maxwell and Reed were happy, particularly Maxwell because the price for Odhams was quite acceptable. This was Maxwell's second and successful attempt to restructure the gravure publication printing industry in the UK. (In 1989, however, the BPCC part of Maxwell Communication Corporation was sold to the management in a Management Buy Out scheme and hence was no longer a part of the Group. BPCC was later transformed to the BPCC Magazine Ltd and merged with Watmough's in 1992. Eventually this new entity was renamed the Polestar Group and it is one of the major publication printing company in the UK and Europe.)

Reeds International also owned the Mirror Group of Newspapers. The Daily Mirror, located in Fleet Street, was a badly run newspaper riddled with very strong print unions. The management of Reeds International was not able to control the situation and decided to concentrate their efforts on the publishing business of magazines. After the successful result of selling Odhams Printers to Maxwell, he was their obvious choice. The price agreed in 1984 when the ownership changed hands was quite low – a mere £93m. It was estimated that the premises at Holborn alone were worth more than £100m. At last Maxwell had gained control over a major newspaper in the UK and named himself publisher. Once he became the sole owner of the Mirror Group Newspapers, he started a series of negotiations with the local print unions to break the poorly managed technical services of the newspaper.

One interesting piece of information may be added, namely that in the technical departments of typesetting, image manipulation and printing, the various unions controlled the situation completely. The unions made the lists of who was to be paid and how much every week, and presented these lists to the management. The money for the salaries was given to the unions, who in turn paid their members. The management had no control over hire and fire, and did not know who and how many were employed. It later became public knowledge that many names on the lists were fictitious and that the extra money was given to the union leaders (so called Fathers of the Chapel). These practices were common-place in Fleet Street.

In the end, with the help of new legislation presented by the Thatcher government, Maxwell prevailed. The print unions had to succumb, because their previous strike strategy was no longer permitted (Bower 1991, p.399). Hence, new technology was quickly introduced, and in 1989 he was the first publisher to introduce four-colour offset printing on Fleet Street, which was many years earlier than all the competitors. He was the first to undertake a constructive change to the newspaper industry in the UK by changing old working habits and breaking the unions de-moralising grip on editors, management and owners.

Once he was in the publisher's seat in the Mirror Group, a completely new era began in Maxwell's life. He boasted that in a couple of years he would be the owner of a conglomerate of companies in publishing and printing worth more than a billon pounds. He became very involved with editorial matters in the Daily Mirror, which was contrary to what he had previously stated (Greenslade 1992, p.68). He was then already 65 years of age, but nevertheless he started a flurry of new deals and investments in media companies. It was never easy to find the strategy behind these acquisitions and later disinvestments. He purchased stakes in various newspapers, in the UK and abroad, and cable television companies and other publishing or printing companies. Starting in 1985 and 1986 he made a new deal every second month, but this pace was only the beginning. From 1987 onwards a new deal was made every third week, up to 18 new deals every year.

Among those, a few were future-oriented as he started to restructure the American gravure industry by first buying Providence Gravure in 1986 and a year later the Diversified Printing Corporation. In 1987, he also renamed British Printing & Communications Corporation (BPCC) the Maxwell Communications Corporation (MCC). The American gravure printing companies became part of the MCC Group as it was publicly known. The same year the French gravure printer Imprimerie Francois was included in the group. By then, the MCC Group was one of the largest printing companies in the world and only the Japanese Dai Nippon Printing and RR Donnelly in the US were larger. Despite its being a public company, its business and accounts were very cloudy and difficult to analyse. As many witnesses have stated, Maxwell ran the corporation very much as his own private company.

In 1987 he made an unsuccessful bid for the largest textbook publisher in the US, Harcourt Brace Jovanovich. This hostile take-over attempt was probably the first step towards his later demise, because the owners of this publishing firm managed to find serious information about his activities in Easter Europe as well as his secret foundations in Luxembourg (Greenslade 1992, p.154). Despite the very bad press he had got in the US during the fight over Harcourt Brace Jovanovich, in July 1988 (Bower 1992 p. 479) he bid on the shares of one of the largest American publishing companies the US Macmillan. Eventually Maxwell bought the company for a staggering sum of $ 2.6 bn, but at a price which probably was at least 50% too high. Hence, Maxwell fell very much into debt to most bankers and financial institutes in Europe and in the US. The US Macmillan takeover must be considered as a Pyrrhic victory where Maxwell was driven by the desire to expand and accelerate the realisation of his visions (Conger, in Pfeffer 2001, p.219) without considering the immense burden of debts to be repaid.

Maxwell appointed himself Chairman and Chief Executive Officer of US Macmillan, and his interest in both the Daily Mirror and MCC took second place, much to the relief of its directors and managers. In view of the burden of debts, Maxwell started to disinvest a number of companies in the Macmillan group as well as in Pergamon. 1989 was a rather calm year with few acquisitions, but the banks were starting to get worried about the great debts. Until this time Maxwell has managed to keep his bankers and financiers happy by always paying the interests and amortizations of all the debts on time. The international depression begun to have an effect on Maxwell’s empire, and the companies generated much less earnings and profits than before. Hence, the shares of the public companies fell. Most of these shares, however, were held as collateral for these huge debts. In order to calm the financiers, more shares were deposited as security for the loans, and the whole group soon became caught in a vicious circle. The value of the shares was diminishing, and more shares were then needed to cover the collateral.

Despite this process going on, Maxwell managed to persuade other financiers to support new ventures. In 1990 he started the pan-European newspaper The European with editorial content covering not only the old Europe, but also the new Eastern European countries just coming out from behind the Iron Curtain. The idea was to build a concept similar to the USA To-Day, but the commercial side of The European never became successful (The paper started off as a weekly, but it never reached the critical mass needed to become a daily newspaper).

During the same year, the first series of investigating journalism hinted that there was a possible misuse of pension funds in Maxwell Communications Corporation. Other journalists were trying to investigate the links to the personal trusts in Luxembourg, and how they were financed and controlled etc. At the end of the year much of the interest was concentrated to the US and in particular to New York.

Early in 1991 he acted as a “white knight” (Bower 1992, p.510) and accepted taking over the New York Daily News from the owners of the Tribune. Maxwell was given m$ 60 by the previous owners, but he inherited all debts and other liabilities. Very soon it was seen as a very unsuccessful acquisition, and some time after Maxwell’s death the paper was taken over by Mortimer Zuckerman, the editor and owner of US News and World Report. During the rest of 1991 Maxwell had to fight hard to keep his creditors happy as well as finding new creditors who were willing to lend him money. These new loans were used to pay off earlier creditors, and so it went on. In November the same year Maxwell was found dead, floating in the sea off the Canary Islands, where he had been cruising with his private yacht, the Lady Ghislaine, named after his favourite daughter. Despite two independent autopsies, one by the local Spanish authorities and the other by British specialists asked for by the family, the real cause of his death has been questionable and never truly established (Thomas and Dillon 2002, p.401). He was awarded a state funeral in Israel and is buried in Jerusalem.

Appendix B

Structural changes in the British Publication Printing Industry

In the 1970’s, the British publication printing industry was dominated by the British Printing Corporation and Odhams Printers in Watford. The British Printing Corporation was founded in 1964 with the merger of Hazel Sun in Watford and Purnell’s and Sons in Bath, but this merger and further acquisitions was never really successful. During the 1970s there were two giants in the European gravure publication printing industry, both situated in Watford outside London, Sun Printers (part of British Printing Corporation) and Odhams Printers (owned by Reeds International).

During the 1960s and in the beginning of 1970s they were both very large in terms of employment and each had about 3 000 employees. During this time the weekly and monthly magazines boomed, and both circulation and advertising revenues grew. Later, when commercial TV got a strong foothold in the UK, the magazines’ circulation and revenues sank from year to year. Due to very strong unions there was very little the management could do to reduce excessive manning and rationalise the production processes.

In the beginning of 1980, Sun Printers was losing money every year and its working practices were very old and obsolete in comparison with the large continental printers in Europe. The only consolation for the local management in Sun Printers might have been that the labour situation in Odhams Printers was even worse. When Maxwell decided to expand his business interests, he made a successful move when he chose the British Printing Corporation in 1980. Although his leadership in this particular company was very heavy-handed, he did not at the very beginning interfere in all its business. He should be remembered as the one who restructured the British publication printing industry and in particular gravure publication printing.

Nevertheless, within two years after having taken full control of British Printing Corporation, Maxwell managed to strike completely new manning deals with the local unions, and the result was more or less a sensation. The gravure printing was consolidated to Sun Printers with a level of manning which was similar to those in Europe. New more efficient presses and equipment had been installed, and the company was making a profit.

The British gravure publication printing industry was radically and drastically changed by this man alone. The previous owners were incapable of making any significant changes and were often victims of the power of the local unions. The discussion among the union representatives was of course very different. Maxwell had by pure power and energy during the intensive negotiations worn the union representatives down (‘He is the greatest wheeler-dealer we’d ever met’) says Bill Keyes (union official cited in Bower 2002, p.342) and he continues by saying: ‘He will charm the birds off the trees and then shoot them’, (cited in Bower 2002, p.511).

In 1986 the British Printing Corporation also became involved in the printing of the Daily Mirror Group newspaper. Maxwell moved all the printing of the newspapers to a new division of BPC called the British Newspaper Printing Corporation. The new presses were erected in the former Odhams Printers premises in Watford, and by doing so he created a strike-free zone for these titles (Bower 1991, p.417). This was his final coup in beating the print unions at the Mirror.

Although the British Printing Corporation was his first important vehicle for expansion, the former publication printing division (which was renamed the Maxwell Communications Corporation) was sold without sentiment by Maxwell in January 1989. The Maxwell Communication Corporation needed a strong cash injection on order to repay some of its debts, and the division was sold to its management in a Management Buy-Out (MBO). After the buy-out from MCC, the division was renamed BPC Magazine Ltd.

In 1992, the BPC Magazine Ltd merged with Watmough’s Holdings to become the cornerstone of the present Polestar Group. Watmough’s Holdings was a privately owned group of smaller gravure printers in the northern part of England, Bradford and Scarborough. The group was quite successful and went public in 1990. The merger between BPC Magazine Ltd and Watmough’s was named the Polestar Group, which is owned by a private investor and is one the largest publication printing companies in Europe.

Maxwell also tried to make similar structural changes in both the French and the US publication printing markets and brought these companies into the group. In 1986 he bought Providence Gravure and Webb Printing Group in the US and a year later the Diversified Printing Corporation. In the same year he bought a stake in the largest publication printer in the US, RR Donnelley in Chicago. The shares in Donnelley were later disinvested. The other acquisitions in the US were later bought by the Canadian Quebecor group, which is today one of the largest publication printing groups in the world with interests in the UK, France, Belgium and the Nordic countries.

Appendix C

Structural changes in the British Newspaper Industry – 1980-1990

In 1983 the first efforts towards changing the technology of producing newspaper were made by Eddie Shah – the publisher of the Messenger in Warrington. He fought a bitter fight with the print-unions about the introduction of computerized prepress in the paper. He invested in new colour web-offset presses, a computerized prepress and launched a new national daily tabloid the Today. Then he decided to hire his production staff among members from the Electrical union (EETPU) and a long and bitter fight with the traditional print unions broke out. With the support of the new labour legislation introduced by the Thatcher Government he was able to prevail, even though his new national tabloid never became a commercial success. Nevertheless, with new technology he was able to lower the manufacturing costs of producing a newspaper quite dramatically.

The next effort towards changing the industry was Robert Maxwell's dealings with the print unions when the Mirror Group was taken over in 1984. After the first year the financial situation had deteriorated and Maxwell had not been able to reduce the huge production costs of the papers. During a series of meeting in the autumn of 1985 he finally managed to reach agreements with all unions concerned on December 10th. The agreements meant that the work force was going to be reduced by 2 100 out of a total of 6 000, and that all former malpractices of operations would cease immediately. In fact the redundancies were to be paid out of surpluses of their pension funds.

Maxwell did it single-handed his own way, by wheeling-and-dealing with all the print unions in the Mirror Group until they finally succumbed. These agreements would not so easily have been achieved, if the Thatcher Government had not changed the labour legislation a few years earlier to prohibit the closed shop and supportive labour actions in non-conflicted companies. The Daily Mirror was the first UK tabloid to be printed in web-offset in four colours and invested heavily in modern printing equipment from Germany. All other competing national tabloids were still being printed in black-and-white only. Later in 1988 all the printing operations were transferred to a new division of the British Printing and Communications Corporation, called the British Newspaper Printing Corporation. Nevertheless, the new agreements changed the balance between management and union in the UK and new technology could be introduced at a greater pace.

Rupert Murdoch changed the rules for ever, when in January 1986 he re-established firm management control of the production of newspapers – typesetting, printing and distribution etc. - when in total secrecy he built a new printing plant in Wapping. He had disguised his movements as a launch of new morning newspaper – the London Post – to be produced in the premises in Wapping. After having negotiated with the print unions of the Times, the Sun, the News of the World and the Sunday Times, he closed all his Fleet Street operations on Friday night and then on the following Monday morning restarted all the operations in the new plant with completely new staff recruited from the Electricians' union (EETPU).

The entire work force of 6 000 belonging to the traditional unions went on strike, and the plant was effectively sealed off – the Wapping Fortress – by the police. The strikers were demonstrating and trying to block all transport to and from the plant. When the disputes were growing a large police force was mounted to ensure that the plant could operate without interruption. After one year of blockage the strike finally collapsed, and with this collapse all the restrictive union practices associated with Fleet Street and the printing industry ceased. Only a few of the previous members, who had defied the blockade, were able to retain their jobs. These structural changes in the British newspapers were a turning point for both the newspaper and the printing industry.

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Benchmarking Gravure Cylinders

vs.

Web-offset Plates

by

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Key words: Gravure cylinder processing

Computer to Plate (CTP) technology
Web-offset-plates, Electro-mechanical engraving,
Direct digital engraving,

Abstract

This paper deals with an important part of a forthcoming survey of the European Publication Printing Industry – and highlights the developments in recent years of the processing costs of producing either offset plates or gravure cylinders. In 1985-86, one of the most comprehensive studies of the publication printing industry was carried out by the European Rotogravure Association in Munich. This study was the first of its kind and a comparable study has, to author's knowledge, never been compiled. The objective of the present paper is to determine what factors are important when the choice of a particular printing method is made, and if this process was fundamentally different in 1985 than to-day. The hypothesis is that there were some determining factors in 1985 such as the economic consequences (processing costs and market prices), the speed (lead-time) and finally the quality of the printing process to be chosen. In order to make the two studies comparable a statistical analysis of various European macro economic indices has been used, and now 20 year later the first follow-up study is now available.

With an abundant number of players marketing and selling CTP-solutions, there is a tremendous competition in the world market. Hence, most industry observers have the opinion (or belief) that producing web-offset plate's to-day is much cheaper and easier than processing gravure cylinders. The gravure cylinder processes are still considered to be very expensive, cumbersome and old fashioned to the great disadvantage of the gravure printing process. What is often forgotten is that the recent web-offset plate technology is in fact emulating the much earlier developed gravure technology, going directly from the digital file to the image carrier. The big difference is that modern PC and networking technology has made the direct digital interfaces very much cheaper for the gravure printing industry than it was 20 years ago for the first pioneers, and the reliability of the engraving process has reached a level where gravure proofs are no longer necessary.

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1. Introduction

In 1985 the European Rotogravure Association (ERA) conducted a study on gravure and web-offset, and the study was called “Separating the facts from the myths” (Bjurstedt 1986). The investigation included in depths interviews with the leading industry managers, and the processing costs of producing various printed products for each individual company were investigated. The figures were given to the investigator under a non-disclosure agreement. Subsequently the data, containing some 500 files, was processed, and a summary of the findings was given to the members of the Association in 1985. However, it was not possible to identify any individual company, but every participating company was given their relative position in the study. Later in 1986 an official report from the Association was published to the graphic art industry. During the spring of 2005 a new study has been compiled by the author under a similar non-disclosure agreement. This time, however, in depth discussions with the leading supplier of CTP-technology and Engraving systems have been included in the study, as the technical developments, in particular in the high power laser area, are progressing very fast.

Automation and robots controlled by networking computers have been introduced in both the cylinder making department as well as in the plate making department, and modern processes need very few people. Web-offset printers have profited greatly from the new CTP-technology (Computer to Plate) which has come to the market during the last decade. The new technology has lowered the entry level for the web-offset industry, improved the print quality and made longer runs possible. The gravure industry has been slow to respond to the challenge, but recently new efforts in developing alternative methods for the publication printing industry is slowly coming to the market. Newly developed technologies in the engraving area, both for the traditional electro-mechanical engraving heads as well as the new laser engraving units, have automated the calibration processes and significantly improved the production rates and shortened the lead-time. Many gravure printers are now able to use sophisticated process controls of the processing of cylinders, and the processing costs of cylinders have plummeted. These new developments made it clear that a new survey comparing costs, lead-time and quality was indeed needed.

2. Why Benchmarking and how

During the Drupa 2004 a series of in depth interviews were conducted with many top managers in the industry, in particular in the supplying industry. Most comments about the gravure process stated that cylinder making was still a major drawback. Web-offset technology was seen almost everywhere in the exhibition and made a strong impact on most visitors. Nevertheless, some new developments were shown concerning the production of gravure cylinder that was not quite obvious to everyone. Hence, the concept of doing a benchmarking investigation of the current processing costs of gravure cylinders and web-offset plates became an obvious possibility and had to be explored.

Benchmarking is a relative new methodology but has been used in the industry for some time. Notably here is the automotive industry, where many of the most important competitors are comparing the number of hours used in the assembly line to produce a new car. Among those participating in an annual benchmarking exercise are Daimler-Mercedes, GM, Volvo Cars (now belonging to Ford Motor Co), Honda and Toyota. By analyzing the results the European car manufacturers have been able to improve their efficiency and closing the productivity gap to the Japanese industry. “Examples provide an irrefutable standard of comparison that stimulate people to perform better” as stated by Karlöf (Karlöf et al 2001). He suggests that the methodology of Benchmarking shifts the burden of proof to those who question why something should be changed.

However there are not much scientific research in the publication printing industry conducted on the subject matter, but Slimani has suggested a model of benchmarking for prepress companies (Slimani 2000). She suggests in her paper (which is a part of her dissertation) that there are certain benchmark factors which are both relevant and seen as success factors. Such success factors quoted in her study were performance, reliability, efficiency, customer expectations and customer satisfaction.

One of the important factors is the notion that the prepress technology has gone so far that technical quality seems to be approximately the same for all companies. A remark here would of course be that this statement presumes that most prepress companies are frequently investing in leading edge technology. This is not quite true in the gravure printing industry, where one often finds rather old equipment – still operating technically well but not always up to recent standards or possible performance.

As the present investigation does not only compare gravure cylinders and web-offset plates, but also compares different companies, it has a dual purpose. This duality makes this study of particular interest. Some may comment that when comparing an internal process, the customer expectations and customer satisfaction are not quite relevant. But on the other hand, when it comes to compare printing forms, these two success factors are indeed very valid. They really determine the final print quality, which in the end the customer is paying for. Most customers to the publication printing industry in Europe are delivering pages in PDF-format which are ready for engraving or plate making. Here, the active communication between the customer and printing company is one of the determining factors in achieving a quality printed product as demanded by the market. To-day, to the benefit for both customers and printers, there is an established ISO standard for gravure publications which defines the various parameters.

The previous study conducted by ERA in 1985-86 was one of the first of its kind and very comprehensive and included a number companies from Scandinavia, the UK and Central Europe. In this new investigation 22 companies have been participating, among those four of the major suppliers. Some of the companies from 1985 are still in operation and also part of the present study. However, other companies have merged, changed ownership, structure and in some cases gone out of business. Another study from the Gravure Research Institute (G.R.I.) in the US became available in 1987. In this investigation the GRI study is only used as a relative reference (the number of companies included in the US study is not known). GRI was merged with GTA (Gravure Technical Association) in1989, and the new association is the Gravure Association of America (GAA)

3. Hypothesis

In the ERA study from 1985-86 stated, that for processing one 4-colour page in A4 size, the relationship between the cost of gravure cylinder and web-offset plate was about 3:1. The study presumed that the preparation costs of text and images (prepress) prior to cylinder and plate processing were approximately the same for both processes. The publication printing industry used halftone separations, manual planning and montage (or in the case of many gravure printers, colour page make-up systems) and preproofing of the current standard. Most of gravure printers did all this work in-house, to the contrary to many web-offset printers who were outsourcing.

During the last decade with the advancements of prepress technology (Bjurstedt 2005) customers are now using the PDF-technology by Adobe. Almost all prepress work are now sent by wire from each customer, and pages are supplied, including colour profiles (ICC) defined by the printer, ready to be engraved or exposed. The lead-time prior to the press-room is getting very short, which is a great burden to the printer, as he has to control that all pages are correct and ready to be processed. This is, however, a major change since 1985-86, and the printer of to-day has very little influence and control of the creative process. Hence, it is of vital interest to the publication printer to have technical communication process with his customer. Remakes are very costly, independent of the printing process chosen.

The technology shift during the last 10-15 years has had an enormous impact on the publishing industry, and the printing industry has been forced to close or move to the customer most operations producing prepress pages. The entry level of publishing a new magazine has never been lower than to-day, and new titles are being introduced very frequently in all markets in Europe.

The previous technology was quite expensive and complicated, and only trained operators were in control of the technology. These processes have now been simplified to such level that it has become everybody's standard procedure. Hence, the proliferation of the prepress technology has made it much easier for even very small printing companies to handle these processes. During the last decade the development of the CTP-technology and web-offset plate making has undergone tremendous progress. To-day there is hardly any web-offset printer who does not use CTP-technology.

Even if direct digital engraving has been the standard procedure for almost all European gravure printers since the beginning of the 1990-ies, the process of producing gravure cylinders have not progressed until the last few years. One important progress, however is, that to-day there is no need for gravure proofs for publication works. In 1985-86 it was not uncommon that certain gravure companies were proofing their cylinders up to three or four times, in particular for the most demanding advertising pages on the back-side or inside of a cover, and between each proofing process there were also many hours of manual corrections. To-day, the majority of the European gravure industry is still using quite old cylinder processing equipment, and mechanical engraving systems can be as old as 20 years but possible to update to reasonable technical standard. Substantial investments in new gravure cylinder technology, however, have been implemented by some of the larger companies in Europe. Again, one must not forget the impact from the customers, demanding higher reliability, quality and short lead times.

Hence, the hypothesis is that the current relations are still much in favour of web-offset plate making. The previous ratio has increased further during recent years, because there has been a tremendous investment boom in the European web-offset industry with the introduction of more advanced CTP-systems. This investigation will determine whether this hypothesis is true or not.

4. Prepress technology in 1985-86

In 1985 the production methods in the prepress area were mainly manual with the extensive use of graphic films in both printing processes. However, some of the very advanced gravure printers were using digital technology, which drove the electro-mechanical engraving units. Some year's earlier precylinder operations in the gravure industry had moved from using continuous tone films to halftone films in the so called OT-conversion process. (OT stands for Offset-Tiefdruck meaning that continuous tone films were replaced by litho film (i.e. halftone films in the German language)). Most publication gravure printers had large prepress departments, where customer's pages – text composition, images scanned and pages assembled - were processed. Halftone separations made it possible to use commercial available preproofs, such as Matchprint and Cromalin, although the colour gamut match in many instances was questionable. Halftone film (or line film) was much cheaper and easier to process than the continuous tone film, and there was no pre-proofing concept available for this kind of films.

4.1 Web-offset plate making

Web-offset plate making was still basically manual with stripping of pages in 8-page montage as planning format. There were both negative and positive films in use, which varied depending on the market. In the US most web-offset printers were using negatives, whereas in central Europe most printers used positives. Some printers (Kipphan 2001) made single pages and subsequently copied the pages by step-and-repeat units (Krause, Misomex). Planning of single pages was said to be faster and more accurate than the planning of a full montage.

After exposure the plate was fed into the developing unit, rinsed and then gummed up. For longer runs the plate could be heat-treated (baked). In the middle of 1985 a service life of the plate of more than 100 000 revolutions were rare. Several sets of plates had to be used for longer runs.

4.2 Gravure cylinder processing

In 1985 most European publication printers had abandoned the old etching technique and switched to the mechanical engraving method. The first commercial engraver – the Helioklischograph from Dr Hell - was first shown at Drupa 1965 (Picture 1), but it took about 20 years until all etching departments in the gravure industry were closed in Europe. The break-through came in the early 1980-ies, when Dr Hell developed new scanning heads for descreening halftone films. The cell structure produced by the Helioklischograph is semi autotypical (Picture 2), which means variable depth and surface whilst the cell structure on etched cylinders was classic – same surface but variable in depth.

All printers were using single page make-up. The single films were copied to bromides, a material called Opalines, which was a white opaque film. These were mounted on a scanning cylinder, page by page sideways and lengthways, one cylinder for each colour. The scanning cylinder was read and simultaneously a copper cylinder would be engraved. The process of producing bromides was rather expensive and slow (Gravure - Process and Technology 2003). Eventually, with the event of the digital prepress operations a direct digital interface was developed by the most important suppliers, Scitex, Crosfield and Dr Hell. The first major installation, using a networked Scitex Response system, of a filmless operation in gravure was already in 1982 at Gutenberghus (now known as Egmont Magazines) in Copenhagen (Bjurstedt 2005). The direct digital interfaces were much faster, obtained a better cell quality and were easier to control than the previous methods.

5. Contemporary technologies

The extreme fast progress of digital technology in the 1990's had a great impact on the printing industry, in particular in the prepress area. New and affordable software packages for editorial and image manipulation were quickly accepted by the publishing industry, and the previous analogue technology was soon abandoned. With the help of modern PC and server technology as well as new networking protocols, such as Ethernet and Internet, the digital revolution in the printing industry created a chain of reactions. Postscript 3 was indeed superior to the previous versions, but there was still a need for improving the lithographic print quality (Bjurstedt 2005). Larger size formats were not easy to do plan manually, and the first step was called CTF – or computer to film. With the digital workflow, however, there was a need for new tools, such as automatic imposition, trapping and pre-flight control (Bjurstedt 2005).

As a result, new digital workflow techniques were introduced, all based on the PDF-technology (a subset of Postscript), which improved the control and transparency in the prepress process. Larger image-setters became available to the market, and web-offset printers could start using a digital work-flow creating a plate-ready film as output. All these new techniques created a dramatic change in the way the industry had worked, because the customer suddenly gained complete control of the work flow and indeed the prepress work. Previously, the publication printing industry processed all the pages and controlled the both prepress work and the work-flow.

5.1 Prepress technology

The photographic film had some serious disadvantages, such as smaller dots could not easily be reproduced, and the film material had a very high sensitivity and affinity for dust particles (static electricity). New screening technologies which could improve the print quality of lithography were introduced, but the film material limited the possibilities of these new technologies when the plates were exposed the old fashion way. An urgent need for a new technology, exposing the offset plate directly was needed, and it was called Computer to Plate – CTP. The common opinion in the graphic art industry is that plate making for offset has made dramatic progress during the last few years, and many technical solutions were developed with the emerging Computer to Plate technology.

5.2 Web-offset plate making

In 1993-94 the first attempts of CTP-technology were tested in the industry. Among the pioneers were DuPont, Autologic (now part of Agfa) and Creo Inc. (now part of Kodak). DuPont was using a silver based plate for shorter runs, up to 50 000 copies in the newspaper market, and the CTP-device was a reengineered

Pagefax receiver unit from Crosfield Electronics (at the time partly owned by Dupont). The major limitation in this particular combination was the quality of the plate, and the resolution and format of the receiver. The latter was optimized for newsprint (newspaper production) and could not for commercial work.

In the end of the 1990-ie, more advanced screening algorithms, imposition and trapping systems became available as well as Preflight systems (Picture 3 and 4). With these technical developments the CTP technology quickly matured and became accepted by the offset printers. Another contributing factor was of course the PDF-technology which made digital prepress affordable for all customers. Then many of the prepress companies were marketing larger size CTP-devices suitable for web-offset plates in the 32 or even 64 page press formats (Picture 5). Heat-treatment (baking) has given a service life of up to a million copies (Kipphan 2000).

Recent developments, with faster laser diodes and an abundance of different plates available on the market, made CTP-technology and plate marketing extremely competitive. During the interviews with various suppliers it has been quite obvious that this particular market is the buyer’s market, with hard pressure on prices and margin. There is hardly any independent CTP producer after the latest merger between KPG (Kodak) and Creo Inc. It seems, after many deliberations, that all the suppliers are really struggling to maintain a reasonable profitability.

5.3 Gravure cylinder processing

Most of the European gravure publication printers have engraved the cylinders digitally since the middle of the 1990-ies. The gravure cylinder processing market, however, is dominated by only two players – Hell Gravure Systems, Germany and Dätwyler AG, Switzerland. These two companies are both offering the full range of equipment for processing cylinders for both publication and packaging printing in gravure, and may offer their customers turn-key solutions. Hell Gravure Systems is a recent management buy-out from Heidelberg (Dr Hell by acquired by Linotype in 1990, and in 1995 Linotype was acquired by Heidelberg)

Unfortunately, most of the technical development concerning engraving technology was on a very low level during most of the major part 1990-ies, because the owners were not very interested in the gravure market. However, after the MBO more funding for technical developments has become available, and many new products have been brought to the market. Hell Gravure Systems is affiliated with the Kaspar Walter Group in Munich, and together they can offer complete integrated lines of plating and engraving of cylinders.

The only contester is the Swiss company Dätwyler AG, which has been active in the cylinder processing (plate making units) market during more than 25 years.

Since a decade the company has been developing a direct laser engraving technology using zinc rather than copper as the cylinder surface (the zinc layer is subsequently chromed to obtain the perfect printing surface). They have been very successful in the packaging market, but there is to-day only one major installation in gravure publication printing – Bauer Druck in Cologne. The Bauer installation is now considered to be very successful, but it has taken considerable time to move the first installation into success. In the autumn of 2005 another major installation will be at the Polish subsidiary of Bauer Druck, and will be operational later the same year. The cell structures can easily be modified by the laser (Picture 6), and the direct laser engraver from Dätwyler is said to improve the ink release and hence the printability on most publication printing papers.

The growing competition from Dätwyler has prompted Hell Gravure Systems to improve the mechanical engraving technology. During DRUPA 2004 the first prototype of a new laser engraving technology was shown but very little detail was published. The new laser system from Hell will engrave either on copper or chrome, but is not be marketed for publication gravure until sometimes in 2006/2007. Recent mechanical engraving heads may engrave up to 12 kHz, which is quite an achievement as the first head could only do less than 4 kHz (Picture 7). The majority of the existing heads are still in the 4 kHz which indicates a large market for upgrades and improvements.

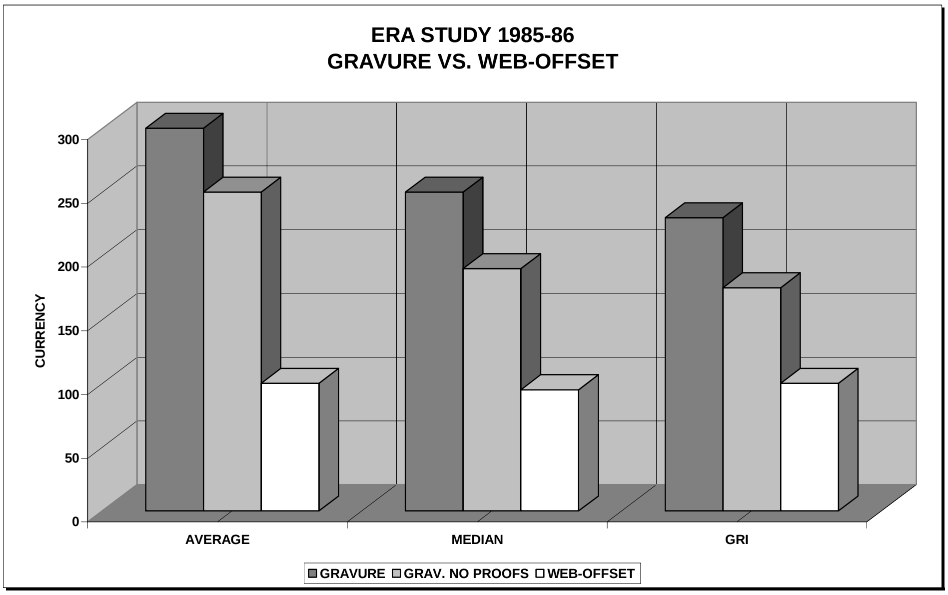
However, the direct laser engraving has an advantage of speed of more than double the engraving speed (8 channels of 7.5 kHz in comparison to 140 kHz), when smaller sizes of cylinders are compared. This advantage will of course change when using wider cylinders, as one channel is needed for each ribbon. Nevertheless, the calibration, loading and unloading of a cylinder, whether using laser or mechanical heads, still take a very large part of the process time needed for one cylinder. When compared with web-offset, the CTP-technology is much easier and faster to implement, in particular when using very fast laser diode arrays rather than a single beam. Further, the power of the lasers for CTP is only in the milliwatt range (mW), but in order to engrave in metal (like copper or zinc) the power is exceeding 300 W.

Recently, more advanced products have also been developed in the plating of copper or chrome of the cylinders. These allow the user the full automation inclusive loading/unloading and transport to a cylinder storage. The complete cylinder processing cycle is controlled by networked PC, and the processes in the individual plating or finishing unit can virtually run without any human intervention. Also the engraving units – the electromechanical or laser engravers – are to-day fully automated, and any changes of format, gradation etc. as well as calibration, is now controlled by the network Even an individual cylinder can be controlled, and some users have a chip built in each cylinder for easy identification and control.

6. Analysis of data from 1985-86

The summary showed that generally speaking web-offset plates were cheaper and faster to process with a ratio of 1:3 to the disadvantage of gravure cylinders. However, this number was only valid when the worst scenario gravure was used – standard offset size A4, one gravure wet proof, some corrections on the cylinders etc. The project concluded, nevertheless, that the gravure printing process was stated to be very competitive from 32pp signatures (and larger), if best practice and technology were used (Bjurstedt 1986). The results of the 1985-86 study can be found in Diagram 1.

Diagram 1



The figure to the right is showing the numbers from the US Study from Gravure Research Institute previously mentioned (the result converted in European currency as very favourable at the time, because of the recess of the dollar). However those companies using best practice and processing a reasonable numbers of cylinders would easily reach a ratio of 2.5:1 or less. One important observation at the time was that the variable cost of producing one gravure cylinder was low compared to a web-offset plate. Hence, with the right management and technical awareness, the gravure cylinder processing was indeed competitive.

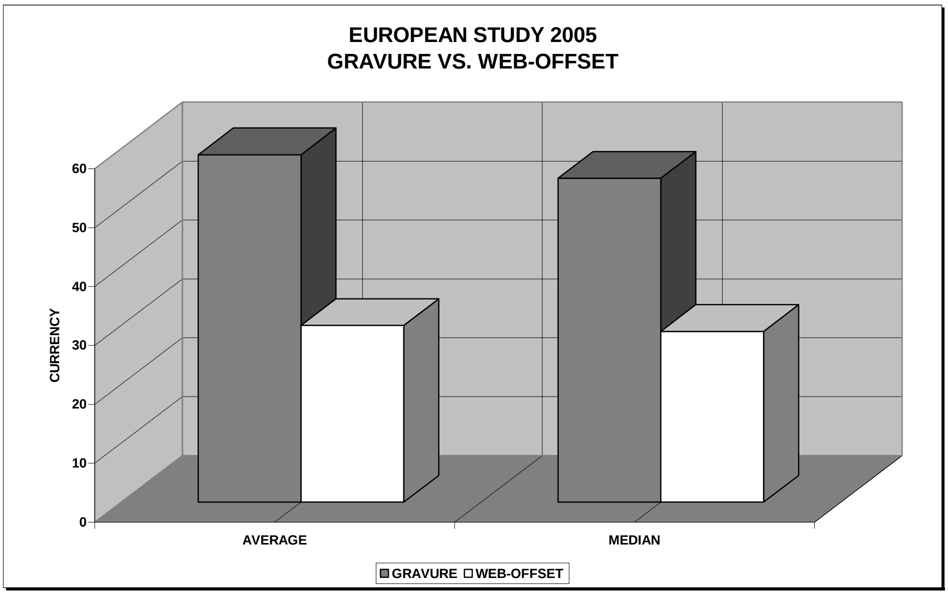
Consistent with these known facts some gravure printers pioneered the new digital technology already in 1983 and were among the first to benefit from the use of direct digital interfaces to the cylinder engravers. By doing so they omitted the use of graphic film, which greatly reduced costs, improved the quality of the final printed product and shortened the lead times.

As already has been mentioned within a decade later most gravure printers followed in their footsteps and went digital. This enabled many publication printers to go directly to the press without having to proof the cylinders. Simultaneously, some of the leading advertising agencies and admittedly some other customers embraced the new digital technology and demanded that their digital artwork - ready-to-be-printed – should be distributed by telecommunication. Only for very prestigious and expensive advertisements was proofing still needed.

7. Analysis of data from 2005

During the winter of 2005 further interviews have been conducted with a substantial number of printers – both gravure and/or web-offset printers – using the same technique as in 1985-86. For the first time a benchmarking methodology has been used in the publication printing industry on a European basis.

Diagram 2



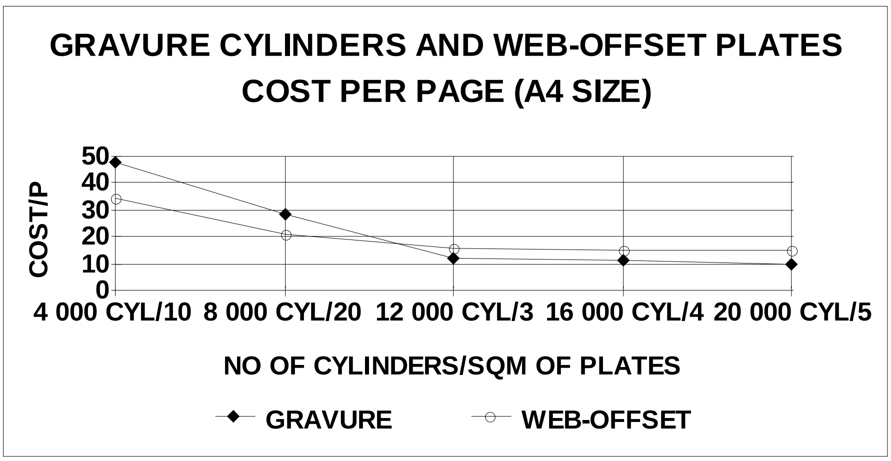
The validity of the statistics collected has been assured, and a sufficient number of printers answered. A similar non-disclosure agreement as in 1985 has been used (Diagram 2) The recent results show that the ratio between gravure cylinders and web-offset plates has been reduced to about 1:2, and when using wider cylinders the ratio is even further reduced. One of the major conclusions is the great change of attitude and procedure among gravure printers. To-day with the improved computerized control of the process, there is no need to carry out corrections or proofing of the cylinders.

By abandoning the old bad practice modern gravure printers are now able to produce gravure cylinders much cheaper and with much more reduced lead-times than ever before. Another significant change is that the element of fixed costs in web-offset plate making has grown since the introduction of the CTP technology. Using the “old” manual technology, the element of fixed costs in plate making was very low.

Nevertheless, the spread among the European gravure printers is indeed very large. The statistics shows, that the cost of processing small and medium size cylinders in low numbers is very high. Consequently, printers with low volumes and small or medium size cylinders have high costs and will face strong competition from modern web-offset printers. With a limited number of pages on the cylinder, the unit cost becomes very high. On the other hand, those printers utilizing the very wide cylinders in greater volumes have very low cost per page, some even lower than the mean/average of web-offset pages (Diagram 3).

The cost per page among web-offset printers seems to converge into a European average, and the spread is significantly smaller than among the gravure printers. My assumption is, that the competition in the European market for plates and CTP-devices has been extremely tough during recent years and that the cost of equipment and materials from different suppliers have become very close to-day, almost to a point of a standard European level. Furthermore there is almost impossible for a supplier to be competitive in the web-offset market, if he can not offer both plates and CTP devices as a combined business.

Diagram 3



The price elasticity in cylinder processing is rather weak, which means that if a printer decides to invest in wider cylinder face width, i.e. going from 2.5m to 3.7m the increase in the investment is much less than 50% - typically about 20-30%. Web-offset plate making is much more surface dependant, even if there is, as in cylinder processing, no linear relationship for devices needed for larger plate sizes. The maximum plate size for publication printing is to-day about 1.3 x 2.2 m (or almost 3 m^2) in comparison to the maximum size cylinder which is 1.4m x 4.3m (or 6 m^2), i.e. the double size. Web-offset plates twenty years ago were slightly larger than 1 m^2, but already then the largest gravure cylinders were almost 4 m^2.

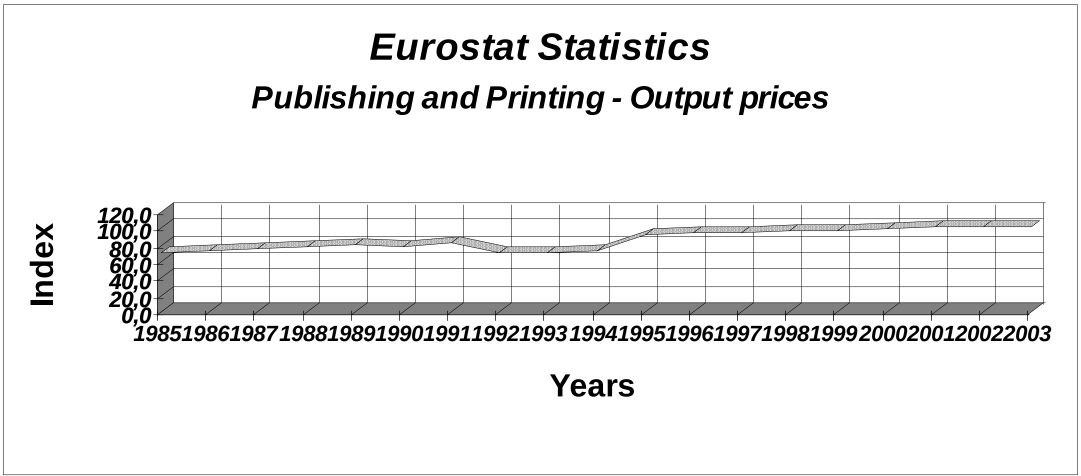
The marginal costs, defined as the variable costs (consumables, materials, energy costs and some maintenance for one additional plate/cylinder), are very low in processing another cylinder. In this context for both gravure and web-offset, wages and social costs are considered to be fixed in a short medium term. However, the marginal cost in plate making is much higher as another plate has to be processed. Diagram 3 shows the relationship of the cost per page between gravure cylinder processing and web-offset plate, and it seems that the break-even level is about 10 000 cylinders (equal to 25 000 m^2).

8. Best Practice of contemporary technologies

A statistical analysis of recent numbers from the statistical office of the European Union (Eurostat) indicates that the general production cost index in the printing and publishing business has increased by 32 % in current prices during the last 20 years, Diagram 4. The annual figure shown is the average taken from the individual index figure of these countries, which has been participating in the study. During the recession about 15 years ago the cost index decreased by almost 10%, and during the last decade the index has increased with less than 10%. The cost control in the business has become tight, and many companies have been forced to cut costs by reducing the workforce and/or other actions.

Hence, when taking the general development of the production cost index in perspective, the cost reductions in the plate and cylinder processing has indeed been very substantial. The introduction of new technology has given a reduction in running prices of about 80% in gravure cylinder processing (if the previous proofing costs are included). The relevant figure in web-offset plate making is about 65%. The general trend in the industry has had an increase of less than 1.2% (compounded) annually, which shows that the above mentioned reductions in prepress area are quite dramatic.

Diagram 4



Nevertheless, it is believed that most of the economic benefit of lower costs in preparing cylinders and/or plates has not remained within the printing industry, but has been transferred to the customers. It has been a buyers' market during the last decade, but that is quite another story.

8.1 The investment model

In this investigation an investment model is introduced. This model shows the actual cost of using modern technology, whether it is CTP for web-offset or direct digital engraving for gravure cylinders. The model is simulating the cost, estimated per A4-page or m^2, using the same annual volumes in all processes. The condition of work is the same, such as personnel costs and number of working shifts. However, manning levels used in the model have been taken from the advice from each supplier and is supposed to cover file and data handling, cylinder or plate processing including plating processes in gravure. Similarly, depreciation, maintenance and service contracts and cost of consumables have been submitted by each participating supplier.

The annual production of cylinders (and plates) has been converted into surface (m^2) area for an easy comparison. The annual surface area has been chosen to either 10 000 m^2 or 20 000 m^2, which is equivalent to 4 000 and 8 000 cylinders respectively. However, these production levels are quite small, but interesting for a middle size gravure production in the European market. The width of the cylinder is only 2.5 m holding 32 pages in A4 size – in 8 ribbons and 4 pages around in landscape mode (4U). With larger circumferences, 48 pages in 6U or even 64 pages in 8U can be engraved. Modern gravure presses and cylinder processing equipment can accommodate from 4u to 6U and 8U.

A comparison with this configuration should be advantageous to web-offset plate making.

8.2 The investment model for web-offset plates

The investment model for web-offset plate making has a few very central issues, such as the investment costs for the CTP-devices, the capacity and the procurement of plates and chemistry. The model calculates the cost per m^2 and for a 16 pages plate (size 1240 x 980 mm) as well as the marginal costs for another plate (or m^2 plate). It is quite obvious, that with the present performance of contemporary CTP-devices (from Agfa or Fuji) the capacity level is very low. Another issues is whether there are one or two CTP-units needed in the model. However, the assumption is when a four shift operation with very close deadlines is chosen, a second back-up unit would be needed for redundancy.

An example of concluding page of the model shows the capacity, lead-time and the cost per m2 and other figures of the model can be found in Appendix 1.

8.3 The investment model for gravure cylinder processing

In the gravure model there are many more variables such as the investment in all plate processing equipment, logistics to handle the cylinders, investment of the base cylinders etc. as well as the capacity of engraving units. There are two different engraving systems on the market, hence the model has been divided between mechanical or laser engraved cylinders.

The number of engraving units differs, as the laser engraving unit has a higher frequency rate – 140 kHz – as compared to mechanical engraving heads of 7,5 kHz/ribbon and head. That means that the laser engraver is always faster than the mechanical engraver, unless more than 18 heads (channels) is used (more than 16 channels is not yet commercial available). It is expected, however, that in a rather short period of time, new mechanical heads running at 12 kHz will be available for the most modern models. The calibration and other pre-engraving operations are still quite a substantial part of the total process time for both processes. In theses procedures much more work for enhancement and shorter turn-around cycles is needed.

According to the model – and the size of cylinders chosen – there is only a marginal difference in the cost performance between mechanical or laser engraved cylinders. In both cases, a part of the maintenance cost have been applied as well as the additional costs of the plating process (Cr/Co or Cr/Zn respectively and the power needed for plating) for one cylinder. Nevertheless, there is a distinct difference in the marginal cost, which is due to the maintenance of the stylus (diamond tips) for mechanical engraving heads. However, in the case of laser engraving, this marginal cost is only the power/energy used for one additional cylinder.

Examples of concluding page of the model can be found in Appendix 2 and 3.

8.4 Comparison of the Investment Model for gravure and web-offset

A comparison of the relative costs for gravure using either mechanical engraving(EMG) or laser engraved cylinders(DLG) and web-offset plates as well as the lead time for producing plates and cylinders for a 64 page signature with 4+4 colours have been done using the input from those suppliers participating in the study. However, there has not been possible to add any overhead costs into the model, as these costs would undoubtedly vary from printer to printer depending on organization or size of the company etc. The absolute numbers are available for the author, but as these numbers have been given under condition of non-disclosure, these can not be shown.. In Table 1 the summary can be found:

Table 1

Comparison of gravure cylinders and web-offset plates – relative figures/ € per page in A4 size – 64 page signature

ANNUAL CAPACITY	EMG	DLG	CTP
10 000 m2/4 000 Cylinders	1.4	1.4	1.0
20 000 m2/8 000 Cylinders	0.8	0.8	0.6

Web-offset plate size = 1 240 x 980 mm. Gravure cylinder size = 875 x 2 500 mm.

The model shows, that with increasing volumes, gravure cylinders become relatively seen cheaper to process.

This is of course consistent with the numbers noticed in the present investigation. When looking at the individual answers about cylinder costs, it became very evident that with higher numbers and larger cylinders, the cost per page can become as low as 1:1 in comparison with a web-offset plate. These facts can easily be verified by changing the parameters in the model itself. Although the calculation is not shown here, using the investment model of present standard size of 3m face width, the gravure process is as cheap to produce as a web-offset plate calculated per page. (a cylinder with 3.7m face can accommodate 48 pages in 4U or 72 pages in 6U in comparison with a present maximum of 32 pages in plate processing). Even with the standard size of a gravure cylinder of 2,5m width, a relationship of 1:1,3 can be expected when comparing up to date technology in both processes.

The marginal cost of producing another 1 m^2 of plate resp. gravure cylinder surface can be found in Table 2.

Table 2

Comparison of gravure cylinders and web-offset plates – relative figures The marginal cost of producing one additional plate or cylinder

ANNUAL CAPACITY	EMG	DLG	CTP
10 000 m2/4 000 Cylinders	0.8	0.3	1.0
20 000 m2/8 000 Cylinders	0.7	0.3	0.9

Web-offset plate size = 1 240 x 980 mm. Gravure cylinder size = 875 x 2 500 mm.

It is obvious that the laser engraving method has a much lower marginal cost than both web-offset plates technology and mechanically engraving. When the production of cylinders or plates has to be increased, the cost advantage in the gravure process is quite obvious. However, it is quite easy to produce another plate with modern CTP-technology, and in many cases this request can be handled by the press room operator if something goes wrong in the press room. This is still an unlikely scenario in a gravure press room, but on the other hand remakes of cylinders caused by some malfunction in the press room are indeed very rare.

Another factor of great importance is time to market. In this context the lead time is defined as the time from receiving digital artwork for processing plate or cylinders until these are ready for the press room. It is assumed, however, that handling and control as well as the preparation of data are more or less the same, independent of the process chosen. This is particular true when PDF-files with the relevant colour profiles (ICC) are received from the customers.

Table 3

Comparison of gravure cylinders and web-offset plates – relative figures - Lead time to produce cylinders or plates for a 64p signature

ANNUAL CAPACITY	EMG	DLG	CTP
10 000 m2/4 000 Cylinders	4.6	4.2	1.0
20 000 m2/8 000 Cylinders	3.1	2.1	0.5

Web-offset plate size = 1 240 x 980 mm. Gravure cylinder size = 875 x 2 500 mm.

Lead-time to press is still a major drawback for the gravure process, even if the time in absolute values has improved tremendously during the last few years. Nevertheless, the time difference is still between 3-4 hours. In the press room, however, part of this loss can be regained in modern gravure presses with automatic cylinder loading/unloading and modern presetting technique of colour register and folder. There is no significant difference between laser and mechanically engraved cylinders, although the number of engraving units in the department has a significant importance to the lead-time, Table 3.

9. Conclusions

It is clear from the results obtained that the present hypothesis is false. The results may even be regarded as a surprise, and to the contrary of the belief of many observers in the industry. The relationship has improved from 3:1 to 2:1 (or even less) during the last decade. Although no numerical data is available from 1995, it seems plausible that the relationship ten years ago probably was even worse seen from a web-offset printer's perspective. Due to the proliferation of the CTP-technology and the extreme competitive web-offset markets during the last five years, the web-offset industry has been able to restore some of the previous advantages. Much of the focus in the printing industry has been devoted to lithography and indeed the CTP-technology, which was very obvious during the recent DRUPA exhibition in 2004. The only new gravure cylinder technology shown was the Creo/Acigraf (similar to the Think Laboratories of Japan concept) Exactus concept with autotypical cells (Picture 8). This process may process cylinders at very low rate, much less than the numbers shown in the Investment Model, but yet there is no information available from the first installation at R.R. Donnelley in the US.

It seems that the gravure users has been able to claw back some of the recent advantages of web-offset plate making by the introduction of faster and more automated processes needing much less manning than before. Nevertheless, there are still some very distinct advantages with web-offset plate making. Simplicity and speed are still the two major factors, which should not be underestimated, and there are many players in this particular market. Furthermore the investments needed for a turn-key CTP-solution are much less than for a similar capacity in gravure cylinder technology. The numbers given by the individual suppliers to the investment model indicate that the investments in gravure cylinder process equipment may be more than 4 times higher. For an entry level company who needs more base cylinders than those included in the model, this figure can be even higher.

Some industry observers believe that with the present huge investments in the gravure industry in the UK and Italy, the engraving technology will be further enhanced. The problem is that there is yet an entry level to be established for new players or for those rather well established gravure printers with ageing press room equipment but only with a need for a medium to low capacity (Puri 2003). The capital expenditures are in relation to web-offset equipment still substantial.
nly way the cylinder processing can be improved is by more automation and faster processes. Laser technology in cylinder engraving has been slow in gaining

acceptance among gravure publication printers. This is, however, already well spread among the packaging engravers. Most certainly there is a lack of entrepreneurship among the publication printers, and new technology has some difficulties in getting the necessary attention and acceptance. With newly installed laser engravers and up-to-date mechanical engravers the cell structures in gravure can be improved substantially, and as a consequence the gravure print quality will probably leap-frog to an almost continuous tone (photographic) level, which was common with the old and classical etching methods in the 70's.

Web-offset (surface variable lithography) can never come even close to similar photographic quality, even if the CTP technology has enabled very much improved screening technologies, such as FM and hybrid screening for the web-offset market. What improvements in plate making for web-offset printers can be expected in the near future? The process-less plate is now available, but with a limited service life. It is questionable whether the total cost of ownership will improve significantly. The single most important cost item is the basic plate, and the cost is of course depending on the world market price of raw aluminium. It is not expected to see a slump of the aluminium price on the world market, rather the opposite, when demand from the construction and automotive industries are rising from new emerging markets such as China and India.

In what direction will the demand for high print quality go? The demand for print quality is the most determining factor when choosing a particular printing method. In some market good enough quality is indeed good enough!

Some final points:

- Investments in gravure cylinder processing is about 4 times higher than the current CTP-technology compared on a turn-key level and with similar capacity
- Recent advances in the prepress technology has benefited the web-offset process more than the gravure production
- Lead-times have substantially been reduced with modern prepress technology
- Nevertheless, lead-times in gravure are still an issue – about 2-3 hrs longer in cylinder processing than plate making
- The cost per page for both processes are converging
- Cylinder processing costs have their own dynamics....
- Gravure is still a process for larger companies with many presses (=more cylinders to process) and large cylinders (=more pages on the cylinders)
- An entry level for the gravure process is still to be found..........

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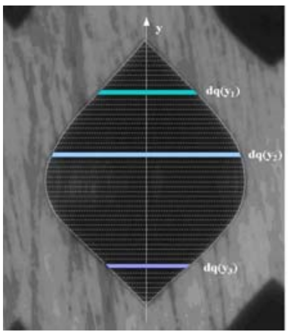
Finally many thanks goes to Hell Gravure Systems GmbH, Max Dätwyler AG, Agfa Sweden and Fuji Film, Sweden; for most valuable input and comments as well as in depth technical discussions. Illustrations to this article have been given and authorised by the each company respectively.

Pictures

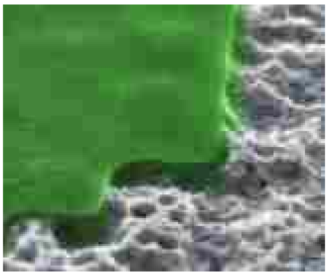
1. Dr Hell – Helioklischograph – first launched at Drupa 1965.
First prototype already 1961   Page 5

2. Cell structure – mechanical gravure – semi autotypical cell structure (middle tone)



3.

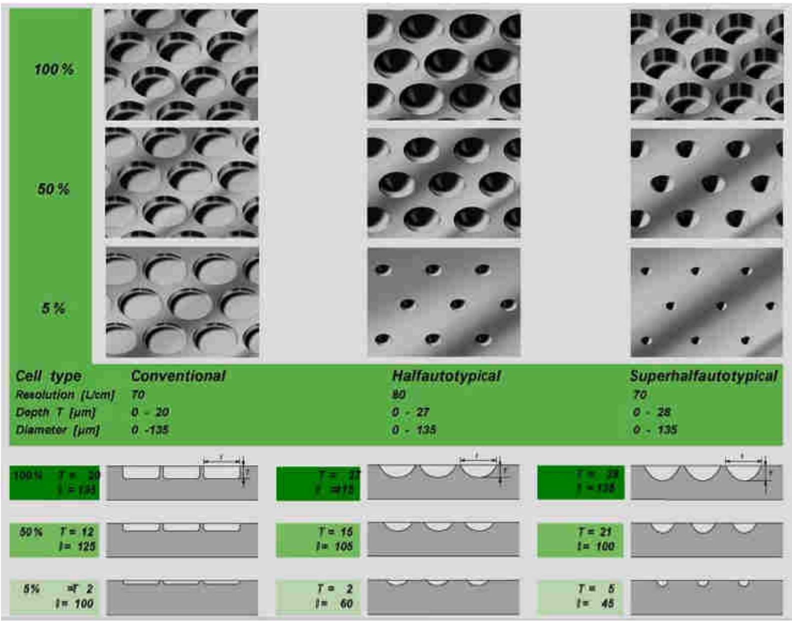
4. Screening systems – Creo – example of Square Spot



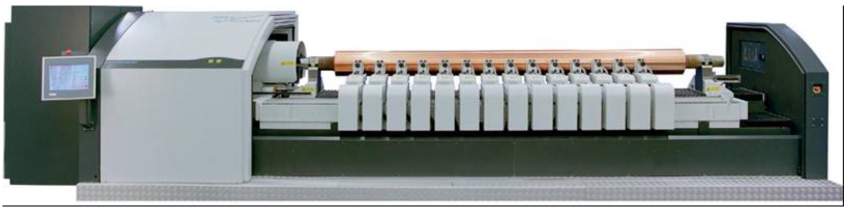
4. Hybrid screening from Fuji Film

5. Agfa – large size CTP unit

6. Cell structure – comparison with conventional cells, semi-autotypical and super cell structures – Dätwyler Direct Laser Engraving

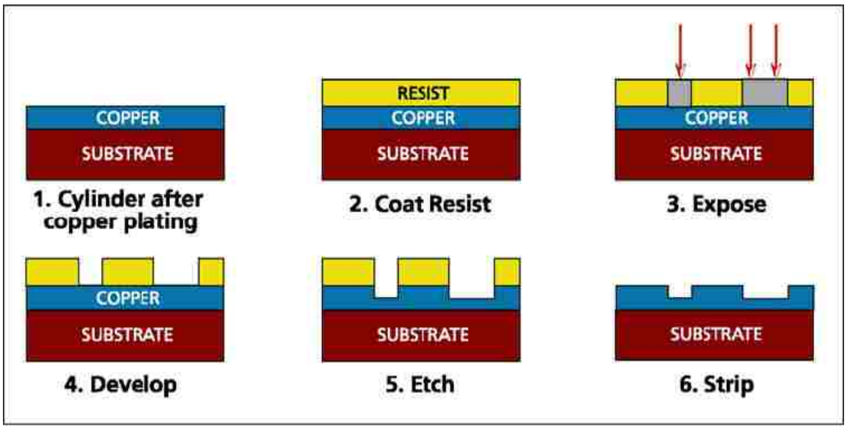


7. Hell Gravure Systems - K6 Engraving unit fully automated with 14 channels



Cylinder face width = 440 cm – protection lid open

8. Creo/Acigraf – autotypical cell structure (same depth, variable surface)



MARKET CONDITIONS FOR EUROPEAN PUBLICATION PRINTING A TWENTY YEAR SURVEY 1985-2005

by ANDERS BJURSTEDT, M.Sc., Lic. Eng.*

KEYWORDS:
PUBLICATION GRAVURE PRINTING, COMMERCIAL WEB-OFFSET, PLATE-MAKING, GRAVURE CYLINDERS, INTERNATIONAL MARKETS, QUALITY, PRESS PROOF

Abstract

This paper deals with an important part of an ongoing survey of the European Publication Printing Industry – and highlights the present market conditions and product specifications in relation to the conditions which prevailed twenty years ago. In 1985-86, one of the most comprehensive studies of the publication printing industry was carried out by the European Rotogravure Association in Munich. This study was the first of its kind, and no comparable study has, to the author's knowledge, ever been reported. The objective of the present paper is to determine what factors are important when the choice of a particular printing method is made, and to consider whether this process was fundamentally different in 1985 than it is today. The hypothesis now being formulated is that the determining factors in 1985 were the economy of scale, the speed (lead-time) and finally the quality of the printing process to be chosen. In order to make the two studies comparable, the same questionnaire has been used today as twenty years ago, with only one minor amendment concerning what digital format that present customers prefer.

In the present investigation, a qualitative approach has complemented the quantitative study, and most questionnaires have been answered during rather extensive personal interviews.

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The recent investigation includes in-depth interviews with the leading managers in various sectors in the industry, and this time not only printers but also the most important suppliers – printing press manufacturers, paper and ink manufacturers, plate processing equipment suppliers, cylinder processing equipment manufacturers and other important contributors to the printing process, were interrogated. This approach has also given the author the possibility of explaining some of the issues in greater detail, and this will give the reader a deeper understanding of the current European market situation.

The extremely fast progress of digital technology in the 1990's had a great impact on the printing industry, particularly in the prepress area. New and affordable software packages for editorial and image manipulation were quickly accepted by the printing industry, and within a short time the previous analogue technology was abandoned. During the recent interviews, it became clear that most prepress work is now done outside the printing companies (outsourced). Even the integrated publisher/printer prepress work has moved from the printing to the publishing division. These new techniques created a dramatic change from the way in which the industry had previously worked. Suddenly, the customer gained complete control of the work flow, mostly based on PDF technology (a subset of Postscript) and of the prepress work, previously created and controlled by the printing industry. Digital advertising materials are today centrally produced according to the new ISO standards for publication printing (gravure or web-offset). Larger multi-European campaigns can be produced by one agency, whilst the different language versions are later distributed via the Internet.

This paper shows that the changes in the market conditions and product requirements have been dramatic in Europe during the last 20 years, and that further changes are about to happen. These new developments in both prepress and press for web-offset have put the gravure industry under immense pressure, and it has become very clear during the interviews that the mid-size gravure concept has fallen between two stools. Most efforts have gone into the development of the super-wide presses, today 3.8 m or wider, whilst little effort has been put into the lower end of the market. A new approach to defend the mid-size markets in Europe may be needed.

1. Introduction

This paper deals with an important part of an ongoing survey of the European publication printing industry – and highlights the present market conditions and product specifications in relation to the conditions which prevailed twenty years ago. In 1985-86, one of the most comprehensive studies of the publication printing industry was carried out by the European Rotogravure Association in

Munich. This study was the first of its kind, and no comparable study has, to the author's knowledge, ever been reported. The objective of the present paper is to determine those factors which are important when the choice of a particular printing method is made, and to discuss whether if this process was fundamentally different in 1985 than today. The hypothesis is that there were some determining factors in 1985 such as the economy of scale, the speed (lead-time) and finally the quality of the printing process to be chosen.
In order to make the two studies comparable, the same questionnaire has been used today as twenty years ago, with only one minor amendment concerning what digital format that the present customers prefer. The methodology in 1985 took a quantitative approach. The questionnaire was distributed to the respondents and their individual responses were later analysed. In the present investigation, a qualitative approach has complemented the quantitative, and most questionnaires have been answered during rather extensive personal interviews. This approach has also given the author the possibility of explaining some of the issues in greater detail, as this will give the reader a deeper understanding of the current European market situation

2. Methodology

The area of research is an investigation of the European publication printing markets, and how these have changed during a period of twenty years. The hypothesis is that due to new technology the market conditions in publication printing have changed. The research target is clearly the European publication printers and to some extent those publishers who are still maintaining the printing facilities. In this case the survey technique has been used, and a group of companies and/or executives have been asked to participate. With a survey it is possible to collect in depth information about some very important questions in the industry.

In 1985/86 the survey was conducted by mailing the questionnaire to all the printing companies (and/or their contact persons and managers) which were members of the European Rotogravure Association (ERA). In this context, about 20 of the leading companies in Europe were approached, and the answering rate was close to 75%. It has been possible to retrieve most of the empirical basic data from the archives; both my own personal as well as those of the ERA. The content and structure of the questionnaire were discussed and decided by a project group which consisted of managers from the leading European publication printers at the time. Some of the basic data and findings were also discussed in this group, and as a result in 1985 and 1986 two separate reports were published by the ERA. These are available today. The survey in 1985 can be regarded as a quantitative analysis, which was supported to a lesser degree by direct interviews.

In 2005/2006, the survey has a broader audience, and the main emphasis is a qualitative approach with personal interviews. The interviewees have been selected among the most important publication printers companies in Europe, but the target group has been enlarged to include also the supplying industry. In this context, there are about 12-15 important suppliers to the industry; paper and ink manufacturers, printing press manufacturers and prepress (plate and printing cylinder manufacturers). It was decided to include the supplying industry this time because today most of the research in developing new technology and/or production processes has now become concentrated to the suppliers. In the past, some important work in this area was done by the publication printers (=users). The number of respondents answering the questionnaire is about the same, although there have been some very important changes in the industry:

- Many companies in the first study have been merged, changed ownership or gone out of business
- Many of the leading managers are no longer in the business; they left the industry, retired or are no longer available
- New structures have emerged in the industry – particularly in France, the Netherlands, Germany, Italy and Sweden

The main emphasis has been to interview these managers personally, and so far none has declined to participate. One major challenge is that some of companies interviewed are not members (or have previously been members) of the ERA, and this could have a significant impact on the quality of the answers.

In the literature, methods are described for assessing different sources, or for using different methods to assess the same source, such as triangulation of methods or data – "…the most important advantage presented by using multiple sources of evidence is the development of converging lines of inquiry, a process of triangulation….. " (Yin cited in Östbye et al 2003). Media research literature covering the two major research approaches in the media field such as quantitative or qualitative analysis are both covered by Östbye et al (Östbye et al 2003) and Bruhn Jensen (Bruhn Jensen 2002).

By using different sources - from both users and suppliers - in the recent survey some of the results deduced may be stronger than if they were coming from one source only. Another important issue in a survey concerns how the generality of the answers. Are the answers also valid for those not taking part in the survey, ince it is not possible to ask all companies and/or executives in the European markets? Is it possible to generalize the results from the survey and state that these are the common perception of the market in Europe? The members of the ERA are the most influential companies in each European country – 2-4 companies in each country, depending on the size of the market. As these companies are dominating their individual markets, it could be deduced that their answers are quite general and are valid for the purpose of this particular research study.

The content of the questionnaire has not been changed, but one additional question has been added. This question may appear rather trivial but behind the simple nature of the question lies a revolution in the prepress work and, hence, a huge structural change in the industry during the last decade. The additional question concerns how advertising and editorial material is delivered to the printer. In the past there were only two possibilities, the material was either delivered as “raw” (in this context; text as typed or written manuscripts and images etc. as colour transparencies or reflection copies) or “ready to process” pages (in this context; a set of screened separations for four-colour printing). When the material was delivered as “raw”, the printer was contracted to make it “ready to process”, and this would normally take a couple of weeks or more to complete.

With the technical developments during the last decade, all this work has become digital and the task of completion the pages “ready to process” has moved to the originator (or in some cases another subcontractor). Hence, the logical additional question concerns the digital format in which this material is delivered (=supplied). In order to ensure a smooth internal process, all publication printers publish (either as a brochure or on the Internet) the colour profiles and other traits which the supplied material must have.

The method of doing most of the second survey as a qualitative study is of course more time-consuming and more expensive. On the other hand, some of the more important issues may be easier to discuss face-to-face rather than in a more anonymous questionnaire distributed by mail. The notion of using more depth and time during the interview gives the interviewer more time to reflect and the possibility of adding supplementary questions. Hence, the interviewer gains not only a personal contact but also a more in-depth knowledge of the conditions on different markets in Europe.

3. The ERA Survey of 1985

In 1985, the production methods in the prepress area were mainly manual with the extensive use of graphic films and, since the introduction of the offset/gravure conversion, both processes were using halftone separations for cylinder- and plate-making (Bruno 1986). However, some of the more advanced gravure printers were already using digital technology outputting screened separations from colour page make-up systems producing ready-to-engrave pages, and a few gravure printers were using direct digital interfaces with electro-mechanical engraving units. However, most gravure printers were operating the prepress in-house, whilst many web-offset printers received finished pages from their customers as screened separations ready to be stripped (planning), followed by plate processing.

Press configurations

The format for publication printing being used in the industry was DIN A4 size or close to this (A4 is 210 x 290 mm or about 8 ¼ x 11 7/16). However, the untrimmed press format was smaller in gravure because all gravure folders used grippers rather than pins. The majority of the gravure presses were running landscape-size products (or short grain). The recently established standard for publication gravure presses of the time – first introduced by the large German publisher/printer Axel Springer AG in the beginning of the 1980s - had the following specifications:

- Number of units = 8
- Web width = 245 – 260 cm
- Cylinder circumference – from 840 to 1120 mm - 4 page around – short grain
- Cylinder circumference – from 1260 to 1680 mm – 6 pages around – short grain
- Variable folder – 4U – 64 pages (or 2 x 32 pages) and 6U - 96 pages (or 2 x 48 pages with a split folder) maximum – signatures could be produced in increments of 8 pages (12 pages – 6U)
- Web speed – about 10-12 m/s

All commercial web-offset presses in the investigation were equipped with pin-folders which caused almost 4% more trim waste than in gravure. There were however, some installations in the UK with a narrower cut-off of 1220 mm. At the time of the investigation, there were only two sizes of commercial web-offset presses available; 16pp or 32pp presses. Both were single width – max 98 cm – and with single or double round plate/blanket cylinders respectively:

- 4 units - blanket to blanket
- Web – width = 98 cm
- One dryer (hot air with catalytic afterburner)
- Cut-off 630 mm (a few with 620 mm)
- A fixed sized pin folder with a cross fold – long grain
- Web speed – about 5-6 m/s

The long grain concept had some obvious drawbacks with, because it was considered to limit the possible press speed to about 7-8 m/s. Cross-fold (or chopper folding) techniques had been used for a long time in narrow gravure presses, but were abandoned for that very reason in the end of 1970s.

Some attempts were made to design short grain web-offset presses to overcome the speed limitations, but short grain presses in web-offset had another problem; in the post-press operation of perfect binding with hot-melt glue.

The low moisture content in the paper made the spine prone to wrinkles causing customers to complain, particularly when printing low grammage papers (this phenomenon was not present in gravure). Short grain products were, however, very suitable for stitched magazines.

Paper grades and paper quality

Publication gravure had for a long time enjoyed the privilege of printing high quality on Super Calendered (SC) paper qualities, which gave a print quality comparable to that of coated stock in commercial web-offset, albeit at a much lower cost in gravure. This economic disadvantage prompted some publishers in the UK to contact their leading paper suppliers - the Finnpapp sales organization in Finland - to develop an SC paper for commercial web-offset. (Finnpapp was the joint sales department of all Finnish paper-mills until the beginning of the 1990s)

The new paper quality – HSWOP papers - became very popular among publishers in the UK and Scandinavia because it offered an adequate print quality at a reasonable price. The manufacturing costs of HSWOP paper were still higher than the SC for gravure, hence a small price difference (about 3-5%) was noticeable in the market, which in any case was much less than the difference between SC and LWC.

Feeling stronger competition on many markets, publication gravure printers were complaining about the limited offer of gravure printing papers. In the survey of 1985, some of the comments were:

- A stiffer sheet would be needed, particularly LWC seems to be flimsy
- A higher whiteness on uncoated stock and a larger selection of grammage
- Standard offset reels may often be found on the open paper market, to a very competitive price

Some German publishers wanted an even cheaper grade than SC mechanical paper, and urged its printers to test newsprint, which is bulky, rough and normally not suitable for gravure printing. These publishers had already tested commercial web-offset but they were not pleased with the print quality in the very competitive domestic advertising market.

In the US market, many Sunday supplements were being printed by gravure on Roto News; a paper grade which is very close to ordinary newsprint. Electrostatic Assist (an electrostatic device is used to improve the printability reducing the missing dots) was first developed and patented by GRI (Gravure Research Institute) in 1966 (Gravure 2003), to overcome the major quality problem in gravure – the missing dots.

The US quality level on Roto News was considered to be unsatisfactory on the very competitive German markets, and there were many obstacles to overcome in order to obtain the necessary print quality, improved printability, improved ink hold-out (too high a porosity in the sheet) and colour gamut (poor shadow detail). In the end, further developed and improved ESA (Electro Assist) systems in the printing units gave the necessary printability, and a combined effort from ink makers and engravers achieved substantial improvements in the colour gamut and ink hold-out.

The new paper grade was called “improved newsprint”, because it was slightly brighter and smoother than conventional newsprint. Some of the early adopters were the weekly magazines – the Bild der Frau (Image of a Woman) and the Auto Bild (a car magazine) – both published by Axel Springer Verlag AG in Germany which quickly gained substantial success on the market. Reasonably priced to a reasonable quality!

Another advantage of the improved versions of ESA was the ability to print not only on improved newsprint but also on normal offset papers with an acceptable printability.

Run length

In the final report from 1985/86, it was clearly stated that the run length in publication gravure printing was indeed very market-dependent:

- Scandinavian and Swiss markets — 150 000 copies
- French and German markets — 500 000 copies
- UK market — about 1 million copies

In commercial web-offset, however, the print runs were more homogeneous:

- Most markets in Europe — 100 – 200 000 copies
- UK market — up to 1 million copies

But, very small runs were also reported for commercial web-offset; even down to 20 000 copies.

Advertising material

One of the major issues in publication printing at the time was the handling of advertising material. In some countries, the centralized reproduction of advertising materials was already the state of the art, and in those cases no distinction was made between gravure and web-offset printing despite, their different colour gamuts.

In the major European markets, however, centrally processed materials were not used at all, forcing the advertising agencies to produce colour duplicates and to send those to all printers concerned when a particular advertisement was to be printed (Bjurstedt 2005). A statistical analysis showing the different conditions in the European markets for publication gravure is shown in Diagram 1 - ERA 1985). (The lead-time is calculated from the latest date for the acceptance of artwork/ film prior to press start).

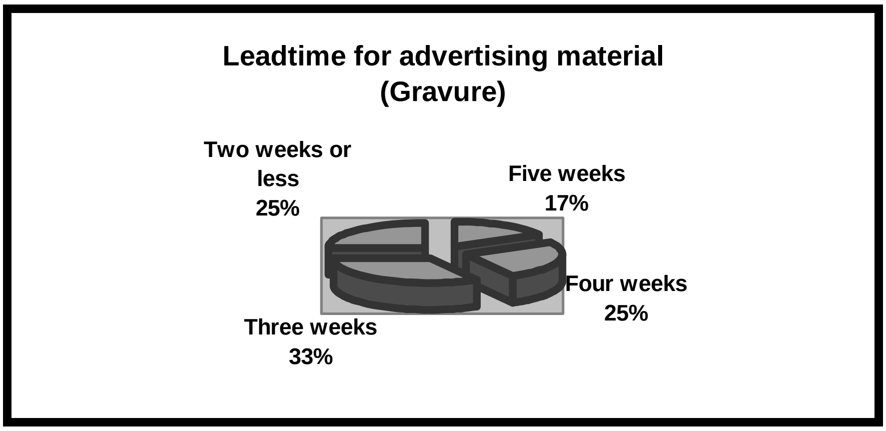

Diagram 1

The shorter lead-time (2 weeks or less) was applicable for those gravure printers accepting films from the agencies (screened halftone separations), which was the market condition in the Nordic countries and in Switzerland.

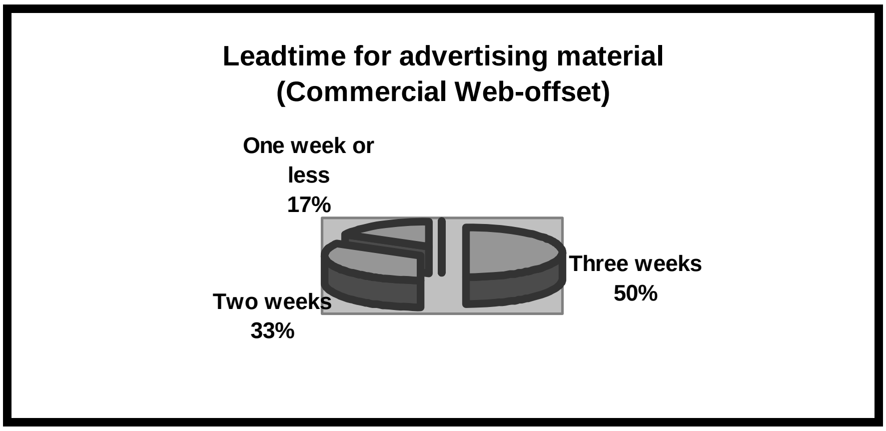

Diagram 2

Some gravure printers in the UK, Italy and Finland also accepted films, but in all other markets original artwork was delivered to the printers. The conditions for commercial web-offset were quite different, see Diagram 2. In particular, all advertising material was delivered as halftone separations with or without a relevant preproof. From these diagrams it is clear that the advertising agencies had a more favourable attitude towards web-offset as it was easier and probably cheaper to support their customers. Only in Germany, where gravure has always enjoyed a large share of the market, did the situation seem to be different, and the German publishers/printers did not accept anything other than original artwork.

The fast acceptance of the use of halftone separations in publication gravure in the beginning of the 1980s made life somewhat easier for both printer and customer. Preproofing methods were soon developed which could simulate the more extended colour gamut in gravure. The development of new and relatively cheap colour preproofing concepts, such as Cromalin™ or Matchprint™, had made the evaluation and control of customer (or outsourced) pages and separations much easier than before. Already at the time of the 1985 survey, more than 80% of the gravure printers were using one of the two suppliers, which in turn meant that the use of gravure proofs was no longer required in the advertising market. Only the German printers were supplying gravure proofs to their advertising customers (agencies).

Quality assessment

The continental printers showed more self confidence in the quality assessment of their own publication gravure production. In general, it was suggested that gravure print quality was superior to commercial web-offset with one exception – the UK - although the perceived quality difference in the Scandinavian market was quite small.

Anticipated future trends in 1985

An interesting issue in the questionnaire concerned future trends, and many believed that within the next 3-5 years advertising and commercial material would be delivered in digitized form to publication gravure printers. This would not, however, apply to commercial web-offset, where film would be used for considerable time, because there were no signs of a digital solution for offset at that time. In gravure, a number of printers were already using direct digital engraving systems, and at least three vendors were offering digital interfaces to the most common mechanical engraver, the Hell Helioklischographs.

Another major issue in the investigation was how to improve the competitiveness of publication gravure, particularly in Scandinavia and in the UK. The major problems were considered to be cylinder proofing and corrections. These techniques had originally been developed to improve the image quality and please the customers, but now they had become extremely expensive and time-consuming operations. If a magazine could be printed without corrections and proofing, lead times and costs could be greatly reduced. Hence, a lot of development effort was directed towards these areas, as well as to improve the entire cylinder-making process and press make-ready.

4. Results from the 2005 survey

The investigation conducted in 2005 included in-depth interviews with the leading managers in various sectors of the industry, and this time not only printers but also the most important suppliers – printing press manufacturers, paper and ink manufacturers, plate processing equipment suppliers, cylinder processing equipment manufacturers and other important contributors to the printing process - were interrogated. The views were given to the investigator under a non-disclosure agreement similar to that established twenty years ago.

During the recent interviews it became obvious, that, consistent with some of the recommendations from the 1984 survey, all publication gravure printers had decided to engrave cylinders directly form digital data. However, not until around 1994-95 had this became the standard procedure in the industry. By doing so, they eliminated the use of graphic film, and this greatly reduced costs, improved the quality of the final printed product and shortened the lead times. The cylinders were delivered to the press room without being proofed.

Press configurations in 2005

The format for publication printing now being used in the industry is still DIN A4 size or close to it. The untrimmed press format has been further reduced in web-offset, since new designs of commercial web-offset presses have been brought to the market. The trend in publication gravure presses has gone from 64 pages in the middle of the 1980s to 96 pages; although there is one installation in Germany with two super-wide presses running 112 pages in A4 (two other printers will be installing presses of this size later this year).

- Number of units = 8
- Web width = 370 – 390 cm
- Cylinder circumference – from 840 to 1120 mm - 4 page around – short grain
- Cylinder circumference – from 1260 to 1680 mm – 6 pages around – short grain
- Variable folder – 4U – 96 pages (or 2 x 48 pages) and 6U - 144 pages (or 2 x 72 pages with a split folder) maximum
- Web speed – about 14-16 m/s depending on cut-off

The present standard for publication gravure presses in the European market (Kipphan 2000) has the above specifications.

Commercial web-offset presses were redesigned in the middle of the 1990s incorporated two features which are necessary for high speed printing, namely a smaller overlap (a precise overlap is mandatory for all post-press operations) using gripper folders (as in the gravure) and the mini-gap on blanket and plate cylinders. Some manufacturers are using a sleeve type of blanket to reduce the vibrations in the units, but these have not yet gained wide acceptance in Europe. There are many alternative press configurations available for the potential buyer, and the average format is today 48 (either landscape or portrait) or 64 pages (portrait) (Kipphan 2000).

One may add that there is no standard configuration in commercial web-offset - operations; because the configuration depends very much on the market the printer is present. The maximum web-width is presently about 195 cm for the 64 page alternative in portrait size, although there are a few presses running 72 pages, but a smaller size than A4 size.

- 4 units - blanket to blanket
- Web – width = up to 195 cm
- One dryer (hot air with catalytic afterburner)
- Cut-off 620 mm (portrait) or 890 mm (landscape)

- A fixed sized gripper folder with two cross folders – long grain
- Web speed – about 14-16 m/s

The former drawback using cross folders (Kipphan 2000) has been overcome, and the commercial web-offset presses can operate flat out also in portrait size, even though there are some limitations concerning grammage vs. page count.

Paper grades and paper quality

For a number of years, the European paper mills have responded to the complaints from the first survey regarding the number of available publication gravure papers. Super Calendared (SC) has now been divided into several subgroups, from SC C quality up to SC A++ differentiating in smoothness, brightness, opacity and price. Unfortunately for the gravure printers these grades are also available for commercial web-offset.

The emerging lower quality grade in 1985 – MF Paper or Improved Newsprint – has gained significant popularity among some publishers during recent years. A number of publication gravure printers have mastered the technique and have learned how to produce excellent print quality on these paper grades. For the publishers it has meant significantly lower costs in using a lower grammage and quality as well as a reduction in the distribution costs. One distinct advantage in publication gravure printing is the possibility to frequently change of paper grades in the press without too much disruption in terms of cleaning and downtime. Linting is still perceived to be a serious problem in commercial web-offset printing.

Run length

In the present investigation, print runs in publication gravure are still very market-dependent:

- Scandinavian and Swiss markets 200- 300 000 copies
- French and German markets > 500 000 copies
- UK market > 500 000 copies

In commercial web-offset, however, the print runs were more homogeneous:

- Most markets in Europe 100 – 300 000 copies
- UK market up to 1 million copies

But, even if the average run in commercial web-offset has increased, very small runs were also reported for commercial web-offset; less than 20 000 copies for some very special high quality magazines.

Advertising material in 2005

In the major European markets, however, centrally processed advertising material is accepted, and there are no longer any geographical markets but only one European market. Digitally distributed materials have been standard procedure for quite some time, although most printers would like to apply their own colour profiles (ICC profiles) when the files are being processed. It is typically possible to download these profiles from the Internet from each printer, but there is a European standard (see ISO standard from 2004 in the list of references).

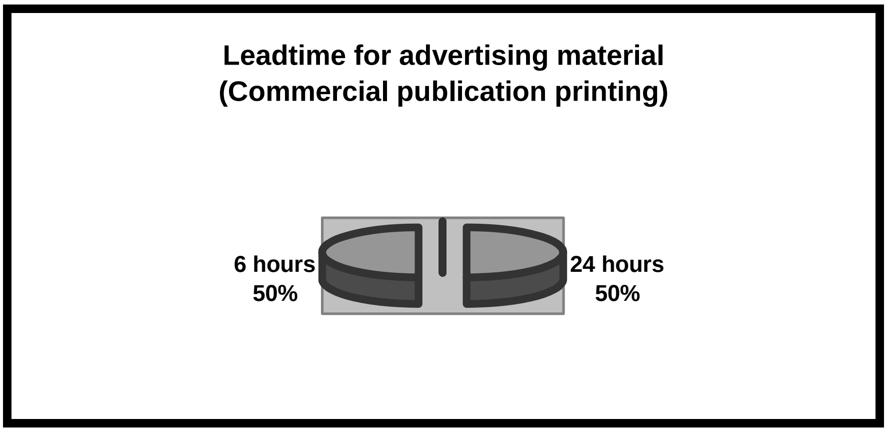

Diagram 3

The digital revolution has meant that the lead-time from receiving the data to press start has been dramatically shortened. The time is now counted in hours rather than days; there is no practical difference between the two printing processes. It is possible to suggest even shorter lead-times than above, but it is of course dependent on a very close cooperation between printer, publisher and advertising agency.

The only additional question in the questionnaire concerned the digital formats being used in supplying advertising materials. All the printers who responded say that PDF (Portable Document Format from Adobe Inc.) is the standard file format, even though a few still say that they are also receiving CT/LW files (former Scitex standard). It seems, however, that the current standard for advertising material, PDF 1.4 (PDF/X-3), is not yet quite well-known in the industry.

All parties involved in the advertising business are using standard preproofs. The most common are now standard inkjet printers, such as Epson™ equipped with specialized software emulating precisely the print process, whether it is gravure or commercial web-offset, on almost any paper. The former preferred suppliers of preproofing systems (DuPont Cromalin™ and 3M Matchprint™) have lost substantial market shares to the providers of the cheaper inkjet systems.

Quality assessment

In general, the continental printers have more self confidence in the quality assessment of their own publication gravure production. Most of the respondents suggest, nevertheless, that gravure print quality on uncoated mechanical stock is still considered to be superior to that achieved by commercial web-offset. Web-offset would have to use coated stock (LWC) to compete in print quality, which of course has some financial ramifications. The “good enough” quality concept, introduced in the early 1990s, has made customers less sensitive to image quality and appearance.

Nevertheless, press room deficiencies are not of course accepted by the customer, and one of the major defects in commercial web-offset is waviness in the finished products. This defect is probably caused by the extremely fast drying process in modern presses, and considerable efforts are now being made by paper, press and ink manufacturers to overcome this serious quality defect.

The most serious complaint in publication gravure is the jaggedness of text and LW (line work). Most publication gravure printers are using a fine screening for the K cylinder, but it is often not sufficient. New engraving techniques to overcome this problem (“hinting” etc.) have been developed, but they have not yet penetrated the gravure market. When editors are using headlines or negative text in the primary colours, jaggedness is very obvious and this causes complaints from time to time.

Anticipated future trends in 2005

The basic worry in the recent answers to the questionnaire concerns over-capacity, and the dominance of the print buyer. Some respondents are also concerned by the perceived increase in print capacity in Eastern Europe. Most printers are not concerned about future trends in technology but are more worried about the development of their own markets.

The issue of competitiveness of publication gravure is still considered to be important. The old problems of cylinder corrections and proofing have been solved, because the cylinder process has to a large extent been digitized, automated and fully controlled. Nevertheless, CTP technology and the new, fast and wide commercial web-offset presses have had a great success in all European markets. Hence, web-offset technology is very much more visible and is perceived to be more advanced than gravure. The overall opinion is that there still room for many improvements in the cylinder processing area. Investments in new engraving and galvanic departments are still high in comparison to contemporary CTP technology for commercial web-offset.

Finally, the new ISO standard for publication printing in Europe was issued in 2004, and it will probably be fully accepted in the next few years. If the new standards l be successful or not depends very much on the acceptance of print buyers, and whether they will demand that the standards must be used by the publication printers.

5. Comparison between the surveys in 1985 and in 2005

The answers collected in the questionnaire show there is a number of changes. It is doubtful, whether so many changes have ever happened before in the industry in such a short time:

Prepress

- Going from analogue to digital in the prepress – PDF technology is dominating the market
- Direct digital interfaces in cylinder engraving (gravure)
- CTP technology in web-offset and new screening algorithms
- No gravure proofs and/or corrections for publication gravure; preproofing with inkjet with suitable professional drivers has achieved full market acceptance

Press configuration

- Press configuration in gravure – page count > 50%, press speed > 40%
- Press configuration in web-offset – page count 50-100%, press speed > 100%

Paper grades

- Quality assessment – web-offset has substantially improved print quality but is struggling with waviness
- Quality assessment – gravure has improved print quality on MF papers
- Paper grades – paper mills have expanded their available product range; the choice of uncoated mechanical papers for paper buyers is large

Run length

- Run length – about 50% longer in gravure than before, web-offset has a pattern similar to that in 1985 except in the UK

Advertising materials

- Dramatic reductions in lead-time for advertising materials, particularly in gravure – from average 3-4 weeks to less than 24 hours

General trends on the market

- Cylinder processing has improved in 20 years, but there is still room for further improvements in productivity, economy and technology
- Recent ISO standards for advertising and publication printing (both processes) are slowly gaining market acceptance
- New players from East Europe will probably increase their competitiveness; may pose a threat for publication printers in West Europe, because technology is no longer an entry barrier. Print is going global, but outsourcing of print jobs further than to the East Europe is not feasible

6. Conclusions

The extremely fast progress of digital technology in the 1990's had a great impact on the printing industry, particularly in the prepress area. During the recent interviews, it became very clear that most prepress work is now done outside the printing companies (outsourced). Even the integrated publisher/printer prepress work has moved from the printing to the publishing division. These new techniques created a dramatic change from way in which the industry previously worked.

Suddenly, the customer gained complete control of the work flow, mostly based on PDF technology (a subset of Postscript), and of much of the prepress work previously created and controlled by the printing industry. Digital advertising materials are today centrally produced according to the new ISO standards for publication printing (gravure of web-offset). Larger multi-European campaigns can be produced by one agency, with the different language versions later being distributed via the Internet.

Standardized preproofing has become an extremely important issue for both customer and printer to ensure that the final printed copy meets the expectations of the customer. The main difference today is that previous technologies have been replaced by digital methods using ink-jet, made by companies like Epson and HP. However, these ink-jet printers are driven by third-party software packages developed by colour specialists. Hence, it is reasonably simple for the customer-printer to create common preproof standards, which are both repeatable and consistent with the final print. The use of generic preproofing systems is one of the most important steps in creating a digital workflow, where the lead-times can be extremely short, some times only a few hours prior to press start.

Many publication gravure printing companies have been struggling with these dramatic changes during the last decade, as they have been forced to disinvest their previous prepress operations and make their staff redundant. Most web-offset printers, however, have been totally unaffected and have benefited from the new digital workflow systems available on the market, because they decided very early to outsource all prepress work (except plate-making) to third parties. Furthermore the common opinion in the industry is that plate-making for web-offset has made dramatic progress during the last few years, and the process has been greatly simplified. The number of companies competing in this particular area is large, and several advanced technical solutions have been developed for Computer–to-Plate (CTP) technology.

These new technologies have probably led to changes in the previous break-even levels. Very few gravure printers are producing signatures or products with a print run shorter than 250-300 000 copies, unless the pagination is above 64 pages. Web-offset printers, on the other hand, with present plate technology may easily print up to a million copies without having to change the plates, and hence there have been huge investments in larger (48-64 pages) web-offset presses during the last few years.

Hence, it can be clearly stated that the hypotheses presented in the introduction to this paper have been supported by the analysis of the answers from the respondents. This paper also clearly shows that the changes in the market conditions and product requirements have been quite dramatic in Europe during the last 20 years, and that further changes are about to happen. These new developments in both the prepress and press for web-offset have put the gravure industry under immense pressure, and it has become very clear during the interviews that the mid-size gravure concept has fallen between two stools. Most effort has been devoted to the development of the super-wide presses, today 3.8 m or wider, while little efforts has been put into the lower end of the market. A new approach to defend also the mid-size markets in Europe may also be needed.

7. Acknowledgements

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Finally, many thanks go to the staff of the European Rotogravure Association in Munich, Germany, for their most valuable input and comments as well as in-depth technical discussions. Participation during recent years in the Technical Commission work of the Association has given the author valuable contacts and/or information.

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GRAVURE VS. WEB-OFFSET!
THE CHANGING WORLD OF PUBLICATION PRINTING 1986-2006

ANDERS BJURSTEDT

Thesis for the degree of Doctor of Technology to be presented
with due permission for public examination and criticism
in F3, KTH, Lindstedtsvägen 26 at the Royal Institute
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Abstract

The European publication printing industry and its markets have undergone profound structural changes between 1986 and 2006. This thesis is an investigation of these changes and of how the publication industry has been affected, as well as of the balance between publication gravure and commercial heat-set web-offset. The publication printing market has grown substantially during 1986-2006, and the increase in volume is about 250%, from 5 million tons to 13 million tons of paper. In 1986, gravure was the dominating publication printing technique. Since 1986, however, web-offset printing has grown substantially, and the process has today a much larger market share of the European publication market. This domination is also reflected in the investments in new printing capacity since 2000, where 70-75% has gone to commercial heat-set web-offset press manufacturers.

This thesis focuses on the reasons why the balance between the two competing publication printing techniques, gravure and web-offset, changed between 1986 and 2006. It also studies the main driving forces determining the developments of these techniques and their related processes as well as their competitive strengths. Is gravure a printing process suitable only for very large runs, for huge volumes and for large markets? The changes in the European media market have affected the two major segments of the publication market; magazine and catalogue printing. In the magazine market, print runs in the segments of medium to large titles have decreased, and catalogues have changed from a single, thick catalogue to thinner; more targeted catalogues.

This thesis is based on two studies. The first, focused on the market requirements and techno-economical comparisons of gravure and web-offset in 1985-1986, was carried out by the author as the Secretary General of the European Rotogravure Association (ERA), and the second, in 2005-2006, has investigated the present situation on the European publication markets. The methodologies used in the investigations have been questionnaires (the originals 1985-86 have also been used in 2005-2006), surveys, literature studies and a substantial number of interviews with representatives of print buyers (publishers and catalogue producers), printers and all the major suppliers to the industry.

Given these changes, how can the competitiveness of publication gravure be improved and what strategies should a publication gravure printer use in order to survive in a very competitive European market? With shorter runs in very fast running gravure presses, the turn-around time in the cylinder-engraving department becomes very critical. A Double Ender gravure press for paginations from 16-64 pages, with an alternative up to 96 pages, where only four cylinders are needed, in combination with high-speed laser engraving of the cylinders, may be the answer.

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Break-even analyses
Gravure vs. Web-offset
A new approach!

by

Anders Bjurstedt

"The reason some people don't recognize opportunity is because, more often than not, it is disguised as hard work…! (Anon.)

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Commercial web-offset printing
Break-even
Short runs in gravure
Automatic make-ready
Long grain printing
Short grain printing

0. Abstract

The objective of this paper is to determine what factors are important when a particular printing method is chosen. In 1985-86, a study of the European publication printing industry was carried out by the European Rotogravure Association (ERA) in Munich, and contemporary industry leaders considered that study to be one of the most comprehensive ever made in the publication printing industry. This paper deals with an important part of an ongoing survey of the European Publication Printing Industry – and highlights the development in recent years of the break-even level between gravure and commercial web-offset printing. These studies were the first of their kind and comparable studies have, to the author's knowledge, never been reported.

In 1986, the summary showed that commercial web-offset printing was very competitive when printing signatures with 16 or 32 pages, and that gravure printing was very competitive from 48 pages signatures upwards, even though the manufacturing costs in the bindery for gathering together a number of smaller signatures in web-offset were not included. Further, the data collected also showed that for those gravure printers who were engraving cylinders directly from digital data without having to proof the cylinders, the break-even level even for a 32 page signature became very competitive.

About 15 years ago, some commercial web-offset press manufacturers were redesigning the commercial web-offset press, and the Sunday press concept was launched by Harris (later taken over by Heidelberg, now Goss) in 1993/94. Within a few years, a completely new breed of commercial presses was presented for the publication printing markets; not only the traditional 16-32 pages (in short grain), but also larger and wider presses capable of printing 48 to 64 pages on a single web. There was not only an increase in the signature pagination but also a significant leap in web speed. Automation of plate processing (CTP-technology), plate mounting and other press variables led to a sharp increase in productivity and print quality. Web-speed and productivity in web-offset became close to or in some instances even higher than in gravure printing. Recently, some indicators have shown that during the last decade gravure has lost its previous market dominance to web-offset printing, and recent investments in new printing capacity in commercial web-offset have outnumbered gravure by 4:1.

These recent developments made it clear that a new survey comparing printing costs, lead-time and quality for printing was needed. During 2005/2006, interviews have been conducted with a substantial number of printers – both gravure and web-offset printers – using the same kind of Questionnaire as in 1985-86. Data from internationally renowned printers using gravure and/or commercial web-offset have been collected and analyzed in order to determine the relevant break-even level. A similar non-disclosure agreement as in 1985 has been used to ensure that confidential data will not be disclosed, and that it will not be possible to identify any single printer. For the first time, a scientific methodology has been used to compare the printing costs of a few well-defined signatures.

In 1986, the following hypotheses were formulated concerning the important and decisive factors of a customer's choice:

- the economy (printing costs and market pricing)
- the required lead-time (process speed and productivity)
- the market requirements of the product (format and print quality)

In 2006, the hypotheses have been adapted to the present market situation (chapter 3).

1. Introduction

In 1985, the European Rotogravure Association (ERA) published a study on gravure and web-offset "Separating the facts from the myths" (Bjurstedt 1986). The investigation included in-depth interviews with the leading industry managers, and the costs of producing various signatures (paginations from 16 to 96 pages) for each individual company were investigated. The figures were given to the author under a non-disclosure agreement, so that it would not be possible to identify any individual company. However, as part of the investigation, each participating company was given its relative position in the study. Subsequently, the data containing some 500 files was processed, and a summary of the findings was presented at the 1985 Annual Meeting of the Association. Later, in the fall of 1986, an official ERA report was presented by the author at the G.R.I. (Gravure Research Institute) Conference in Fort Lauderdale, Florida.

The study conducted by ERA in 1985-86 was one of the first of its kind; it was very comprehensive and included a number of companies in Scandinavia, the UK and Central Europe. Some of the companies participating in 1985 are still in operation, and they also consented to participate in the present study. However, others have merged, changed ownership or structure and in some cases gone out of business. During 2005, interviews (with a similar non-disclosure agreement) have been conducted with a large number of printers – both gravure and/or web-offset printers.

This time, however, in-depth discussions with the leading suppliers of both CTP technology, engraving systems and press manufacturers have been included in the study, as technical developments are progressing very rapidly. Web-offset printers have profited greatly from the new CTP (Computer-to-Plate) technology and new offset plate technology, which have matured during the last decade. The new technologies have lowered the entry level for the web-offset industry, improved the print quality and made longer runs possible. The gravure industry has been slow to respond to the challenge, but recently new technical solutions have been available in the engraving area, concerning both the traditional electro-mechanical engraving heads and the new laser-engraving units. Now the question is whether similar developments are going on in the press room in order to improve the production rates and shorten the lead-time in gravure printing technology.

2. Methodology

2.1 Important areas of research and methods

Media and communications studies have developed a variety of analytical procedures and designs; drawing on the social sciences as well as on the humanities. Scientific approaches and social implications are studied in the quantitative research process (cited in Bruhn Jensen 2002, p.206). Quantitative studies are covered both in terms of their basic categories and operations; and with reference to the relevance of survey, experiment, and content analysis. Qualitative studies are presented, similarly, in terms of the systematic processes of interviewing, observation, and textual research, including issues of data collection and data analysis. The complementarily of qualitative and quantitative research is to examine references to both concrete examples and to classical problems in the philosophy of science.

2.2 Quantitative approach

Quantitative research is primarily concerned with demonstrating cause-effect relationships and any research project begins by setting up a hypothesis or a research question. A hypothesis is a proposition to be tested, or a tentative statement of a relationship between two variables. Whilst hypothesis testing is not unique to quantitative research, it is one the fundamental elements, and almost a required aspect of quantitative academic research. In this case, the hypothesis is that the relationship between gravure and commercial web-offset has changed dramatically with regard to printing costs for a predetermined signature containing 48, 64 or 96 pages in A4 format.

The first step in the quantitative research was to create a survey and the main problem was to find a sufficiently descriptive survey. In this particular case, a questionnaire was created already in 1985 and the main question has been whether or not the old questionnaire can still be used. In this case the same questionnaire has been used for the new survey, but the forms used have been updated using the latest available digital forms technology.

According to Siegel and Hodge from 1968 (cited in Bruhn Jensen 2002), there are two fundamental issues in any academic research project, viz. the reliability and the validity of the results Reliability concerns the dependability and consistency of the relationship between two variables or in the score obtained and a single variable at more than one point in time. Reliability can be established by carrying out repeated tests of phenomena and the relationships between phenomena, and by repeating such tests among different groups. Validity and concurrent validity mean that a measure is associated with another indicator that has already been shown to be valid.

The companies interviewed have been selected according to a special cluster sampling. The only way of obtaining access to them was that they belonged to the ERA as the major European association in publication printing and thus belong to the cluster of important gravure printers and/or web-offset printers. In 1985, the questionnaire was sent by mail to the contact persons at each company. Most of questions/issues were also debated and discussed during a number of meetings held during the autumn of 1984 and 1985; hence the relevance of the survey was certified. It can be assumed, in addition, that almost all the respondents understood the background and the meaning of the questions; hence it can be assumed that both the reliability and the validity of the answers to the industry in general can be assured.

2.3 Comparison between the investigations made in 1985/86 and today

In 1985/86, the investigation of the printing costs was very confidential. In this context, about 20 of the leading companies (and/or their contact persons and managers) belonging to the European Rotogravure Association (ERA) were approached. The participating companies sent their assessments directly to the author personally, and the information was kept strictly confidential. Before the request for information was distributed, the content and structure was discussed and decided upon by a project group, which comprised managers of the leading European publication printers at the time. Some of the basic data (non-confidential) and findings were also discussed within this group, and two separate reports were published by the ERA in 1985 and 1986. These are still available to-day. The survey in 1985/86 can be regarded as a quantitative analysis, which was supported to some degree by direct interviews. It has been possible to retrieve the basic empirical data (from my personal archive), and reformat it to modern PC office software.

The 2005/2006 survey, however, was planned having a broader target group, and the main emphasis has been on both a quantitative and a qualitative approach extended with personal interviews. The interviewees have been selected among the most important supplier companies in Europe. There are only a few suppliers to the industry (gravure cylinder processing and press equipment manufacturers). Almost the same number of printers has been involved in submitting the information, although there have been some very important changes in the industry:

- Many companies in the first study have merged, changed ownership or gone out of business
- Many of the leading managers are no longer in the business; they left the industry, retired or are no longer available
- New structures have emerged in the industry in Europe

The reason for including the suppliers this time is that most of the research in developing new technology and/or production processes is now concentrated to the suppliers. In the past, important work in this area was done by the publication printers (=users) themselves. One major difference, although it is not significant, is that today all communication is by e-mail and the Internet. One major challenge was that some of companies interviewed are not members (or are no longer members) of ERA, and this could have a significant impact on the quality of the answers. The main emphasis has been to interview these managers personally, and so far none no one has declined to participate.

3. Hypotheses

In the ERA study of 1985-86, it was stated, that the break-even between gravure and web-offset was very dependent on the pagination of the signature. In the investigation, the worst case for gravure was chosen, namely a standard A4 format for all signatures because most web-offset presses for the European market were designed (with a fixed cut-off) for this format. Gravure presses, on the other hand, were basically designed for a variable cut-off offering a much larger flexibility for the customers.

In 1985/86, it was found that gravure printing was indeed competitive when printing signatures from 48 pages or larger. It could also be said that even from 32 pages, gravure printing was competitive when cylinders were digitally engraved and no wet proofs were made.

Based on a general interpolation of the current market situation, the hypothesis is that the current relations are still much in favour of web-offset printing and that the previous signature size has increased substantially during recent years. There has been a tremendous investment boom in the European commercial web-offset industry with the introduction of more advanced CTP-systems, offset plates with extended service life and new modern web-offset press designs. It is here generally believed that break-even can now only be achieved when printing a signature of 64 pages or more (in a standard A4). This is a quite significant change in competitiveness compared with 1985/86. This investigation will determine whether this hypothesis is verified or falsified.

Another field of interest for gravure printers is the question of the quality achievable when printing on uncoated stock – SC magazine paper grades. In the beginning of the 1980's, British publishers persuaded some Nordic papermakers to develop paper grades similar to SC (super-calendered) for commercial web-offset. The new paper grade was called HSWOP (Heat-Set-Web-Offset Paper) and initially had a great success, particularly in the UK. It was then suggested that the print quality produced in commercial web-offset printing using HSWOP grades was comparable to what achieved with gravure.

During recent years, however, it has been suggested by many print buyers that in order to achieve a print quality comparable to that obtained with gravure printing on SC grades, commercial web-offset printers have to use a coated stock., such as LWC or similar grades. Hence, the second hypothesis is that, in order to achieve a print quality comparable to gravure on SC grades (56 g/m^2), commercial web-offset printers have to use a coated stock – but at a slightly lower grammage (54 g/m^2)

4. Printing technology in 1985-86

In 1985, the gravure presses used in the European publication printing industry were still rather small with narrow webs and moderate speeds. However, the scatter among gravure printers was huge, and many aged presses were still in use and operated mainly manually or with semi-automation of the press functions. By the end of 1970's, the so called 40 000 generation of gravure presses was introduced in the Europe, which meant that the presses were capable of printing 40 000 cylinder revolutions (or more) per hour; equal to about 10-12 m/second. Web width was up to 2.4 but the majority of the new presses were still around 2.0 m.

Commercial web-offset presses were very successful in the North American markets and were achieving running longer runs than in Europe. The pagination was still limited to signatures of 16 or 32 pages. In North America, commercial web-offset printers were printers only, and were subject to fierce competition, but of some the reasons for the success were the demands from the American publishers and print buyers such as:

- Increase in demographic split of editions – large editions were subdivided into many smaller runs
- Flexibility in pagination and colour content
- Bindery operations were outsourced and rather cheap (non-union and mostly non-white operators)

Due to the fierce competition, the North American commercial web-offset companies were running their presses flat out during a rather short period of time. After a cycle of only 5-6 years, new improved presses were installed, which led to a high level of technical development in the commercial web-offset business. And it must not be forgotten that web-offset printing technology was, to a large extent, developed in North America - an American process.

From the end of the 1960’s, an increasingly large number of web-offset presses designed by American manufacturers were installed in Europe. Hence, in the middle of the 1980’s, commercial web-offset presses in the European markets were seldom more than 5-10 year old, and new presses were installed in quite a large number (source: ERA List of Presses – 1986).

American publication gravure printers, on the other hand, were relying on European equipment and process knowledge. Although some of the larger printers (like Donnelley’s and World Color Press) were printers only, others were fully or partly owned by publishers (Burda-Meredith and others). The gravure presses installed in the American market (there were and are no publication gravure presses in Canada) were partly very old, with fixed formats and they were rather inflexible.

The working hours in the European press room were about 102 - 144 hrs a week. However, most of the gravure printers were faced with very strong union demands, which made it virtually impossible to run 24/7, i.e. 24 hours a day, seven days a week. They were forced to accept a moderate-to-low utilization of the printing presses. Commercial web-offset printers were faced with stiff competition, not only from gravure printers, but also from other web-offset printers, and they had to be much more flexible and adapt to the needs of the customer. Hence, commercial web-offset printers did not have to carry the same heavy load of infrastructure, such as large prepress and/or post-press operations, as did many gravure printers, but could concentrate on their core business, the printing operations (and plate making).

4.1 Prepress technology

In 1985, the methods in the prepress area were mainly manual with the extensive use of graphic films in both printing processes (Bjurstedt 2006). Most publication gravure printers had large prepress departments, where customer’s pages –

text composition, images scanned and pages assembled - were processed. Halftone separations were already an established procedure in the gravure prepress activities, and this made it possible to use commercial available preproofs, such as Matchprint and Cromalin, although the colour gamut match in many instances was questionable.

In 1985, most European publication printers had abandoned the old etching technique and switched to the mechanical engraving method. A few were engraving using digital data, whilst the majority were using halftone Opalines and real-time scanning during engraving. Opaline was both an expensive material and rather slow in processing. Web-offset plate-making was also a manual process with stripping of pages and using light boxes for plate exposure. Both negative and positive films were used, depending on the market. In the US most web-offset printers were using negatives, whereas in central Europe most printers used positives (Bjurstedt 2005). The service life of the offset plates was limited to about 100 000 copies (without heat treatment).

4.2 Publication gravure printing

The basic format for gravure publications was DIN A4 size or close. The majority of the recently installed gravure presses were running landscape-size products (or short grain) (Bjurstedt 2006). The recently established standard for publication gravure presses of the time – first introduced by the large German publisher/printer Axel Springer AG in the beginning of the 1980s – was of the 40 000 generation with a web width of 2.40-2.60 metres, capable of printing 64/96 pages in A4 format. The press with its variable folder with grippers could run in excess of 40 000 revs/hour or 10-12 m/s.

4.3 Commercial web-offset printing

Most commercial web-offset presses were, however, limited to 16 or 32 pages, in long grain configuration (= portrait size) with a fixed cut-off (Bjurstedt 2006). Gravure presses, on the other hand, were basically designed for a variable cut-off offering a much larger flexibility for the customers. Nevertheless, the untrimmed press format was smaller in gravure because all web-offset folders were using pins and not grippers (as in gravure folders).

Pin-folders used in commercial web-offset caused almost 4% more trim waste than in gravure printing. There were however, some installations in the UK with a narrow cut-off of 1220 mm, for a product size slightly smaller than A4. There were only two sizes of commercial web-offset presses available; 16 or 32 page presses. Both were single width – max 98 cm – and had single or double round plate/blanket cylinders respectively. The press speed was limited to about 18-20 000 revs/hour (32 page press) with a web speed of 5-6 m/s.

The long grain concept had some obvious drawbacks with, because it was considered to limit the possible press speed to about 7-8 m/s. Cross-fold (or chopper folding) techniques had been used for a long time in narrow gravure presses, but they were abandoned for that very reason at the end of 1970s.

Some attempts were made to design short-grain web-offset presses to overcome the speed limitations, but short-grain presses in web-offset had another problem; in the post-press operation of perfect binding with hot-melt glue. The low moisture content in the paper made the spine prone to wrinkles causing customers to complain; particularly with low grammage papers (this phenomenon was not present in gravure). Short-grain products were, however, very suitable for stitched magazines.

5. Contemporary technologies

The extremely fast progress of digital technology in the 1990’s had a great impact on the printing industry, in particular in the prepress area. New software packages for editorial and image manipulation were quickly accepted by the publishing industry, and the previous analogue technology was soon abandoned (Bjurstedt 2005). All these new techniques created a dramatic change in the way the industry had worked, because the customer suddenly gained complete control of the prepress work and indeed of the work flow. Previously, the publication printing industry processed all the pages and controlled both the prepress work and most of the entire work-flow.

The working hours have changed too. Today almost all printers, gravure and web-offset, are running 24/7 shift systems in order to maintain their competitiveness and shorter lead-times. This became possible during the first recession in the beginning of the 1990’s, when the weaker position of the print unions made this change possible.

About 15 years ago, some commercial web-offset press manufacturers started to redesign their presses. The first commercial concept was the Sunday Press from Harris (Harris was later taken over by Heidelberg and recently by Goss International). A huge leap in web speed became possible when a new design of the blanket and plate cylinders produced a much narrow gap than before. Within a few years a completely new breed of commercial presses was presented for the publication printing markets, and not only the traditional 16-32 pages (in short grain), but also larger and wider presses capable of printing 48-64 pages in a single web. Not only was there an increase in the signature size but also a significant leap in web speed.

Only in the beginning of the 1970’s, when the renowned European publishers/printers Burda and Ringier entered the American market, were variable and more flexible European gravure presses from Albert-Frankenthal (today KBA) and Cerutti installed. By the end of the 1980's, however, American publishers shed their interests in the printing business and became publishers only. The structural changes in the North American gravure market has now gone so far that there are only three huge companies left, Donnelley's, Quebecor World and Quad Graphics. (Both Donnelley's and Quebecor World have many subsidiaries and have also very important subsidiaries in Europe).

New plate technology with extended service life, automation of plate mounting, and other press variables led to a sharp increase in productivity and print quality. Web-speed and productivity in web-offset came close to or in some instances even exceeded that in gravure printing. Recently, some indicators have shown that during the last decade gravure has lost its previous dominance in the market to web-offset printing, and recent investments in new printing capacity using commercial web-offset have outnumbered gravure capacity by 4:1.

5.1 Prepress technology

New screening technologies have improved the print quality of lithography, but the film material limited the potential of these new technologies. A new technology, exposing the offset plate directly from the digital files was needed, and it was called Computer-to-Plate – CTP. The common opinion in the graphic art industry is that plate-making and new plates for offset have made dramatic progress during the last few years, and many technical solutions have been developed with the emerging Computer-to-Plate technology.

CTP technology has quickly matured and became accepted by the offset printers. Another contributing factor was of course the PDF-technology which made digital prepress affordable for all customers. Then many of the prepress companies were marketing larger size CTP-devices suitable for web-offset plates in 48 or even 80 page press formats. Heat-treatment (baking) has given a service life of up to a million copies (Kipphan 2000). Recent developments, with faster laser diodes and with many different plates available on the market, have made CTP-technology and plate marketing extremely competitive.

All the European gravure publication cylinders have been engraved digitally for many years. Recently, more advanced products have also been developed in plating the cylinders with copper and chromium (Bjurstedt 2005). These products allow the user full automation including loading/unloading with a minimum of staff comparable almost to the CTP operations in web-offset.

5.2 Publication gravure presses

The format for publication printing now being used in the industry is still DIN A4 size or close to it. The trend in publication gravure presses has gone from 64/96 pages in the mid-1980's to 96/144 pages; although there is one installation in Germany with two super-wide presses running 112/168 pages in A4 (two other gravure printers will be installing similar presses later in 2006/2007) (Bjurstedt 2006). (The larger signature can be printed with cylinders with 6 pages around). When using cylinders larger than 3.0 m face width, all cylinders-loading is done automatically with no manual intervention. The cylinders are mostly moved automatically from the cylinder storage or department to the press department and loaded to cylinder loading device. The web width is typically 3.6-3.8 metres and the speed is approaching 15-16 m/s, The newly designed variable folders may run up to 58 – 60 000 revs/hour, although tests are being done with even higher speeds.

5.3 Commercial web-offset printing

Commercial web-offset presses redesigned in the middle of the 1990s incorporated two features which are both necessary for high speed printing; a smaller overlap (a precise overlap is mandatory for all post-press operations) using gripper folders (as in gravure), and the mini-gap on blanket and plate cylinders (Bjurstedt 2006). Some manufacturers are using a sleeve type of blanket to reduce the vibrations in the units, but these have not yet gained wide acceptance in Europe. There are many alternative press configurations available for the potential buyer, and the average format is today either 48 (either long-grain or short-grain) or 64 pages (long-grain) (Kipphan 2000).

There is no standard configuration in commercial web-offset operations; because it depends very much on the market in which the printer is working (Bjurstedt 2006). The maximum web-width is presently about 2.00 cm for the 64 page alternative in portrait size, although there are a few presses running 72 or even 80 pages, albeit smaller than A4 in size.

The sleeve blankets are quite expensive and very bulky to transport compared to the traditional flat blanket. The dryer capacity has been improved, but dryers are today very long. The length of the dryer is about 1 m per 1 m/s web speed, which means that the longest dryers are close to 17-18 metres. The former draw-back using cross folders (Kipphan 2000) has been overcome, and the commercial web-offset presses can operate flat out also in portrait size, even though there are still some constraints concerning grammage and page count.

6. Analysis of data from 1985-86

The 1986 study assumed, however, that the preparation costs of text and images (prepress) prior to cylinder and plate processing were approximately the same for both processes. The publication printing industry used halftone separations, manual stripping and planning (or in the case of many gravure printers, colour page make-up systems) and preproofing of the current standard. Most of gravure printers did all this work in-house, in contrast to many web-offset printers who were receiving plate-ready film separations from the customer and/or trade house.

The Questionnaire asked the participants for their best estimate of the printing costs (no pricing information) on the following product (-s):

- Print run – 350 000 copies
- 4+4 colours
- 16, 32, 48, 64 and 96 pages
- Format – standard A4 (210 x 297 mm after post-press trimming)
- Paper – standard SC Magazine paper – 60 g/m2
- One gravure wet proof (per cylinder set)
- “Normal” ink coverage for magazine production

It was also assumed that the calculations should not include post-press operations for either gravure printers or web-offset printers. After some initial discussion, a more comprehensive study was made on the new standard of recently installed gravure presses capable of printing 64 or 96 pages with web (250-260 cm web-width). Commercial web-offset printers were using either 16 page or 32 page presses. In the following diagrams, break-even is shown for each signature size in gravure, except for the 16 page, in comparison with the 32 page web-offset press.

Generally speaking, web-offset printing was cheaper when printing signatures from 16 to 32 pages in A4 format. However, this was only true when the worst scenario gravure was used – standard offset size A4, one or two gravure wet proofs etc. The project concluded, nevertheless, that the gravure printing process was rather competitive from 32pp signatures, but very competitive when printing 48 pages and above, if the best practice and technology were used (Bjurstedt 1986). The results of the 1985-86 study can be found in the following diagrams:

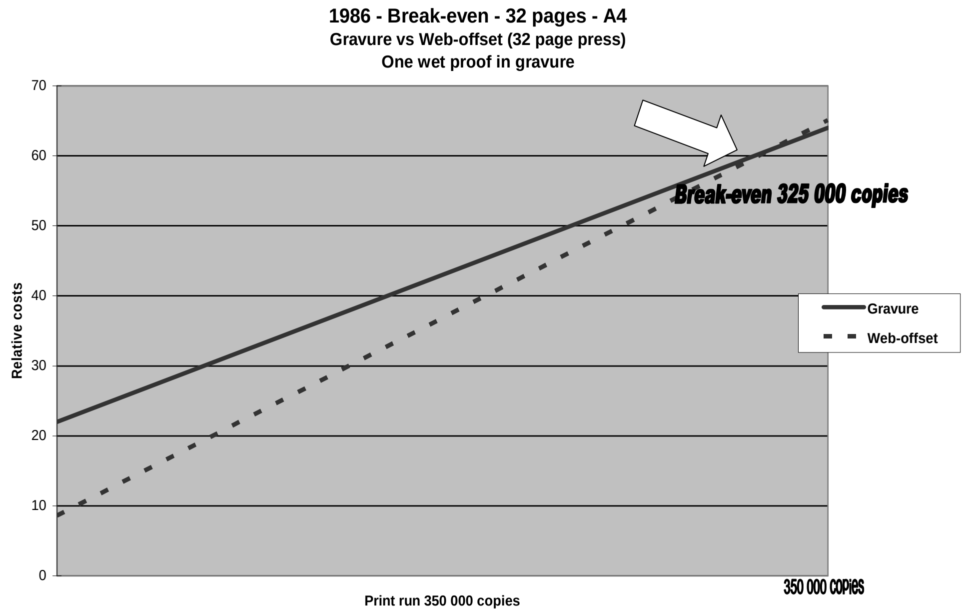


Diagram 6.1 - 32 pages A4

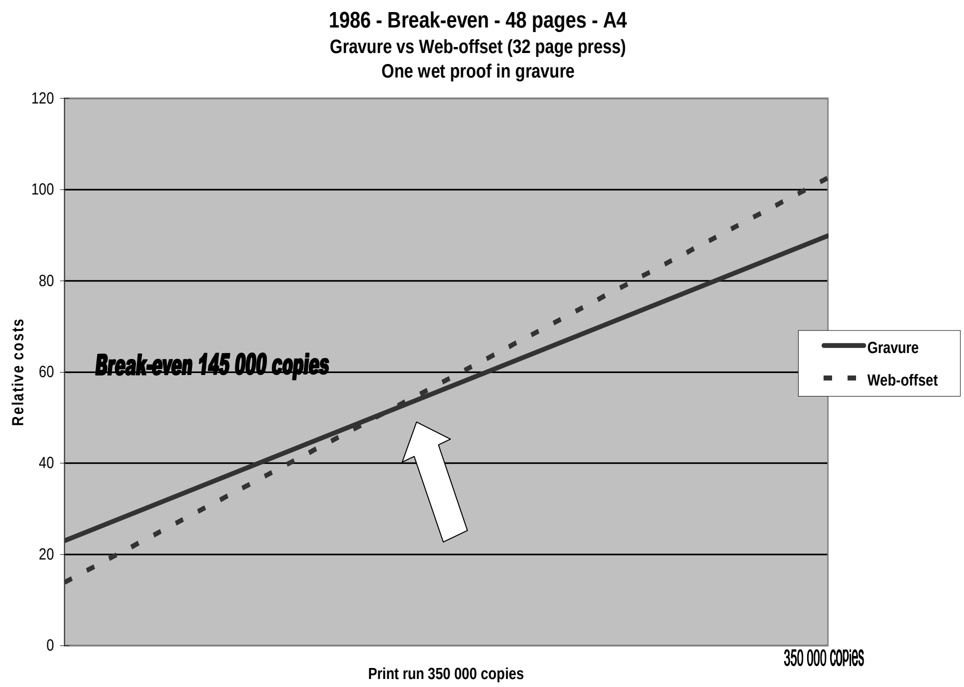


Diagram 6.2 - 48 pages A4

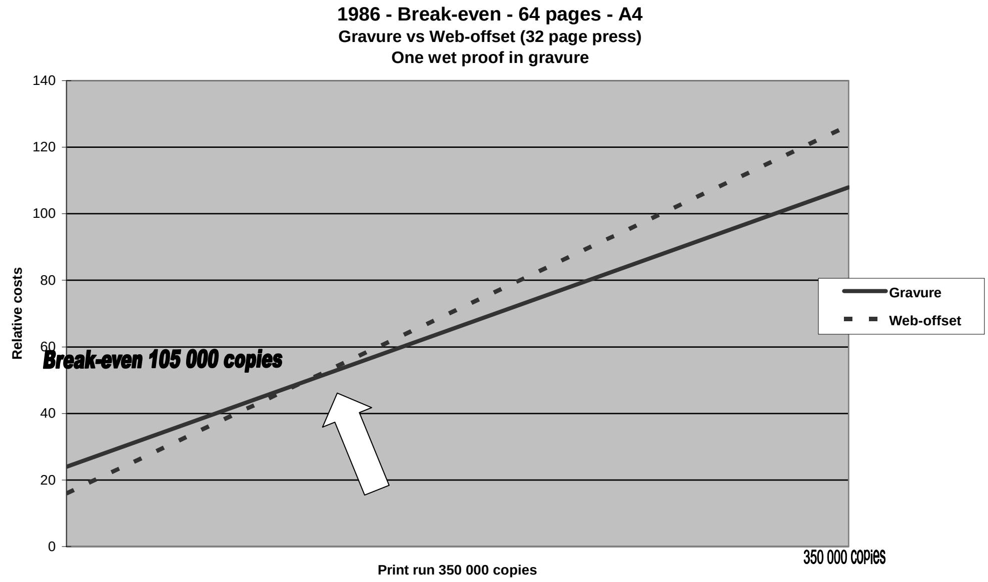
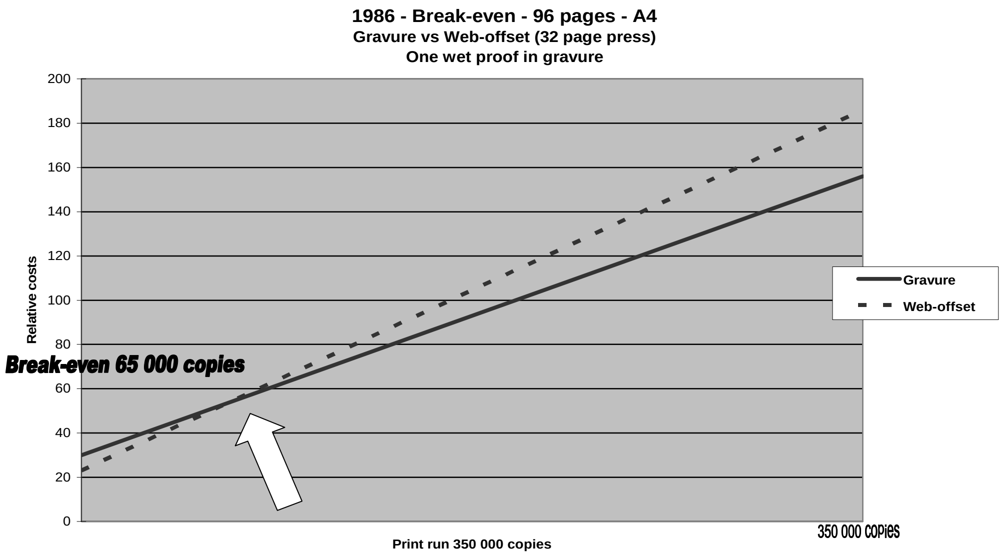


Diagram 6.3 - 64 pages A4



D
iagram 6.4 – 96 pages A4

In the final report (Bjurstedt 1986), several suggestions were made for improvements to the gravure process:

- One of the most important suggestions was digital engraving, i.e. engraving directly from digital data (rather than scanning Opalines) which would save both costs and lead times in the process
- Another suggestions was to dispense with gravure wet proofing and go directly from chromium plating to the press room
- The 64/96 page press (paper width 250-260 cm) was suggested to become the standard European press configuration
- Presetting or automation of folder and colour register settings when changing formats was suggested to improve the make ready process
- Reduction of waste during the acceleration (from make ready speed to production speed)

It was also stated in the report *"…it is obvious from the figures… that gravure is uncompetitive on lower paginations when considering short run work using the existing large presses."*

It should be noticed however that, already during the period when the report was being compiled, Bauer Druck in Cologne had installed two new gravure presses with web width of 3.0 m. The three-metre-wide-web stirred considerable confusion among some of the suppliers, particularly the paper industry. The logistics of serving Bauer Druck with 3 m wide paper reels was not an easy task to solve.

Chapter 8 includes a more thorough analysis of the different options for short run gravure.

7. Analysis of data from 2005 and 2006

7.1 Break-even levels

During the winter of 2005 and spring 2006, further interviews have been conducted with a substantial number of printers – both gravure and/or web-offset printers – using the same technique as in 1985-86. A similar non-disclosure agreement as in 1985 has been used. The scatter among the European gravure printers is indeed very large, and the statistics show, that the cost of producing smaller signatures is high in comparison with web-offset. The data obtained are shown in the following diagrams. However, there are many more combinations, particularly on different sizes of commercial web-offset presses, and only some of these are shown here:

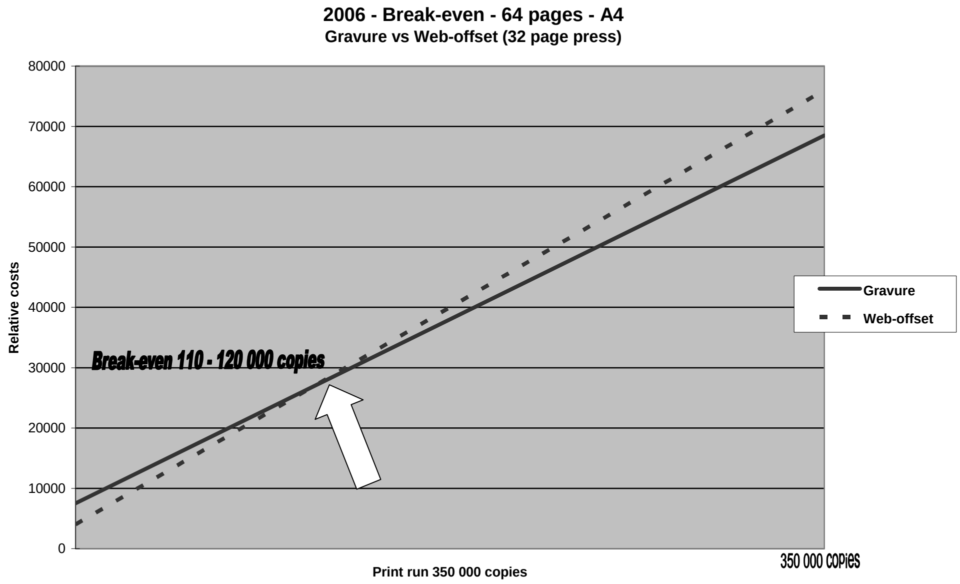


Diagram 7.1 - 64 pages A4

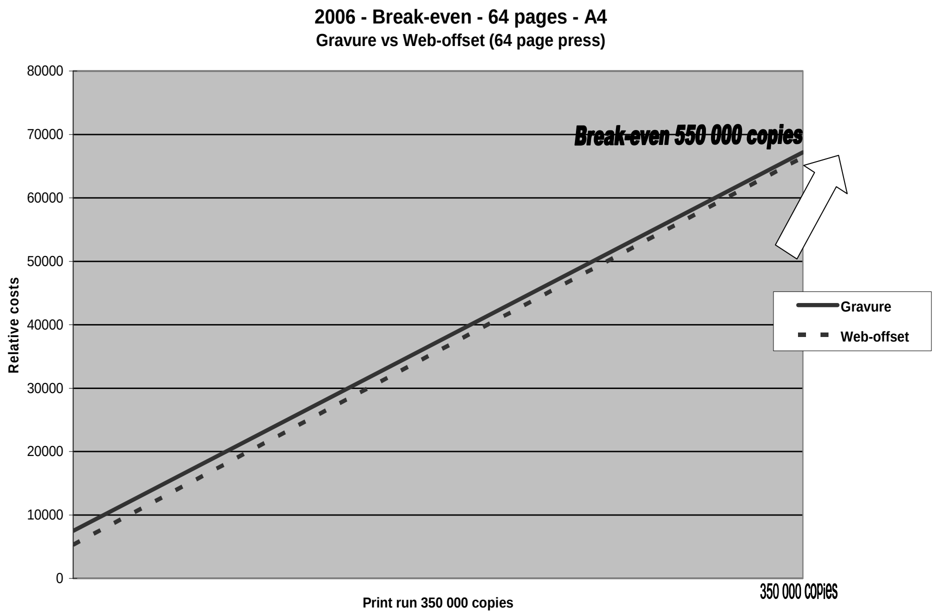


Diagram 7.2 - 64 pages A4

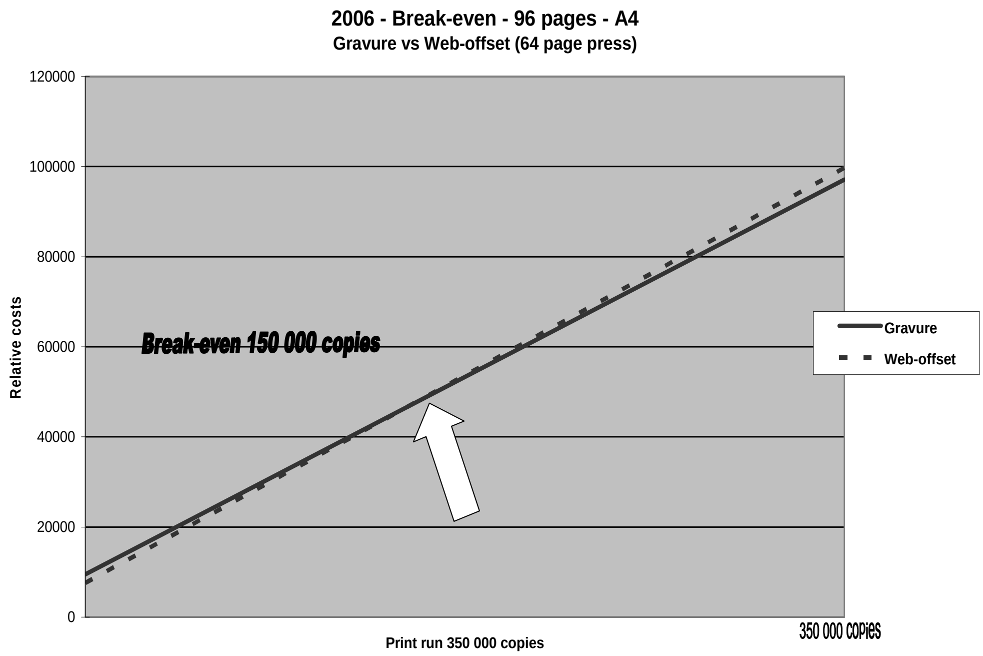


Diagram 7.3 - 96 pages A4

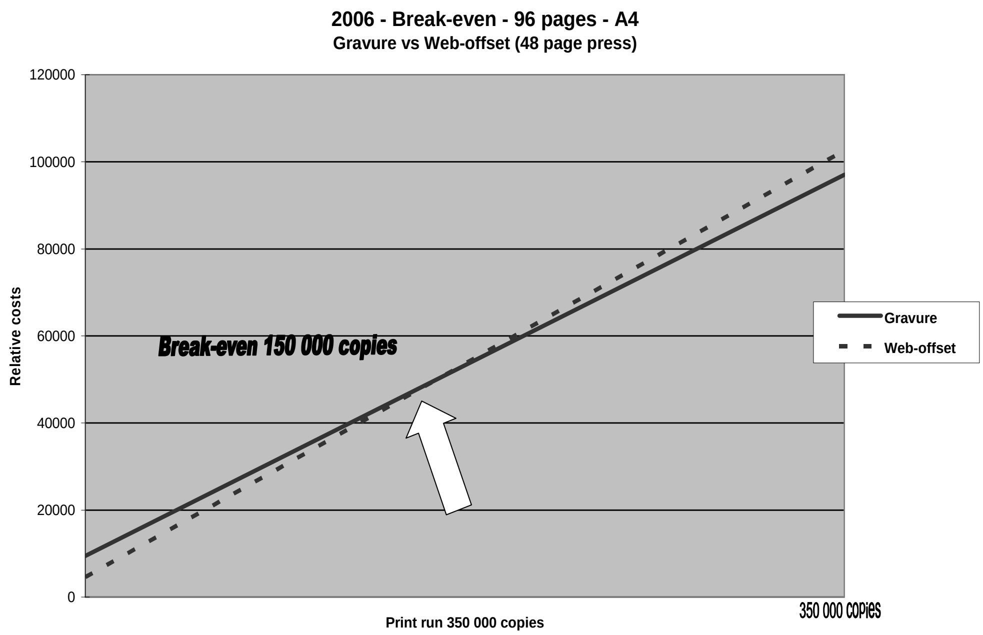


Diagram 7.4 – 96 pages A4

These diagrams clearly show that the break-even levels have been pushed to a much higher level than they were at twenty years ago. Producing a 64 page signature with a brand new 64 page commercial web-offset press is indeed very competitive against any of the gravure alternatives. Only the 32 page web-offset alternative is not very competitive, even though no post press operations are included. When comparison is done on the 96 page alternatives, gravure is clearly very competitive from about 150 000 copies or more, although the break-even level is not quite clear cut. It should also be mentioned that the scatter among all participating printers is much smaller today than it was 20 years ago.

7.2 The European printing press market in 2006

The technology shift during the last 10-15 years has had an enormous impact on the publishing industry, and the printing industry has been forced to close or move to the customer most prepress operations. The entry level for publishing a new magazine has never been lower than it is today, and new titles are being introduced very frequently in all markets in Europe.

Table 1 together with the break-even diagrams 7.1 and 7.2 clearly shows that gravure has lost its previous dominance over web-offset on both the larger signatures and medium size runs

Table 1

COMMERCIAL HEAT-SET WEB-OFFSET PRESSES INSTALLED 2000-2005								
Country	**Pages**	**16**	**24**	**32**	**48**	**64**	**> 64**	**Total**
Austria		2	3	1	4	1	0	**11**
Belgium		5	2	4	4	1	0	**16**
Denmark		3	2	1	3	0	1	**10**
Finland		6	0	0	1	2	1	**10**
France		22	3	1	10	2	0	**38**
Germany		50	6	18	18	9	5	**106**
Great Britain		28	1	0	8	9	5	**51**
Italy		10	2	1	7	14	8	**42**
Netherlands		4	2	2	0	0	0	**8**
Spain		13	2	1	8	1	2	**27**
Sweden		1	0	1	0	0	0	**2**
Switzerland		8	0	0	2	0	0	**10**
Subtotal		**152**	**23**	**30**	**65**	**39**	**22**	**331**

The previous technology was quite expensive and complicated, and only trained operators were in control of the technology, but these processes have now been simplified to such level that it has become everybody's standard procedure. Hence, the proliferation of the prepress technology has made it much easier for even very small printing companies to handle these processes. During the last decade, the development of CTP-technology and web-offset plate-making has undergone tremendous progress. Today there is hardly any web-offset printer who does not use CTP-technology. It is also quite remarkable that the investments in commercial web-offset have been extremely high in Germany, which has always been a strong gravure market. It appears that gravure has at last been challenged at its core market, as gravure has always been dominating the German publication market.

The situation in Italy is also very interesting; the majority of the presses installed are very large presses – 64 pages or larger. Recent statistics from ERA, MAN-Roland and KBA are included in Table 1. Gravure has always had a strong position on the Italian market, but it seems that commercial web-offset is rapidly taking over that position. Investments in the Nordic markets have been quite large with the exception of Sweden. The trend towards larger web-offset presses has been quite obvious since 2000, and the majority has been installed in the UK, Germany and Italy.

It has been estimated by web-offset press manufacturers that the investment volume in commercial web-offset during the years 2000-2005 was around 2 billion Euro (€). During the same period investments in new gravure printing capacity have been estimated to be about 0.6 billion Euro or around 20% of the total press investments. It seems that the renewal, and indeed also the installation, of new larger presses are more frequent among commercial web-offset printers. Consequently, gravure printers with low volumes and small-to-medium sized presses have high costs and will face strong competition from modern web-offset printers. With signatures of 16 to 48 pages the total printing costs are very high in comparison with modern web-offset.

During Drupa 2004, a series of in-depth interviews were conducted with many top managers in the industry. Web-offset technology was seen almost everywhere in the exhibition and made a strong impact on most visitors. The web-offset printer has, however, the choice of installing new capacity in 16 page increments, which might be less risky. Any printer contemplating such an investment needs control of the supply and demand on his market.

7.3 Hypotheses testing

One should, however, look at the results shown in Table 7.1-7.4 with some caution. A sensitivity analyses made on the break-even computations show that even a small change (5-10%) on either the fixed or variable costs constitutes a larger change on the break-even level. The diagrams shown should be regarded as trends rather than absolute figures, but it can be stated with sufficient validity that:

- The hypothesis that gravure printing is competitive from 64 pages is falsified (comparing the most modern web-offset presses with a capacity of 64 pages)

The result from the Questionnaire regarding gravure print quality on SC grades (uncoated stock) vs. HSWOP was that the majority of the respondents were supportive; the remainder did not know or were indecisive:

- The hypothesis that gravure print quality on uncoated stock is considered to be superior is supported

8. A new concept for small and medium sized gravure printers

8.1 Sensitivity analysis of present data

The above mentioned diagrams are drawn from data and formula with a rather high sensitivity. A sensitivity analysis shows that even a small change in the fixed or variable costs for any of the web-offset or gravure alternatives, may lead to a quite dramatic change in the break-even level. This sensitivity suggests that a considerable amount of caution should be applied, and one may note if the fixed costs in gravure approaching those of web-offset, these changes may become quite large. The fixed costs in gravure are, to a very large degree, dependent on the cylinder-processing costs, and any sudden progress in cylinder processing will have a dramatic effect on the competitiveness of gravure printing. Any printer should use its own data when computing break-even levels and use the results in this report only as indicative. This is, of course, also relevant for any supplier of printing presses and/or cylinder- and plate processing.

8.2 Cylinder processing costs

Although direct digital engraving has been the standard procedure for almost all European gravure printers since the beginning of the 1990’s, the process of producing gravure cylinders has not progressed until the last few years. One important advance, however, is that today there is no need for gravure proofs for magazine publication work. In 1986, it was not uncommon that certain gravure companies were proofing their cylinders up to three or four times, particularly for the most demanding advertising pages on the reverse side or inside of a cover or a demanding mail order catalogue signature. Between each proofing process there were also many hours of manual corrections.

This has changed during the last few years, and very few gravure printers are still offering gravure proofs and/or corrections. Some claim, nevertheless, that they retain these procedures, but that the customer has to pay for any use of the facilities. The majority, however, have no or little capacity (or competence) to do these manual operations. Other printers suggest that it is economically better and faster to carry out the necessary changes in the digital data and re-engrave the cylinder set. However, with the recent fast progress on new preproofing devices (more sophisticated software); the emulation of a gravure print is approaching a near perfect level. Corrections on cylinders may then only be necessary because of some malfunctions in the engraving cycle; hence a remake may be the only solution. The former skill of the trained craftsman is vanishing very rapidly.

Substantial investments in new gravure cylinder technology have, however, been implemented by some of the larger companies in Europe. Again, one must not forget the impact from the customers, demanding higher reliability, high quality and short lead times. Fully automated engraving and plating lines with a minimum of staffing have made the cylinder process much more efficient. Even if the investments in new technology in the cylinder processing department are large, the unit costs can be very competitive compared with web-offset platemaking, provided that the volume of cylinders is sufficiently high (Bjurstedt 2005).

8.3 A new approach

Already in the final report from 1986 (Bjurstedt 1986), some ideas were put forward as to how to improve the situation for the small and medium sized gravure printers. The concepts of short-run gravure and/or smaller paginations have also been investigated by Puri (Puri 2003). His suggestion, however, was that all the narrow cylinder processing should be outsourced to a local packaging company or Trade service house (Puri 2003). This suggestion might be possible in the North American market, but would probably not work in Europe, because the market demands very short lead times. Notwithstanding, there is one example in Germany where the gravure printer has outsourced the cylinder processing to one of the leading trade-houses (for packaging gravure cylinders). Nevertheless, in this case, the cylinders are still processed in-house on the printer's premises. Puri also suggests that all PONY presses in Germany and Switzerland have been dismantled. This is not quite correct, because the presses in Germany (and in the US) are still in operation (ERA List of Presses 2005 and other sources).

Short runs in gravure were also discussed in the final report from 1986 (Bjurstedt 1896). Unfortunately, there is no detailed definition available about short runs. A short run on a large market in Germany or North America might be considered to be a long run on a smaller market in Scandinavia, such as Finland or Denmark. I would like to suggest the following definition of short runs < 200 000 copies combined with the pagination of the signature printed, for example:

- Small pagination – < 32 pages
- Medium pagination – 48 – 96 pages
- Larger pagination - > 128 pages

When one considers the circumstances any printer is facing, running the press room on a 24/7 schedule, it quite easy to compute the annual consumption of paper (grades from 50-65 g/m2) in the European magazine markets according to this definition:

- Short runs – small pagination   < 10 000 tons annually
- Short runs –medium pagination   10 – 18 000 tons annually
- Short runs – large pagination   > 18 000 tons annually

It is quite easy to compute the press size which each of these volumes would fit. The standard press of 1986 updated to the 2006 level in automation and speed (the same web width) would probably consume about 24-28 000 tons annually, assuming a medium pagination and medium runs. Hence, the standard 2006 gravure press would consume some 50% more (50% wider web) or 36– 42 000 tons. It is easily recognized that not only the investment but also the demand from the market have to be taken into account.

A narrow gravure press (web width about 2.0 m) would still, with the above mentioned constraints, consume about 18– 22 000 tons. So, how about an even narrower presses? In 1985, it was suggested that the high speed narrow press concept should be investigated, but it was, after lengthy discussions in the project group, "*decided not to proceed with the cost examination of the high-speed narrow press option, because of the relative high initial costs in cylinder making for short run work. The cylinder costs are not linear with the face width of the cylinders although Tandem-engraving is an established procedure……there is no advantage to be had in the capital investment required.*"

Recent investigations in modern cylinder processing equipment (Bjurstedt 2005) confirm the above statement. The linearity of investments vis-a-vi the cylinder face width is unfortunately for the small size gravure printer very weak.

8.4 The DE (Double Ender) concept

The DE concept will allow smaller or medium sized gravure printers to enjoy an entry level similar to that of a commercial web-offset printer, but more versatile and competitive. Preliminary figures collected in the new investigation shows that gravure can be competitive from signatures of 32 pages onwards. The concept is based on the previously mentioned suggestions from the 1986 report (Bjurstedt 1986) called the PONY press design, although the press manufacturers today prefer a Double Ender or DE for short – see Diagram 8.1 – 8.3.

It was suggested in the report that *"The PONY-alternative, where only 4 cylinders are produced, appeared to have more attraction for this type of work, and press room costs and efficiency were computed from known and existing installations."*

Further in the 1986 report it was stated that *"A PONY press is a press consisting of only four units, where half the cylinder width is used to print the recto side, then turning the web to go back to print the verso on the other half of the cylinder……. The proposed press is designed only for PONY-printing…….."*

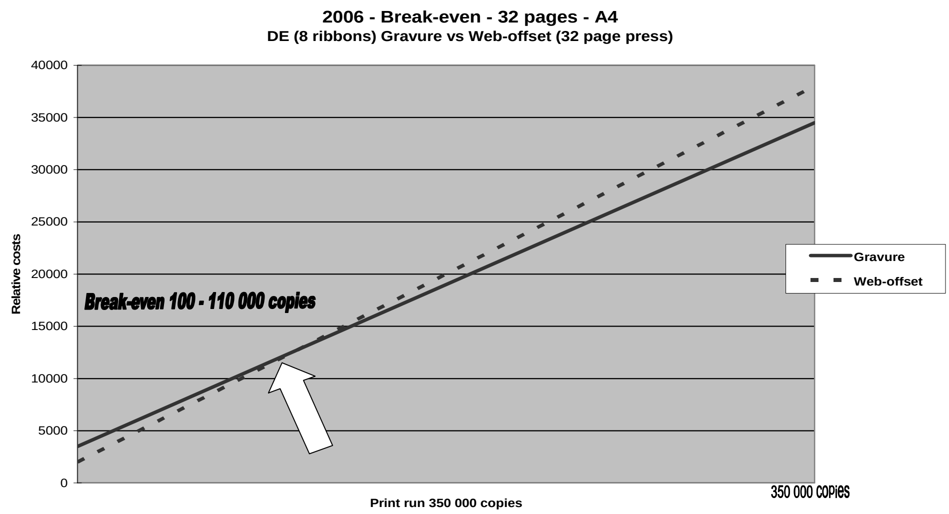


Diagram 8.1 – 32 page A4 – DE gravure press – 32 page web-offset press

In order to improve the situation for the smaller or medium sized gravure printers, a new concept has been discussed in cooperation with the major gravure press manufacturers. With modern design, web control and press automation there is no doubt that a new DE press has a performance which is similar to or very close to a standard 8 unit straight gravure press, and this assumption has been confirmed by one of the leading gravure press manufacturers.

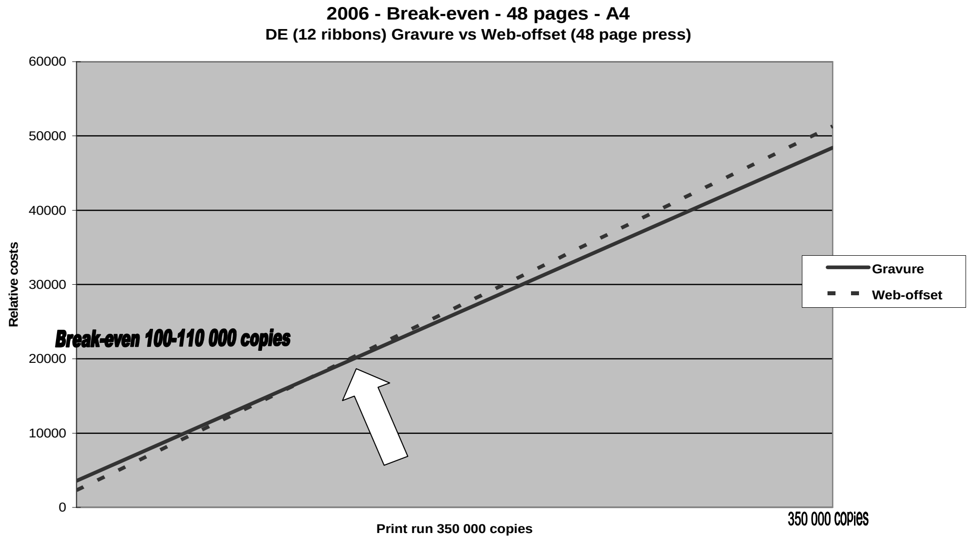


Diagram 8.2 – 48 page A4 - DE gravure press – 48 page web-offset press

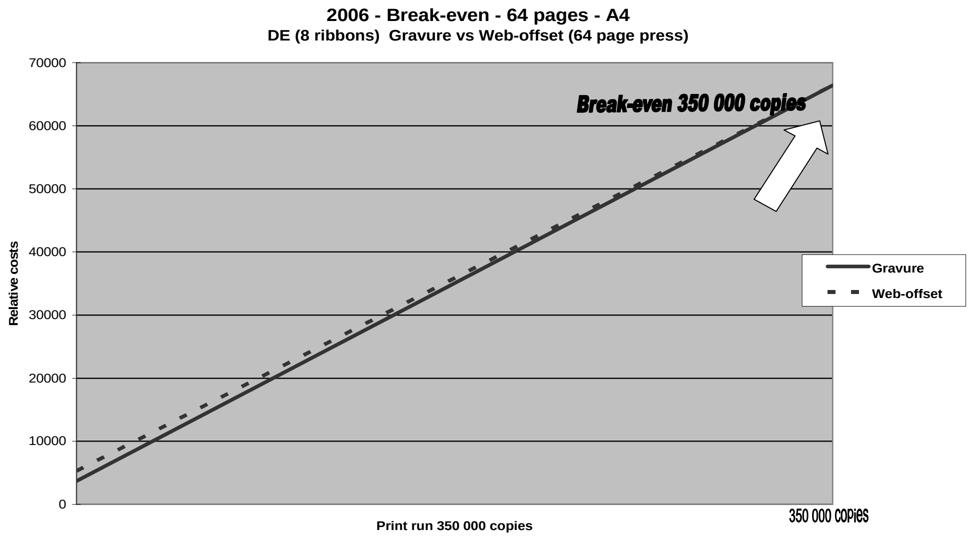


Diagram 8.3 – 64 pages A4 – DE gravure press – 64 p web-offset press

In diagrams 8.1, 8.2 and 8.3, the break-even levels for a 32, 48 and a 64 page signature are shown using the data computed from 2006. It should be noted, however, that the gravure figures are taken partly from synthetic data (estimations of the press room hourly costs) as there are only rather old presses installed. Other data, such as cylinder-making costs, press room performance etc., are taken from the new database. In these diagrams, the break-even levels between a modern DE press and a 32, 48 or 64 page commercial web-offset press are shown. Such a press would fit into the brackets of short runs with medium and/or large paginations, all depending on the product mix.

The number of ribbons mentioned in the diagrams is equivalent to a straight 8 unit press, but in the DE-alternatives only half of the number produces the signature. It should be mentioned, however, that a 64 page signature can only be printed on a DE with 8 ribbons and 8 pages around (8U). (The DE with 12 ribbons may print 72 pages in 6 pages around (6U)). The lead-time of engraving cylinders in 8U is roughly twice the normal engraving time, and should for this very reason be avoided for printing jobs with the demand of short lead-times, diagram 8.3. In any case, the break-even level is also less advantageous for gravure.

Any publication gravure printer contemplating a DE gravure press has to make is own calculations based on the product mix and the annual volume to be printed. A DE press for 32-64 pages would process about 10-12 000 tons of paper annually depending on the product mix (pagination and print runs) and paper grades. A wider DE press suitable for 48-96 pages would process about 50% more. The initial investigation has shown some very interesting facts:

- A DE gravure press for 32 to 48 pages (web-width 250 – 260 cm) is similar to a 48 page commercial web-offset press with regard to capital investment
- A DE gravure press has a very small foot-print (smallest press room area even with an automated cylinder loading/unloading) – about 12 x 18 metres
- The same paper reels can be used for printing 16 pages up to 64 pages (8U) but using different cylinder circumferences
- Combined with the most modern cylinder processing equipment, the time to market, or the lead time calculated from the receipt of digital data until the press produces acceptable copies, is probably shorter (< 3 hrs) than that of a standard 48 or 64 page commercial web-offset press (3-4 hrs).
- It should be possible to run a DE press with lower staffing than a 8-unit press, regardless of the web width
- A DE press has the same flexibility of format as the normal gravure process
- A DE press has the same colour gamut and excellent print quality also an uncoated stock – superior to web-offset
- A DE press uses less paper for a given size and circulation compared with commercial web-offset – less printed waste and trimmings

It is important for the future of the gravure process that there is a close cooperation and understanding between the gravure press and the cylinder equipment manufacturers, for example for press manufacturers to understand the economics of gravure cylinder processing. An internal paper from ERA published in 1987, written by Ms Ann Wilkinson *(Break-even zones presses – presses for short runs & low paginations*), can unfortunately no longer be retrieved from the ERA archives. Nevertheless, one copy was recently found in my archive, and the following statement from this paper is still valid and possibly of great interest for smaller gravure printers:

"Should a gravure cylinder-making system be devised or developed which had a cost linear relationship with cylinder face widths, or even pages, such as in offset, than the Pony (=DE) principle would have far more economical constraints. Even then, there is the additional fact that the price of a press is also not linear with the width, and halving the number of units in a press cuts investment costs more than halving the width, even including the additional web-turning and alignment features. In those cases where only a small capacity in gravure is required, then the DE machine is the most economical investment. It also permits the lowest possible next investment step that is, retrofitting to u-units when the extra capacity is needed."

9. Conclusions

In the present investigation, the first hypothesis about the current break-even level of 64 pages is falsified. The current relations are still much in favour of web-offset printing and the previous signature size has increased substantially during recent years. One the reasons is that there has been a tremendous investment boom in the European web-offset industry with the introduction both of more advanced CTP-systems and new modern web-offset press designs. Break-even in gravure can now be achieved only when printing a signature of 96 pages or more (in a standard A4). This is a quite a significant change in competitiveness compared with 1985/86.

Nevertheless, it has been shown that gravure print quality on uncoated stock is still superior to that of commercial web-offset. Although some of the previous advantages for gravure printers, a cheaper sheet (then about 50€ per tonne) and less printed waste and trimmings, have been reduced to only – namely about $1/3^{rd}$ to $1/4^{th}$ less printed waste according to reliable sources. There is still some economic advantage to print on SC uncoated grades in gravure in comparison to commercial web-offset on LWC grades, even if a slightly lighter grade could be used.

What can be done for the short run gravure concept? If these advantages of the DE concept can be scientifically established, why has this concept never been a commercial success? There were some initial installations of new DE presses in Germany and Switzerland in the middle of the 1980's, but after these there have been no developments in this field. The German installations are producing covers (4 page products sometimes with gate folds and other special features etc.) and some very special low pagination work in superb gravure quality. Maybe the reasons are quite simple:

- Gravure is dominated by two large markets – Germany and North America
- Gravure printers operating on those markets are used to the biggest customers, long runs and high pagination work
- Gravure equipment manufacturers have no product management – contrary to commercial web-offset equipment manufacturers – and rely on input from their large customers in Germany and North America
- Neither ERA (European Rotogravure Association) nor GAA (Gravure Association of America) have hardly any smaller printer as member. In the US market, there are only three big groups, each having a number of gravure printing plants. In the past ERA, however, had many small or medium sized gravure printers as Active Members, but many of these have been merged by other printers or gone out of business. During recent years, only one printer (previously in web-offset) has started a completely new green site in publication gravure.

It can be concluded that the key for future success for shorter runs in gravure lies in the cylinder-making process. One may add not only is a lower investment cost solution necessary, but more importantly, a technical solution which is highly automated (=less staffing than before), high reliability, predictability and repeatability. Such a solution would also enable the smaller and/or medium sized gravure printers to process gravure cylinders almost as cheaply as web-offset plates, provided that the volume is there.

The DE concept is worth exploring not only for the small and medium sized printers but also as a complement to larger groups to meet the demand for smaller signatures, covers or other speciality products printed in gravure.

In 1986, the working group concluded by saying that *"These figures obviously prove that there is large untapped market available to gravure printers, provided they are prepared to organize themselves to attack these sectors.*

We have shown that gravure can be cost competitive for short print runs, but in addition we should not forget that gravure gives the print buyers other advantages."

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IS THERE A FUTURE FOR THE EUROPEAN PUBLICATION PRINTING INDUSTRY?

A study of the European publishing markets and the effects of important techno-economical factors 2007-2010

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Key words:

PUBLISHING MARKETS
PUBLICATION GRAVURE PRINTING
COMMERCIAL WEB-OFFSET PRINTING
MARKET SEGMENTATION
MAGAZINES AND PERIODICAL PRODUCTS
CATALOGUES
PREPRESS OPERATIONS
GRAVURE CYLINDERS
CTP-TECHNOLOGY

Abstract

This paper deals with a survey of the European Publication Printing Industry – and it highlights the potential development of future markets and some of the techno-economical factors which are important to the industry. Previous research has indicated that the cost of producing signatures in either gravure or commercial web-offset have been reduced by 65-70% over the last 20 years. Nevertheless, it is believed that most of the economic benefit of lower costs has not remained within the printing industry, but has been transferred to the customers. It has been a buyers' market during the last decade.

The extremely fast progress of digital technology since the middle of the 1990's has had a great impact on the publication printing industry, not only in gravure but in particular in web-offset. New and affordable software packages for editorial and image manipulation were quickly accepted and within a short time the previous analogue technology was abandoned. These new techniques led to a dramatic change from the way in which the industry had previously worked, and the customer gained complete control of the work flow. Since the autumn of 2006 until January 2007, a series of in-depth interviews were conducted with top managers in the industry, both customers and suppliers to the industry.

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A scientific methodology has been used to evaluate the responses, and those have been discussed during extensive personal interviews.

The investigation includes interviews not only with the leading managers from the customer to the industry, but also some of the most important suppliers – printing press manufacturers, paper and ink manufacturers, plate and cylinder processing equipment suppliers, and other important contributors to the printing process. This approach makes it possible for the author to explain some of the issues in greater detail and to give the reader a deeper understanding of the current and future European market situation. Are there new technologies to be seen in the near future which will have a strong impact on the structure of the industry?

The findings indicate that those publication printers working in the segment of catalogue printing may find the market becoming increasingly difficult. Many of the major catalogue producers are changing their marketing focus from catalogue to E-commerce, which means that today's few but very thick products will probably be replaced by thinner but more frequent issues. The total volume of print will also be affected. Those printers working in the magazine market will also see major differences in the near future. Despite the fact that publishers are increasing the number of titles, the total volume is not expected to increase. The print runs will be more fragmented, and split editions aimed at targeted groups of readers will increase. This means a threat to very large gravure printers, because the newly installed superwide presses may not be sufficiently flexible.

This paper shows that the changes in market conditions and product requirements have been dramatic in Europe during the last 20 years, and that further changes are about to take place.

1. INTRODUCTION

The extremely fast development of digital technology since the middle of the 1990's has had a great impact on the publication printing industry, not only in gravure but particularly in commercial web-offset. New and affordable software for editorial and image manipulation were quickly accepted, and within a short time the previous analogue technology was abandoned. These new techniques of DTP (Desk top publishing) for editorial use led to a dramatic change from the way in which the industry had previously worked, and the customer gained complete control of the prepress work flow (Cox et. al 2005). Furthermore, it has been possible to reduce the entry barriers for new titles and editions (Birkenshaw and Smyth 2001, Cox et. al. 2005, Mowatt 2002), because the publishers have taken advantage of new advanced desktop publishing technology and, more importantly, the previous close relation between the publisher and its printing facility has disappeared.

The largest exhibition in the graphic arts industry, Drupa (Druck und Papier) in Düsseldorf, Germany, opens its doors every four years. During the recent exhibitions - in 2000 and 2004 – the main focus has been on the commercial web-offset industry, showing new technologies to enhance productivity and print quality. Since the millennium, new print capacity has come on stream which is probably unprecedented in the history of publication printing in Europe.

During the autumn of 2006, a series of in-depth interviews were conducted with many top managers in the industry, and with both customers and suppliers to the industry. In 1985, the European Rotogravure Association (ERA) published a study on gravure and web-offset (Bjurstedt 1986). The investigation included in-depth interviews with the leading printing industry managers, but customers and suppliers were not asked to participate. In the present investigation, a qualitative approach has complemented the quantitative, and the questionnaires have been answered during rather extensive personal interviews. This paper shows that changes in the market conditions and product requirements in Europe have occurred during the last 20 years, and that further changes are about to take place.

2. METHODOLOGY USED IN THE PRESENT SURVEY

The area of research covered in this paper is an investigation of the present European publication printing markets, and how these may change in the next few years. The research target is the European publication printers and to some extent those publishers who are still maintaining their printing facilities, but in this context the participating companies are not the printers but the main suppliers and, may be more importantly, the customers of the publication printers. In this case, a survey technique has been used, and a large group of companies and/or executives have been asked to participate. With this approach it has been possible to collect in-depth information about some very important questions to the industry. To the knowledge of the author no similar survey has been directed to the major customers of the industry, catalogue producers/buyers and magazine publishers, although in the middle of the 1980's some data were collected and presented in various conferences by representatives of the association

In this study of the European publication printing industry, the survey was targeted at those companies (and/or their contact persons and managers) who were members of the European Rotogravure Association (ERA). In the past many members were integrated publishers/printers, but there was a distinct difference between these two areas of interest. Hence there were very few print-buyers in the membership. One of the reasons was that those printers working on the commercial markets did not want their customers to be part of an association in which they could meet competing printers.

In 2006, the survey had a broader target group, and the main emphasis was on a qualitative approach with personal interviews and/or interviews by e-mail complemented by phone calls. The interviewees have been selected from among the most important customers and suppliers to the industry. Customers in publishing and catalogue production are, from time to time, invited to make presentations at the meetings of the ERA. Hence, it has in many cases been possible to establish a personal contact with those executives.

Because neither customers nor suppliers were asked to participate in the investigations of 1986, the 2006 questionnaire had to be redesigned. The structure was similar to previous questionnaires, and it was first tested with a small group to check both relevance and completeness. The depth was assured by asking some complementary questions and, for example, it became obvious that the customer’s choice of supplier and printing method is related to the perceived environmental impact.

In this context, there are about 18 suppliers; paper and ink manufacturers, printing press manufacturers and prepress (plate and printing cylinder manufacturers) who were asked to participate in the survey. The reason for including the suppliers this time is that most of the research in developing new technology and/or production processes is now concentrated to the suppliers. Between 1956 and the end of 1980’s, important work in this area was done by the larger publishers/printers (= users) in Europe, sometimes in cooperation with the ERA.

The main effort has been to interview these managers personally, and only two have declined for timing reasons to participate. Some of the interviews were made by telephone because of constraints of time and financial resources. All companies agreed to participate in the survey with the exception of two paper manufacturers. It can be stated that there were 100% coverage in all areas studied with the exception in paper manufacturing with 50% coverage. However, the participating paper manufacturers are representing abut 65% of the European market (see Section 4). The reason for including the suppliers is that almost all of the research in developing new technology and/or production processes is now concentrated to the suppliers.

The other target was the customers to the publication printing industry, mainly magazine publishers and catalogue producers, which are the most important customers to the industry (see also Section 4). The number of publisher asked to participate were six of which one declined to participate. The catalogue producers asked were five of which none declined.

With the recommendations from Bruhn Jensen (2002, the interviewer chose to structure the discourse as follows:

a. Introduction about the purpose of the interview (survey) – secrecy, non-disclosure agreements etc.
b. Some minor less controversial questions about the market conditions in general
c. More complicated questions about background information and knowledge about the industry
d. A few more controversial questions related to the position of the company and problems perceived by the company/individual
e. Conclusion; asking some less controversial questions – some background questions

The questions can be found in Section 4 for each category. In order to be well prepared for the interviews, background information was collected for each company (or group of companies) to be interviewed. Today, such information is normally available via the Internet on the relevant homepages.

The duration of the personal interviews varied between one hour and about half a day. The answers were noted and later submitted to the interviewee for verification and acceptance. Those who were not possible to interview personally, were first approached with the questionnaire followed by a telephone interview lasting about ½-1 hour upon receipt of the response. The depth of the interviews was assured by asking some complementary questions where, for example, it became obvious that the customer’s choice of suppliers and printing methods is related to the perceived environmental impact.

The method of doing most of the surveys as a qualitative study is of course time-consuming and expensive. On the other hand, it may only be possible to discuss some of the important issues face-to-face rather than through a more anonymous questionnaire distributed by mail. The notion of using more depth and time during the interview gives the interviewer more time to reflect and the possibility of adding supplementary questions. This strategy is also supported by Schatzmann & Strauss (cited in Bruhn Jensen 2002). Hence, the interviewer has gained not only a personal contact but also more in depth knowledge about the conditions on different markets in Europe. This context has been very valuable in the survey about the future markets for the European publication printing.

By using different sources - from both users and suppliers - in the recent survey some of the results deduced may be stronger than if they came from one source only. Another important issue in a survey concerns the generality of the answers. Are the answers also valid for those not taking part in the survey? Since it is not possible to contact all companies and/or executives in the European markets, is it possible to generalize the results from the survey and state that these are the common perception of the market in Europe? In this context, where the suppliers represent about 75-80% of their individual markets, it could be deduced that their answers are quite general and are valid for the purpose of this particular research study. In same cases, they represent up to 100% of the market, i.e. the cylinder processing, ink makers and press manufacturers specializing in the gravure markets.

The situation is to some extent different with regard to the customers to the industry. There are many more customers, both magazine publishers and catalogue producers, and it has only been possible to approach some of the larger companies. The constraints have basically been the cost and time which has been possible to allocate to this survey, because a qualitative study is of course more time-consuming and more expensive. On the other hand, some of the more important issues may be easier to discuss face-to-face rather than in a more or less anonymous questionnaire distributed by mail. The notion of using more depth and time during the interview gives the interviewer more time to reflect and the possibility of adding supplementary questions. Hence, the interviewer gains not only a personal contact but also a more in-depth knowledge of the conditions on different markets in Europe.

3. RESEARCH QUESTIONS AND A PARADIGM SHIFT IN THE PUBLICATION PRINTING INDUSTRY

What effects do the techno-economical constraints have on the future development of the European publication printing industry? The hypothesis is that due to changes in advertising spending and consumer behaviour, the conditions for the European publishers and catalogue producers will change. This in turn will affect the publication printers and further adaptation, and a very flexible attitude among the publication printers is needed. This is a quite significant change from previous market conditions. Hence, this investigation will determine whether this hypothesis is verified or falsified.

Will new and emerging technologies, in new press designs and in cylinder/plate processing, be factors which aid the short-term survival of the publication printing industry? Since 2000, many new presses – both in gravure and commercial web-offset – have been installed, and the latest generation of publication presses are running wider webs and much faster. They need less staffing and give very fast make-ready, improved up-times due to new and improved press controls. This in turn means that the additional, aggregate net production capacity is very large and will not easily be absorbed if the future growth of the publishing market is limited.

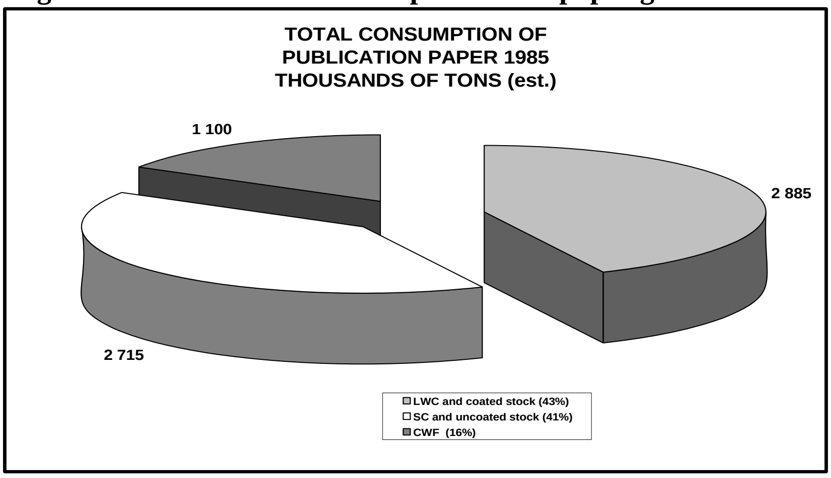
Are we witnessing a new paradigm shift in the technology of producing magazines or catalogues? The shift may show how the industry has changed *"from a craft labour structure to an industrial process"*. Process reengineering – how to integrate plate processing or cylinder engraving (incl. chrome plating/finishing) with an automated press make-ready process into an automated press run – has to be realised. The aim of this process is to produce a first saleable copy without manual intervention – faster than to-day and with less waste!

4. THE MARKETS FOR PUBLICATION PRINTING

4.1 MARKET SIZE AND VOLUME GROWTH 1985-2006

In 1985, the total consumption of publication printing paper was estimated by the European Rotogravure Association (ERA) with the assistance of the leading manufacturers of publication printing paper grades in Scandinavia, Germany and Italy, to be 6.7 million tons of paper. In this context it should be noted that statistics previously presented in Bjurstedt (2005) have to be corrected.

Figure 1 – Estimated volume of publication paper grades in 1985

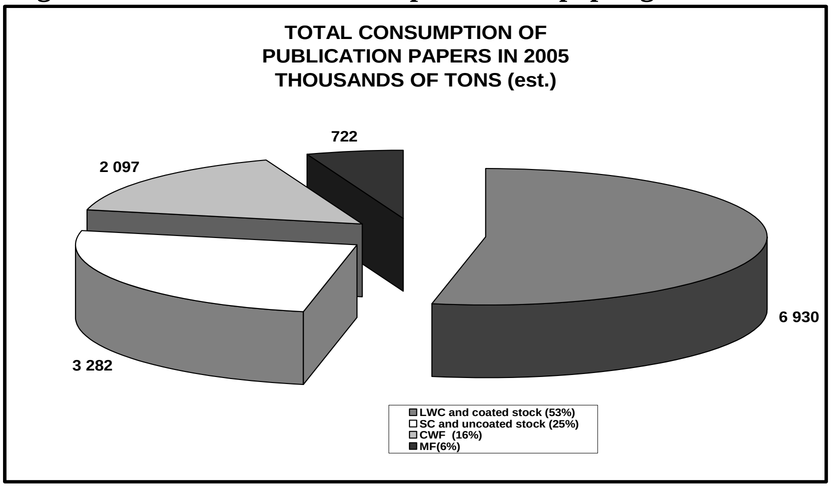


Source: ERA 1985(corrected)

During deliberations with Cepifine (see list of references), it was found that a volume of wood-free coated (WFC) grades used in heat-set web-offset has not been included in the previous statistics. Further, the previously estimated volume of SC grades shown was actually higher than the capacity available in the European mills. Hence, the consumption of SC grades in 1985 has been reduced, and WFC grades have been added correspondingly. Cepifine and Cepiprint started their collection of paper data in 1991, and for earlier years, such as 1984, the only reliable source is the corrected ERA statistics, Figure 1 – corrected volume of publication paper in 1985 (ERA 1985).

The growth in paper consumption for publication printing (including improved Newsprint or Machine Finished grades) has been quite substantial. The annual growth has been about 3.4% (compound) between 1984 and 2006, i.e. for 19 consecutive years. The data for 2005, Figure 2, has been validated by Cepifine and Cepiprint, two organizations within the European paper industry responsible on a monthly basis for collecting statistics from the members of the all production and deliveries of publication paper grades manufactured. The total deliveries to the European market in 2005 were 13 million tons.

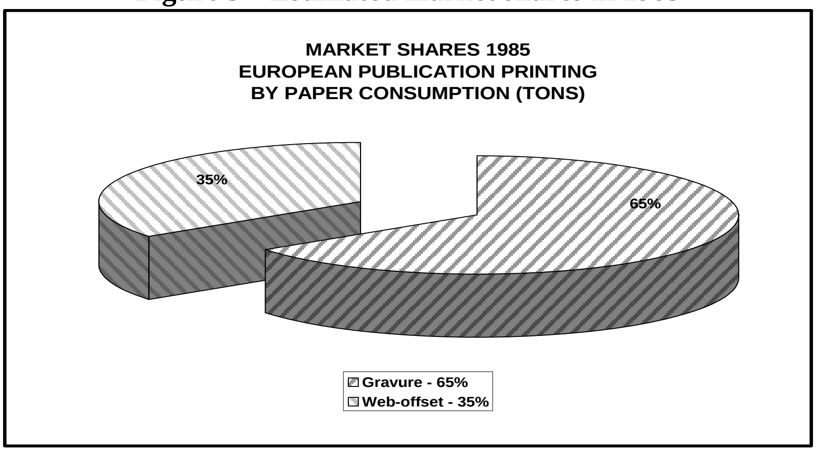
Figure 2 – Estimated volume of publication paper grades in 2005



Sources: Cepifine/ Cepiprint

In 1985, ERA estimated the relative market shares for gravure and web-offset, see Figure 3.

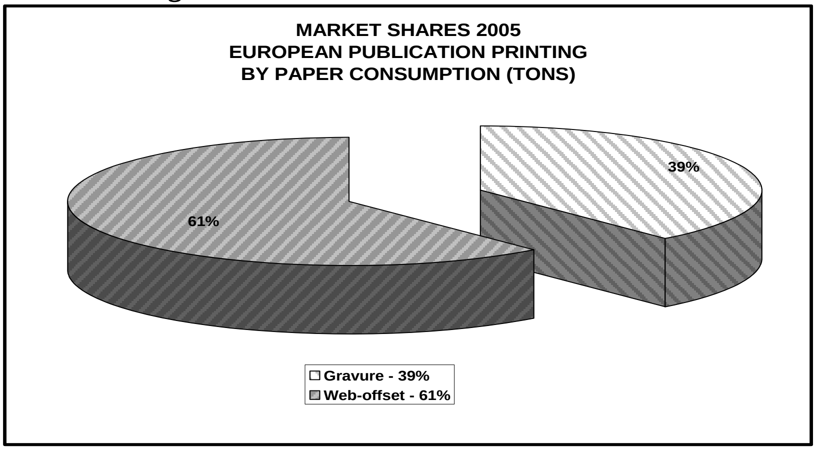
Figure 3 – Estimated market shares in 1985



Sources: ERA1985

The corresponding figures for 2005 are shown in Figure 4.

Figure 4 – Estimated market share in 2005



Sources: ERA, MAN-Roland

Aumiller (2005) has shown figures which are lower for gravure. The total paper consumption was rather close, but the suggested market share for gravure was as low as 35% in 2004.

However, there is another factor to be considered, namely the printed surface area. It has been suggested that the average grammage, particularly in gravure, has decreased, perhaps by 5-10%, since 1985. The reason is the rising costs of postage and transportation, hence the quest for lower grammage from publishers and print buyers (Birkenshaw and Smyth 2000). It is, nevertheless, almost impossible to obtain statistics about the actual paper surface area printed, hence, Figure 4 is a rough estimate. In another survey (Birkenshaw and Hart 2001), it was claimed that gravure, because of the erosion of market prices, has lost substantial market shares during the last decade.

Hence, from Figures 3 and 4, it can calculated that the growth of the publication gravure market has been about 20% since 1985, and that the annual growth of gravure has been very small; about 1% since 1985. This is in contrast to the situation for commercial web-offset printing which has grown by about 200% during the same period of time, and where the annual volume has enjoyed a growth rate of 4.5%.

4.2 MAGAZINE PUBLISHERS

The magazine printing business is by far the largest customer segment for the European publication printers, and the volume is twice that of catalogue printing according to Hohol (2005). The performance of this sector is of the utmost importance for the future of publication printing, and in 2005 the volume is estimated to about 6 million tons of paper. There is no dramatic change in the blend of paper grades used in the publishing industry, although the SC uncoated grades seem to enjoy an above average growth. (Ibid. 2005).
In 1987, ERA made an investigation in cooperation with those publishers who were integrated publisher/printer (in 1985 about 75% of all members), into the number of general interest titles vs. circulation in Europe, Table 1, above 100 000 copies (ERA List of Members 1985).

Table 1 shows that the major markets for general interest magazines were Germany, France, Italy and the Netherlands. It is, however, interesting to note, that in the Nordic countries the majority of the titles, despite the low circulations, were printed in gravure. The situation in the UK was quite the contrary where most titles, even those above 500 000 copies, were printed in heat-set web-offset.

Table 1 – Magazines in European markets (number of titles) in 1987

Market/ Circulation	100 -200 000	200-300 000	300-400 000	400-500 000	> 500 000	Total
Germany	6	12	9	9	38	**74**
France	18	15	11	6	13	**63**
UK	12	8	5	0	9	**34**
Italy	3	6	5	5	8	**27**
The Netherlands	10	4	2	3	6	**25**
Sweden	14	3	3	0	1	**21**
Norway	3	2	2	0	0	**7**
Finland	9	2	2	0	0	**13**
Denmark	7	2	2	0	0	**11**
Total	**82**	**54**	**41**	**23**	**75**	**275**
Percentage (%)	***30 %***	***20 %***	***15 %***	***8 %***	***27 %***	***100 %***

Source: ERA 1987

Today, the European publishing business is very fragmented, and there are about 50 000 different titles in Europe, of which 17 000 are consumer magazines, 10 000 customer magazines and 22 000 B2B magazines (FIPP – Federation International de Presse Periodique 2005), but most of them are very small. FIPP produces a user manual (World of Magazine Trends) each year which shows for each country the number of titles in each segment (Ibid. 2005).

Table 2 - Magazines in European markets (number of titles) in 2005

Market/ Circulation	100 -200 000	200-300 000	300-400 000	400-500 000	> 500 000	Total
Finland	14	6	1	0	5	26
France	11	7	8	11	19	56
Germany	9	8	1	3	35	56
Italy	6	6	10	4	16	42
The Netherlands	19	6	2	3	3	33
Norway	14	1	1	1	0	17
Denmark	6	2	1	0	0	9
Sweden	19	10	2	0	7	38
UK	14	4	4	3	17	42
Total	**112**	**50**	**30**	**25**	**102**	**319**
Percentage (%)	**35 %**	**16 %**	**9 %**	**8 %**	**32 %**	**100 %**

Source: FIPP World Magazine Trends 2005/2006

Table 2 shows that number of titles above 100 000 copies has grown by 16%, but the number of titles in each size segment remains about the same as in 1987 except for those titles with a circulation between 100-200 000 copies and 500 000 copies respectively.

Table 3 – Titles by segment in 2005

Segments/ Circulation	100 -200 000	200-300 000	300-400 000	400-500 000	> 500 000	Total	Perc. %)
Women's Magazines	22	8	4	10	21	65	**20 %**
TV Guides	11	10	6	5	27	59	**18 %**
General Interest	9	10	6	2	18	45	**14 %**
Consumer special	23	7	9	5	16	60	**19 %**
B2B/trade	21	1	2	1	0	25	**8 %**
Financial	19	5	2	1	3	30	**9 %**
Mens Mag.	7	9	1	1	6	24	**8 %**
Contract publications	0	0	0	0	11	11	**3 %**
Total by segments	**112**	**50**	**30**	**25**	**102**	**319**	**100 %**

Source: FIPP World Magazine Trends 2005/2006

The last segment has grown with 30%, and more than 50% of the paper consumption is in this segment, which should be advantageous for gravure printers. In 2005, FIPP published a list of the types of magazine titles belonging to each segment, Table 3, which shows some interesting facts, but unfortunately it is not possible to do the same detailed analysis for 1987, because FIPP did not gather data about titles until some years later. Most of the segments shown in Table 3 existed in 1987. Television was deregulated by the EU about in the middle of the 1990's, and earlier there were only a few titles in each country. Today, the situation is different, and this segment has almost 20% of all titles larger than 100 000 copies. These titles also enjoy large circulations, 45% of the titles (i.e. 27 out of 59) are larger than 500 000 copies, and these can be found in France, Germany, the Netherlands and the UK. Contract publications are all above 500 000 copies, and the largest geographical markets are the Nordic countries and Switzerland. According to Hohol (2005), the five largest segments account for about 80% of the total paper consumption in 2005.

During the autumn/winter 2006/2007, a questionnaire was distributed to a six European publishers, some of them ERA Members, with a response rate of 83%, with the following question:

1) How do you evaluate the present situation in the European publishing markets?

There were some different opinions, but the most common answers were:

a) all publishers have a digital agenda
b) the brand is the main issue
c) business around the brand is increasing, whilst the core product – the magazine – will be relatively less important in the future
d) the large titles are declining, but the number of niche titles are growing rapidly
e) the printing market is very competitive, squeeze on prices and lead times
f) retail sales are sluggish because the points of sale are fewer and fewer (impact from large retail chains)
g) cost of distribution is an area of great concern, particularly postal rates

In addition to this general open question, a number of questions with multiple choice answers were asked. Table 4 shows a summary of the answers given.

Table 4 – Summary of the answers from the publishers

What factors do you contribute to the growth of periodical products?			
Questions	**Not likely**	**Do not know**	**Likely**
Ease of creating new titles	40 %		60 %
Steady growth of revenues	40 %		60 %
Lower cost of printing	60 %		40 %
Logistics easier and simplified	80 %		20 %
Editors are more creative			100 %
If you compare volume - pages and editions - in 1986 with today?			
	More	**Same**	**Less**
Do you produce	60 %		40 %
What is the main reason for choosing a particular printing method?			
Price	100 %		
Lead-time	80 %		
Print quality	80 %		
Print run	80 %		
How do you confront the future?			
Will the printed product be your prime source of income	100 %		
Will you be leaning more towards on-line services	100 %		
What are the prime factors confronting print media in the future?			
Not flexible enough	80 %		
Not cost efficient enough	80 %		
Younger generation is not used to read	60 %		
Cost of distribution	60 %		
Environmental issues	60 %		

The answers in Table 4 are consistent with the results of other investigations into the behaviour of publishers, such as Birkenshaw and Hart (2001) and Hohol (2005). Publishers are more concerned about distribution costs than the print production costs, and the decrease in manufacturing costs (Paper V) seems to be taken as a Law of Nature. The changes in distribution economics have, however, created new problems of great concern lately, warns Hohol (Ibid. 2005); viz.:

- Losing retail points of sale,
- The supermarket chains are increasing the number of warehouses (they demand a higher part of the sales revenues)
- Increases in postal rates for the subscribed circulation
- New environmental legislation
- Imposed taxes on logistics, i.e. increasing the cost of distribution

- and, last but not least, the changing habits of reading, in particular those of the younger generation.

The competition for people's time from electronic media is of great concern, as well as the advertiser's changing perceptions of where their client's budget is most efficient. Price Waterhouse Coopers say that the largest spenders among advertisers and readers are found in France (€ 6.5 billion), the UK (€ 5.6 billion), Germany (€ 4.5 billion) and Italy (€ 4.2 billion) which is cited by Hohol (Ibid. 2005). These four countries accounted for almost 75% of all revenues in Europe in 2005 (total about € 28.5 billion). However, it is not unlikely that the German statistics is showing lower numbers than it normally would do, because of the recession in the magazine market in the beginning of the millennium.

The respondents to the questionnaire suggested that the current trends in magazine publications are:

- The brand is part of the core business
- Volumes (of larger magazines) slowly declining, versioning and targeting of products
- Growing volatility in purchasing patterns
- Growing threat from electronic media and the use of the Internet
- Increasing awareness of environmental issues related to print (and paper supply)
- Logistics – paper transport from the mill and transportation of the finished product to the retailers/subscribers.
- Costs of distribution and postal rates are growing
- The push towards lower grammage grades will continue
- Publishers (and advertisers) demand ever shorter lead-times from their printers

In the forecast presented by Hohol (2005), the total annual volume of paper is expected to be close to 8 million tons in 2014. The volume of print will probably show a small to modest growth rate, but the increasing number of titles will lead to shorter and more fragmented print runs (Ibid.) Time to market will increase in importance, and this will add to the pressure to decrease the lead-time from the time when the digital files are supplied until the products are available for sale at the retailer (Birkenshaw and Hart 2001).

The advantage for the printer, however, is that the production process repeats itself at regular intervals. This makes a tight integration between customer/printer necessary but not sufficient for a smooth production. The printer has to deliver the best service, excellent quality, short lead-time to the more demanding customer, who is not willing to pay a premium price. Nevertheless, these market conditions will put both paper-makers and printers under pressure. How do you as a gravure printer handle shorter and fragmented runs under such market conditions? The very wide gravure presses may not be flexible enough for such conditions.

One of the top priorities, which were not covered extensively in the questionnaire for the publishers, is the environmental issue. The environmental questions related to the paper supply are one of the top priorities of all large publishers, who have been pushed by the increased awareness of general public opinion. Almost all the major publishers have the pronounced target that all future paper supplies shall come from certified forests and/or other certified sources of fibres. This is stated on all web-sites of the respondents and also from FIPP (Annual Report 2005/2006).

On the other hand, when it comes to the printers, the concerns are not as strong as with the paper supplies. Nevertheless, FIPP recommends that publishers should use printers having either ISO 14001 or EMAS (European Eco Management and Audit Scheme) schemes. It should be noted here that one of the strongest proponents for the use of toluene in publication gravure is the German association of periodical publishers (Verband Deutsche Zeitschriftenverleger - VDZ). The organization was very active when the Eco-label for printed matter was discussed (VDZ 2004).

Another attitude related to the printers can be found in France, where the largest publisher – Hachette Filipacchi with a paper consumption in newsprint and magazine paper grades of about 450 000 tons – has a very stringent regulation for its contracted printers and paper suppliers (Reference Document 2005). Similar opinions are voiced in e.g. (Parritt cited in FIPP Annual Report 2005/2006), "*Print and paper is an industry …. …..with real potential for sustainable development." …….. "Magazines themselves can contribute to sustainable development as they are powerful influencers and beneficial to improving literacy and to learning."*

Another publisher insists that paper manufacturers must be prepared to meet stringent environmental requirements*: "…. our future relationship with paper companies will be characterized by compliance with very rigorous environmental standards. This will likely be the most important issue for us and other magazine publishers in the coming decade."* (an anonymous publisher cited in Hohol 2005, page 68).

4.3 THE EUROPEAN CATALOGUE MARKETS

The second largest customer category in publication printing is the catalogue producers, mainly of mail-order catalogues (or so called Remote Distance Sellers producers). Hohol (Ibid.) writes that this segment had a projected paper consumption of 2.9-3.0 million tons of paper in 2006 (Ibid.). There are about 2 000 companies active in this segment in Europe according to EMOTA (European Mail Order and Trade Association - now renamed to the European Association of Distance Selling). The five largest companies have an estimated paper consumption of about 1 million tons annually, which is about 35-40% of the total consumption in this segment (Ibid. 2005).

Companies	Sales
• Argos (Great Britain)	€ 5.0 billion
• Quelle/Karstadt (Germany)	€ 3.0 billion
• Neckermann.de (Germany)	€ 1.5 billion
• Redcats Group (France)	€ 4.3 billion
• Otto Versand (Germany)	€ 14.6 billion
• IKEA Inter (Sweden)	> € 17.5 billion (no official data available)

The recent sales figures have been taken from the corporate web sites. These companies, except for Argos which is working only in the British islands, are much diversified. This segment can be divided into: a) those that are in the traditional mail-order business and b) those companies which are using the catalogue as a marketing tool for pulling the customers into their stores (e.g. IKEA and Argos).

During the autumn/winter 2006/2007, a questionnaire was distributed to four of those companies with the following question:

1) How do you evaluate the present situation in the European mail order market?

There were some different opinions, but the common answers were:

a. All catalogue producers have a digital agenda
b. Tough market with pressure on prices
c. Smaller sizes and lower grammage because of postal and distribution costs
d. The printing market is very competitive, squeeze on prices and lead times
e. Not one thick catalogue, but many more frequent and thinner
f. Neckermann.de seems to move from catalogue and inserts to the Web only

In addition to this general open question, a number of questions with multiple choice answers were asked and Table 5 summarizes the answers given.

Table 5 – Summary of the answers from the mail order producers

What factors do you contribute to the growth of catalogues?			
Questions	**Not likely**	**Do not know**	**Likely**
Ease of creating new titles	50 %		50 %
Steady growth of revenues	33 %		67 %
Lower cost of printing	33 %		67 %
Logistics easier and simplified	67 %		33 %
Editors are more creative	50 %		50 %
If you compare volume - pages and editions - in 1986 with today?			
	More	**Same**	**Less**
Titles	100 %		
Pages	67 %	33 %	
Special catalogues	100 %		
What is the main reason for choosing a particular printing method?			
Price	67 %		
Print quality	67 %		
Printed volume	67 %		
Paper (SC)	67 %		
How do you confront the future?			
Will the printed product be your prime source of income?	50 %		
Will you be leaning more towards on-line services?	67 %		
What are the prime factors confronting print media in the future?			
Not flexible enough	50 %		
Not cost efficient enough	50 %		
Cost of distribution	67 %		
Environmental issues	50 %		

The strategic issues for these companies are very much the same as those for the magazine publishers. The Internet has become a business driver during the last few years, and some producers have already announced that they will reduce their catalogue volumes during the next few years (Gutschi 2006). The traditional mail order catalogue producers regard the Internet as the new sales channel complementing the more traditional telephone or orders by regular mail.

Other companies use the catalogue as a vehicle for attracting the customers into their warehouses and/or shops. For these companies, telephone sales and/or sales by the net still account for very small numbers. The companies are growing with new outlets, which mean that the volume of printed catalogues is also growing.

One example is IKEA which is the most fast growing of all. IKEA plans to open 25-30 new warehouses every year. Even if the major part of those is outside Europe, most of the catalogues are still printed in Europe, except for the North American and some of the Far Eastern editions (2006 Fact and Figures).

One of the larger German producers is more specific about the future of printed catalogues. In a recent article (Gutschi 2006), the managing director says that the era of a few very thick catalogues is over. He will reduce the printing budget by 2/3 by 2008, and there will be more frequent but much thinner products. The average print run will be considerably smaller, because the new versions will be sent only to those who have earlier shown an interest in a particular assortment. The other giant in the mail order business in Germany, Quelle, announced on the 28th of November 2006 that starting in 2007 the catalogues for clothing and other trend- sensitive products will be published monthly.

One common concern, however, is the environment. Although not specifically mentioned in the questionnaire (only indirectly), it is considered to be of utmost importance. All the major players, purchasing about 1 million tons of paper every year, have imposed strict control of the origin of the virgin fibres. One example is Otto Versand who claims that a reduction of the format has reduced the paper consumption by 1 150 tons of paper, which is about 3.6% of the total consumption of 320 000 tons annually. All paper grades used are chlorine-free, and also here there have been discussions about FSC-certified (Forest Stewardship Council – a scheme for sustainable managed forests (there are no FCF-certified forests in either Finland or Germany) sources of fibres. It is claimed, however, that they did not found the quantities nor qualities of FSC certified grades needed (Otto Versand Annual Report 2005). In 2006, WWF claimed that Otto Vesand printed the first gravure produced catalogue with FSC-certified grades (www.fsc.org).

For the gravure printers there are stringent rules about residual solvents (toluene) in the catalogues, and catalogue producers are more concerned about this than magazine publishers. One reason is said to be that a magazine has a shorter shelf life than a catalogue, and that makes it more susceptible to a possible aromatic smell. Otto Versand (Ibid. 2005) says that regular measurements have been carried out since 1997, and that the level has been reduced significantly.

In the ERA Newsletter (Gravure News 2006, p. 11), it was stated that:
"….have to constantly update their products. ……. This will affect catalogues; instead of the main catalogue, more segmented and more frequent catalogues………" *"The growth in the mail order business is no longer driven by the classic catalogue, since the share of ecommerce has reached more than one third."* A quote from Sommer, member of the executive board of Karstadt/Quelle: *"The mail order houses have underestimated the effects of the new*

technologies, as Internet on their business” ----*“And the catalogue will more support the Internet as the link between customer and web”*

EMOTA (2007) states that these companies are promoting the Internet as the prime channel for sales, and that in some cases these sales are more than 50% of the total sales. The traditional catalogue has the disadvantage of long lead-times; and fast moving consumer goods, like fashion and electronics, have a short shelf life. Hence, the responses suggest that the catalogues will be much thinner, more frequent and more targeted in the near future. The same pattern as in magazine publishing will influence the publication printers directly:

- Volumes (of larger catalogues) are slowly declining
- Versioning and targeting of catalogues
- Growing volatility in purchasing patterns
- Growing threat from electronic media and the use of the Internet
- The number of special catalogues is growing
- Time to market is crucial – shorter lead-times
- The trend towards lower grammage is continuing

With shorter runs and more fragmented volumes, the present gravure technology may not be fast enough or flexible enough for these market conditions.

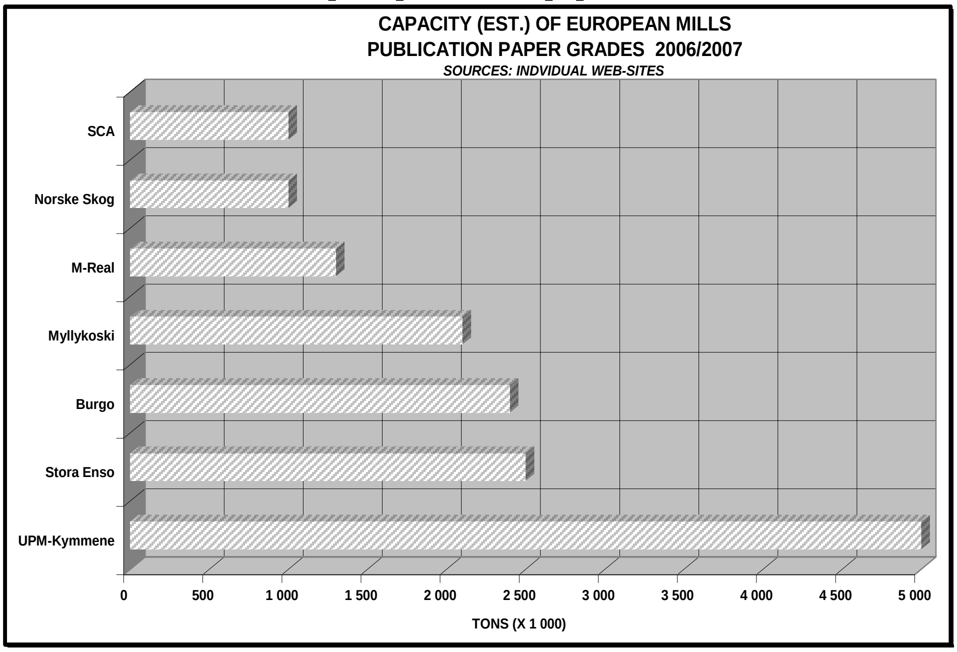
4.4 PAPER SUPPLIERS

One driver in the consolidation process in the paper industry has been economy of scale. If investment in super-wide gravure presses has been impressive, the recent investments in paper machines are more than twice the widths of those presses and more than 10 times more expensive. A new paper machine normally replaces 2-3 older ones, which is the case with the new PM 12 in Kvarnsveden, Sweden, a mill belonging to Stora Enso, with a capacity of 420 000 tons of SC magazine grades. The total investment is in the order of € 400 million (Stora Enso 2006).

In 2006, the segments of publication paper grades (wood-containing paper grades with the exception of newsprint and directory grades), the companies shown in Table 6 are dominating in the European markets (corporate web sites 2006/2007). In this table, the total capacity is about 15 million tons in 2006/2007, although the demand is only estimated to be 14 million tons (Hohol 2005).

All the paper mills support forest certification schemes, chains of custody and/or environmental auditing. The first SC paper mill – UPM SC mill in Schongau, Germany - was recently awarded the Eco-label for publication paper grades (UPM Eco). The requirements from magazine publishers and catalogue producers for sustainable work practices in the paper processing chain are increasing, and it is expected that all paper-makers will soon adhere to both Forest Certification Scheme and an Environmental Auditing Scheme.

Table 6 – European publication paper manufacturers



Sources: individual corporate web sites

During the autumn/winter 2006/2007, a questionnaire was distributed to six of the major European producers of publication paper grades, with a response rate of 50%, with the following questions:

1) How do you evaluate the present situation in the European publication printing market?

The paper mills all have similar market conditions, and their answers were quite similar:

a) Low growth to stagnant markets in publication gravure
b) Paper prices under severe pressure despite higher costs for fibre and energy
c) SC is making fine progress in printability and is approaching LWC

2) What are the top 5 technical issues/solutions in your opinion with the greatest impact during the last five years?

a) Wider reels (< 3.6 m) in high speeds needs further development in manufacturing and logistics

b) Printability and ink behaviour on MF grades
c) Surface gradients on SC paper
d) Colour profiles and management must be adapted to the paper grades (learning curve)
e) Larger reel diameters in HSWO market (from 1.25 to 1.5 m in diameter)

3) What are the most important issues in the next five years? Which are the five top issues?
a) Higher process stability in the mills
b) Higher efficiency in the mills
c) Lower waste in the press room (= less breaks and less paper-related waste)
d) Environmental issues (sustainable forests and custody chains of fibres)
e) Help publishers/advertisers/catalogue producers to find the right paper grade for the application

4) What are the important threats to the publication printing industry during the coming years?
a) Energy costs in the paper industry
b) Energy costs for logistics (still cheap to transport paper)
c) Legislation about environmental issues
d) Offset is gaining in flexibility – gravure must maintain the quality difference between gravure and web-offset
e) Gravure developments in the emerging markets

In addition to these general open questions, a number of questions with multiple choice answers were asked, and Table 6 summarizes the answers given.

Table 6 – Summary of the answers from the paper manufacturers

Do you think that further reductions in the costs of printing are possible?			
Questions	**Not likely**	**Do not know**	**Likely**
Are further reductions to be expected?	33%		67 %
Have we come close to the end of what is achievable	67 %		33 %
Other techno/economical issues			
Questions	**Not likely**	**Do not know**	**Likely**
Is it likely with paper reels wider than 480 – 490 cm	100%		
Trend to lower grades are continuing			100 %
Is it possible to eliminate waviness in heat-set	100 %		
New drying concepts in gravure?	67%		33%
New drying concepts in heat-set	67%		33%

It should, however, be noted that MF (machine-finished improved newsprint) is expected to have a rapid growth in the next few years, because many print buyers are expected to downgrade their paper for economic reasons. The achievable print quality on MF grades is acceptable for some products (Scott 2006, Hohol 2006), but adaptive actions in both gradations and ink manufacturing (special extender) are needed. It is not possible to achieve a similar quality using heat-set web-offset

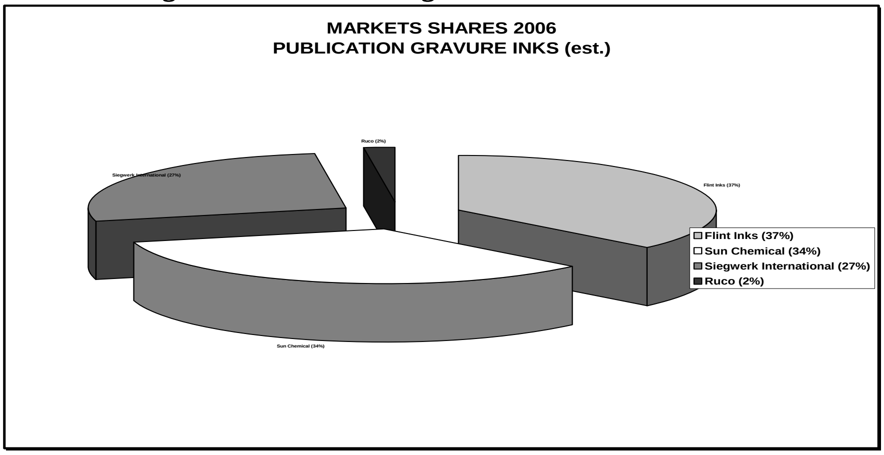
4.5 INK SUPPLIERS

Gravure inks are an important part of high quality publication gravure printing. Although it is debatable whether economy of scale applies in the manufacturing of inks, there are considerable advantages in R&D of being a large company. There have been many mergers and acquisitions in the ink making industry according to Ink World Magazine (2006) and EMOC (Anon. 2003).

1999	Sun Chemical buys Coates Lorilluex, France
2002	Acquisition of Gebrüder Schmidt in Germany by Flint Inks., US.
2004	Merger of BASF printing inks and Akzo Nobel Inks (the nee company called XYZ Solutions)
2005	Merger of Flint Inks and XYZ Solutions
2006	Acquisition of Sicpa Inks by Siegwerk International

In the European publication markets, there are three major and one minor supplier only (Source: World Magazine 2006), Figure 5.

Figure 5 – Publication gravure ink market*:*



Source: Ink World Magazine 2006

During the autumn/winter 2006/2007, a Questionnaire was distributed to the three major European producers of publication inks, with 100% response rate, with the following questions:

1) How do you evaluate the present situation in the European publication printing market?

The answers were very much the same as for the papermakers, e.g. growing concern about the publication printing markets:

a) Low growth to stagnant markets in publication gravure
b) Ink prices under severe pressure despite higher costs for raw materials and energy
c) Ink over-capacity

2) What are the top 5 technical issues/solutions in your opinion with the greatest impact during the last five years?

a) Printability and ink behaviour on MF grades
b) Improved ink mileage
c) Even printability on SC paper
d) Universal extender for high quality independent on paper grade (MF/SC and/or LWC)
e) Missing dots

3) What are the most important issues in the next five years? Which are the five top issues?

a) EU restrictions on the use of toluene
b) Pressure from print buyers transferred to the ink market
c) Pressure from increased web-offset capacity
d) Securing raw materials for publication inks
e) Is paper quality decreasing?

4) What are the important threats to the publication printing industry during the coming years?

a) EU legislation – environmental issues and chromium
b) Increasing costs of raw materials
c) Uncertain future in catalogue printing
d) Competition with heat-set and cold-set web-offset
f) Lack o f workers skills

In addition to these general open questions, a number of questions with multiple choice answers were asked, and Table 7 summarizes the answers given.

Table 7 – Summary of the answers from the ink manufacturers

Do you think that further reductions in the costs of printing are possible?			
Questions	**Not likely**	**Do not know**	**Likely**
Are further reductions to be expected?			100 %
Have we come close to the end of what is achievable	67 %	33 %	
Other techno/economical issues			
Questions	**Not likely**	**Do not know**	**Likely**
Are other solvents than toluene feasible	33%	33%	33%
New drying concepts in heat-set web-offset	100 %		
Is it possible to eliminate waviness in heat-set	100 %		
Same ink (same colour scale) to all gravure printers?	100 %		
ISO standards will not differentiate between gravure and web-offset	100%		
Will a new standard enhance the gravure gamut	100%		
Other colour spaces than CIE lab	100%		

The ink makers have very much the same opinion with the exception of the use of toluene as the main solvent in publication gravure. In almost all other questions they have the same opinion, e.g.

- Heat-set drying will continue in web-offset
- Waviness will be difficult to eliminate in web-offset
- The colour space will remain CIE lab
- Ink supplied will comply to the ISO standard

Since the middle of the 1990's, the activities in the ERA Environmental, Health and Safety (EHS) Commission have been devoted more or less to environmental issues only, and when the toluene problem became acute, ERA commissioned a Special Task Force to deal with the matter (Source: ERA EH&S Commission).

- Finding alternatives and/or substitutes for toluene as solvent
- Development of water-based inks (print quality not yet commercially acceptable) – some patents on water-based inks have been filed
- Development of substitutes for solvent-based inks (e.g. Hot Tec ink - solid inks without solvent, the solid was made liquid by heat - was developed by Siegwerk International until 2000)

- Developing solvents with a low residual content in the finished products (the Danish example, but also demands from customers – ref. previous section 4.2 and 4.3)

There have been many attempts to replace toluene as the primary solvent in publication gravure. Up to the end of the 1970's in some countries, i.e. in the UK, France and the US, toluene was not readily accepted and other aliphatic (a blend of various derivates from petrol) solvents were used. Toluene became acceptable when modern solvent-recovery systems were developed which limited the toluene emissions to the air to about 4-6%. With such high recovery rates, the investment in modern solvent-recovery systems was relatively easy to amortize, and toluene was readily accepted in those countries. A superior print quality in publication gravure is said to be achieved by using toluene-based inks.

In 2004, however, a US petrol company announced that a solvent based on tertiary-butyl-acetate (TBAc™) for use in publication gravure was registered with the US authorities (Lyondell Chemical Co 2004). Although initial tests verified the claims that this solvent was exempt from the US definitions of VOC (Volatile Organic Compound) and HAP (Hazardous Air Pollutant), there has been no further publicity. One ink maker claimed that the first attempts to produce a black ink failed, because the standard resins were not compatible with the new solvent. It was also suggested that the cost was prohibitive and about three times the standard cost for toluene. Hence, the work to find a substitute for toluene (aromatic) solvent-based inks goes on.

4.6 Prepress and printing form preparation – the digital workflow

Work-flow solutions for the printing industry are currently based on technologies developed by Adobe Inc. Both the PDF and the JDF technologies have been licensed to third parties by Adobe which enjoys a near monopoly situation in this market (Bjurstedt 2005). In the printing industry there are only three global companies which can offer a total business concept; selling equipment, software and materials for the printing industry, Kodak, Agfa and Fuji Film (EMOC 2003).

In the past, all three were the leading suppliers of graphic film to the printing industry but they have managed, nevertheless, to move their business from analogue to digital technologies (including electronic equipment) during the last 10 years. The focus of the business for Agfa and Fuji are Europe and East Asia respectively, and that they and Kodak have in effect split the world market into three geographical markets, even though they each have a global presence (EMOC 2003).

During the autumn/winter 2006/2007, a questionnaire was distributed to three of these companies in the prepress sector, with 100% response rate, with the following questions:

1) How do you evaluate the present situation in the European publication printing market?

In this case the answers were very similar between the companies:

a) The European markets is stagnant with very little growth
b) Pressure on prices – digital plates in particular – market price incl. chemistry to-day is about 8-10 €/m^2
c) CTP (Computer to Plate) is mature technology – in the 3rd generation of equipment
d) Overcapacity in print pushes the prices in prepress down
e) Increased demand for value added services

2) What are the top 5 technical issues/solutions in your opinion with the greatest impact during the last five years?

a) Workflow solutions (handling of digital files etc.)
b) Improved CTP solutions
c) Development of thermal plates
d) Digital proofing (inkjet technology)
e) Digital photography

3) What are the most important issues in the next five years? Which are the five top issues?

a) Unified workflow solutions
b) Process-less plates also for long runs
c) Error-tolerant processes – find and correct automatically
d) Ink jet technologies for applications in large format offset and/or screen
e) Think globally and act locally

4) What are the important threats to the publication printing industry during the coming years?

a) Less printing because of customized and targeted logistics of printed matter
b) Internet and e-commerce – an opportunity or threat?
c) Many and smaller titles – demand tight integration

d) Fear – resistance to change is the greatest threat to the industry
e) Inability to provide visions and associated value added services

In addition to these general open questions, a number of questions with multiple choice answers were asked, and Table 8 summarizes the answers given.

Table 8 – Summary of the answers from the prepress manufacturers

Do you think that further reductions in the costs of printing are possible?			
Questions	**Not likely**	**Do not know**	**Likely**
Are further reductions to be expected?	33%		67 %
Have we come close to the end of what is achievable	67 %		33 %
Other techno/economical issues			
Questions	**Not likely**	**Do not know**	**Likely**
A break-through for processing of lithographic plates	100%		
Is aluminium the material of choice?			100 %
Is it likely to expose plates directly in the press?	33 %	33 %	33 %
Is it likely to sell CTP technology in sizes of 2.5 x 1.5 m²			100 %

4.7 Gravure cylinder engraving solutions

If there are three major players in the lithographic prepress market, there are only two in gravure prepress - engraving, plating and cylinder logistics equipment – Dätwyler AG in Switzerland and the Max Ried group. The latter group includes Walter plating systems for gravure cylinders, Bauer for cylinder storage and logistics and Hell Gravure Systems for cylinder engraving equipment. In 2004 Kodak acquired Creo Inc., one the largest companies of CTP plate setters. Nevertheless, at Drupa 2004, Creo displayed a cylinder processing project called the Exactus. After the exhibition, the equipment was installed at a large publication gravure printer in the US. The project was a failure, and the equipment installed has been dismantled and withdrawn.

During the autumn/winter 2006/2007, a questionnaire was distributed to these two companies, with 100% response, with the following questions:

1) How do you evaluate the present situation in the European publication printing market?

In this case the answers were very similar:

a) The European markets for publication gravure cylinder equipment is very small in comparison with the packing markets

b) Strong growth in web-offset – lower margins for gravure printers
c) Consolidation of gravure printers
d) Growing overcapacity
e) We are following our customers very closely – we understand their needs

2) What are the top 5 technical issues/solutions in your opinion with the greatest impact during the last five years?

a) Work-flow solutions (handling of digital files etc.)
b) Full automation in cylinder plating systems (Cu-, Cr- and Zn-plating)
c) Standardisation of data file formats
d) Fully automated K6 mechanical engravers
e) Direct Laser technology for gravure

3) What are the most important issues in the next five years? Which are the five top issues?

a) Fewer steps in cylinder processing and improved text/LW
b) Faster turn-around and shorter lead-times
c) Further reduction of costs – to improve the competitiveness of gravure
d) Some German gravure printers are aiming at 40 €/m^2 for cylinders whilst web-offset plates are around 30 €/m^2.
e) Many gravure printers have mechanical engravers > 20 years old, needs modernization

4) What are the most important threats to the publication printing industry during the coming years?

a) Low or no growth of printed matter
b) Further reduction of costs in the prepress
c) Not able to increase flexibility for certain demands
d) High costs for materials – paper and ink
e) Inability to reduce costs to stay competitive

In addition to these general open questions, a number of questions with multiple choice answers were asked, and Table 9 summarizes the answers given.

Table 9 – Summary of the answers from the prepress manufacturers

Do you think that further reductions the costs of printing are possible?			
Questions	**Not likely**	**Do not know**	**Likely**
Are further reductions to be expected?			100 %
Have we come close to the end of what is achievable	100 %		
Other techno/economical issues			
Questions	**Not likely**	**Do not know**	**Likely**
A break-through for processing of gravure cylinders?			100%
Break- through of other materials?		50%	50 %
Break- through of other materials like Zn?	50 %		50 %
Break- through of other materials like epoxy?		50 %	50 %
Break- through of other metals?	100 %		
Break- through of laser?	50%		50%
Mechanical engraving still dominating?			100%
New calibration systems in mechanical engraving?	50%		50%
Is likely to introduce another colour space?	50%	50%	
Is it likely that a transparent tracking system will be introduced?			100%

It is striking that these two competitors have diametrically different opinions about a few fundamental issues in the area of cylinder processing. The one offering Direct Laser engraving systems on zinc cylinder surface expects that laser technology will have a break-through in the minds of publication gravure printers. The other company, on the other hand, does not believe in laser technology, and states that the mechanical engraving systems have not yet reached their potential. Both would, however, very much like to see further investment in the area in order to modernize the ageing equipment. It seems from the comments from Germany that the German publication printers are feeling the competition from heat-set web-offset and trying to lower the unit costs of gravure cylinders.

4.8 PUBLICATION PRESS MANUFAKTURERS

There are only two competitors manufacturing publication gravure printing presses, Koenig & Bauer (with its Albert Frankenthal division (KBA)) in Germany and Officine Meccaniche Giovanni Cerutti SpA (Cerutti) in Italy. Since the middle of the 1980’s, these two companies have had almost equal shares of the publication press market, but in the last two years – with the development of the very wide gravure presses (4.32m) – KBA has gained a slight advantage (Source: ERA List of Presses 2005). It should be noted that KBA does not manufacture only gravure presses, the division is also responsible for R&D and the manufacture of reel stands and folders for commercial presses, heat-set and semi-commercial newspaper presses, for the Koenig & Bauer group. Today, MAN-Roland is the largest manufacturer of web-offset presses.

During the autumn/winter 2006/2007, a questionnaire was distributed to these three companies manufacturing publication printing presses, with 100% response, with the following questions:

1) How do you evaluate the present situation in the European publication printing market?

In this case the answers were quite similar for all three respondents:

a) Not many new orders in the order books
b) Strong investments during the last few years
c) Very little investments in publication gravure presses in France, Switzerland and the Nordic countries

2) What are the top 5 technical issues/solutions in your opinion with the greatest impact during the last five years?

a) Wider webs – from 10 ribbons to 12-14, web-offset from 140 to 200 cm
b) Complete automation of the press
c) Presetting of formats (folders, ink etc.)
d) Automatic loading/unloading of plates/cylinders
e) Higher speeds
f) Reduction of waste

3) What are the most important issues in the next five years? Which are the five top issues?

a) Total press automation and control
b) Faster turn-around and shorter lead-times
c) Long grain folders with (limited variability) up to 70 000 copies/hr
d) Tandem presses in web-offset - 2 x 32 p/2 x 48p makes 64/96 pages.
e) Reduction of cylinder costs – survival of the process

4) What are the important threats to the publication printing industry during the coming years?

a) Environmental and energy issues
b) E-commerce and catalogues – will print survive?
c) Consumer behaviour – will the young generation still read?

d) What markets will print serve in the future? How about content?
e) Overcapacity in the publication printing markets

In addition to these general open questions, a number of questions with multiple choice answers were asked, and Table 10 summarizes the answers given.

Table 10 – Summary of the answers from the press manufacturers

Do you think that further reductions in the costs of printing are possible?			
Questions	**Not likely**	**Do not know**	**Likely**
Are further reductions to be expected?	33%	33%	33%
Other techno/economical issues			
Questions	**Not likely**	**Do not know**	**Likely**
Is it likely that web-offset can be designed for 2.5m width and cut-off < 900mm	67 %		33%
Is it likely that plates can be exposed in the press?	67%		33%
Is it likely that new drying concepts will be introduced in gravure?	33%		67 %
Is it likely that a gravure press can be designed for 5m widths?		67 %	33 %
Speed above 20 m/s?		33 %	67 %
New drying concepts in web-offset?		33%	67%
Is it likely that waviness can be eliminated in web-offset?		100%	
Is it likely that medium sized gravure presses will be a complement in some markets?	33%		67%
North America?	33%		67%
Japan?	33%	33%	33%
Asia?	33%	33%	33%
Smaller European markets?		33%	67%

Table 10 shows some interesting diverging opinions among the press manufacturers. The point about new drying concepts for publication gravure presses has some other implications. Due to severe EU regulations concerning electronics, electrical and mechanical devices in hazardous environments, the so-called ATEX directives, the design of publication gravure presses is costly in relation to what would be the case if the industry were using inks which did not contain highly flammable solvents. One of the respondents believes that there would be many advantages if the industry could find a substitute which is neither classified according to the ATEX directives nor emitting volatile fugitive gases (VOC). A “green” gravure process could in combination with a medium-sized gravure press certainly make an impact on customers and the public, and open up completely new markets, in Asia, Japan, South America and the smaller countries in Europe.

5. Conclusions

From the responses in the interviews and the questionnaires it has become obvious that there are some factors which may have a profound effect on the future of the publication printing industry.

Although the forecast for European magazine publishing markets suggests a moderate growth, there are other factors to consider. Spending on media advertising will be one of the most important factors affecting future magazine publishing activities. The uncertainty is whether the future spending on advertising in periodical printed media will remain stable or quickly lose in relation to the electronic media such as Internet, Cable TV etc. Further, will printed matter keep its attractiveness to the general public or will reading habits decline? There are, nevertheless, from the responses and other investigations, such as (Hohol 2005) some factors which will affect the printers:

- The brand of a magazine is becoming more important than the printed product
- The growth of new titles is considerable, although these are typically small in circulation
- The large titles are losing in circulation
- Time-to-market is important – shortest possible lead time from the last editorial page until the first saleable copy at the retailers
- Targeting and versioning may become important also in Europe (as it has been for a long period of time in the US)

Similarly, the European catalogue markets are going through changes, from one extreme where the printed product will lose very much in importance to the other extreme where producers have the printed catalogue as their main marketing tool. The buying pattern and habits of the general public are of great importance, and these merits further research. Again, new emerging technologies from electronic media, the Internet etc, will most probably have an impact on consumer behaviour and their buying patterns. However, the responses indicate that there are some important factors for the European printers to consider:

- The catalogues for the traditional mail order company will be more frequent but thinner. The era of a few but thick “directory” types is over
- Smaller, targeted special catalogues will grow
- Time-to-market will be important – special catalogues for fast consumer goods such as fashion, electronics must have a fast turn-around cycle

Both magazine publishing and catalogue markets will need to consider the following factors:

- The use of inexpensive grades and lower grammage will increase
- Awareness and demand for the use of environmental and energy-conserving paper grades will grow strongly
- The publication gravure and heat-set web-offset processes have to conform to the same environmental constraints as to those of the paper manufacturers

The notion that, due to changes in the media markets, the conditions for the European publishers and catalogue producers will change is supported by the results of this study. This will of course also affect the publication printers and, for their survival in a very competitive market, further adaptations and a very flexible attitude are mandatory. In terms of strategy, the publication printer needs to be both a cost leader and differentiated on the market. The major differentiation will most probably be in the value added services which are marketed and promoted to the customers. One example might be an intensified environmental effort with increased pressure for new “green” products from both ink and paper makers, such as finding substitutes for the present use of aromatic solvents in publication gravure printing.

Will new and emerging technologies, in press designs and in cylinder/plate processing, be among the solutions for the short-term survival of the publication printing industry? The responses from the manufacturers indicate that, although if it would be possible to design and install even wider presses in the future, there are other concerns which are more important for future demands from the printers. In order to be more efficient and productive, the printer will demand much higher up-time in the press room processes and, last but not least, the demand for ever more rapid change-overs to new jobs will continue. This is, of course, important if the circulations and/or versioning of magazines and catalogues lead to very frequent changes of pages and/or complete new jobs. This view is also supported by an article in the trade press by Klemm (2006), when he is reporting from the ERA Annual Meeting in Manchester 2006.

The constraint lies, implicitly, in that these new features are not easily to retrofit into existing presses. The publication gravure printers have always been of using very old presses, slow and not very productive, rather than buying new more efficient presses. The technological developments in this segment have been rather slow, invisible and targeted to even wider and wider presses. One of the respondents suggested that one of the technical constraints when designing gravure presses is the compliance of EU ATEX explosion-proof rules. The additional costs to comply are said to be of the order of 20-25% of the total press, but there are other considerations, i.e. paper printed with water-based inks are notoriously difficult to de-ink in the recycling process (flexographic printed newsprint is one example).

In commercial web-offset, on the other hand, since 1994-95 new press design and press technology has been readily accepted, and new presses are being bought much more frequently. Since the millennium, about 40-50% of the press capacity in web-offset has been renewed, whilst in gravure the figure is probably less than 25% (Bjurstedt 2006).

While publication gravure printers were pioneers in going digital directly to the cylinders already in 1982-83, the lithographic technology was rather slow to catch up and was more than 10 years behind with CTP. In 2006, however, this technology is already in its 3rd generation of technological developments, whereas the basic mechanical cylinder engraving technology is more or less the same as in 1980, albeit many technical improvements have been implemented. One manufacturer commented "we know our customers very well and follow them closely". It might be an example of marketing myopia, where the supplier is only watching his direct customer without taking notice of what changes are about to happen with his customer's customer or even further along in the value chain.

Since 2000, however, direct laser engraving technology has been very successful in the packaging and speciality gravure markets, but it still has a limited success in the publication gravure markets. The constraints are basically in the perception and attitudes towards using another material (zinc rather than copper as image carrier) rather than the laser technology itself. It is to be expected, however, that, with the ever-increasing pressure from the customers for lower costs of cylinders and shorter turn-around, that these demands will undoubtedly be important factors in changing attitudes of some of the more conservative printers.

Hence, all publication printers need:

- To change their attitudes and accept new technology in cylinder processing
- To find new financial means to change their existing presses to the state of art technology.
- To improve the perception among customers of environment-friendly processes
- To realize that conservation of energy is a must for future competitiveness in relation to electronic media

Hence, the hypothesis that removing these techno-economical constraints will be one of the most important areas for the future survival of publication printing is supported.

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Are we witnessing a new paradigm shift in the technology of producing magazines or catalogues? Is industry changing *"From a craft labour structure to an industrial process"*? Process re-engineering – how to integrate cylinder engraving (incl. chrome plating/finishing) with an automated press make-ready process to an automated press run – is a problem to address and solve. The aim of the production process is to produce a first saleable copy without manual intervention – faster than to-day and with less waste! The European publication gravure printing industry is not quite there yet, but new solutions in this direction is expected to be shown at the most important trade fair in the industry, the 2008 Drupa exhibition.

"The pioneers are breaking the ground and the settlers are moving in"

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