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ABSTRACT

This report is believed to be the first nationwide attempt in more than three centuries of printing in America to define graphic arts manpower needs. The objectives of this study were to determine the current status of industry manpower and to predict manpower needs for the 1970's. To carry out these objectives two questionnaires were developed, a personnel inventory of printing companies throughout the United States and a survey of organizations manufacturing equipment for the printing industry. Data are presented on the background for the study, major industry classifications, printing production processes, skilled personnel, sales/management personnel, wages, and minority and special group employment. Eleven recommendations for education and training were drawn from the study, including increased emphasis on developing student interest in the graphic arts industry and in preparing students for production and managerial opportunities in the industry of the 1970's. Some specific instructional recommendations for educational programs are made. A summary survey of graphic arts technology prepared for this study by the Graphic Arts Research Center of the Rochester Institute of Technology constitutes almost half of the document. This summary survey was based on a literature search and provides occupational information and a forecast of graphic arts technology. (MF)

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**COMPLETE REPORT**

**KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY**

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Industry Manpower Study

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June 25, 1973

ERIC  
U. S. Office of Education  
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Washington, D. C. 20202

Gentlemen:

Enclosed is a copy of the "Complete Report: Kodak Graphic Arts Industry Manpower Study," which I propose be entered in your microfiche system. This report, sponsored by Eastman Kodak Company, is believed to be the first nationwide attempt to define graphic arts manpower needs in more than three centuries of printing in America. It provides a bench mark which educators may use in planning curricula to meet these needs.

The objectives of this study were (1) to determine the current status of industry manpower and (2) to predict manpower needs for the 70's. To carry out these objectives two questionnaires were developed: a personnel inventory of printing companies throughout the United States and a survey of organizations manufacturing equipment for the printing industry. Twenty graphic communications industry organizations supported this study on a national basis by providing assistance in suggesting study procedures, constructing survey forms, and mailing survey instruments to members of the industry. The third element of the study is the Summary Survey of Graphic Arts Technology conducted by the Graphic Arts Research Center at the Rochester Institute of Technology in Rochester, New York. This summary survey (Appendix V of the report) is based on a search of current graphic arts literature, and provides a forecast of graphic arts technology.

Coordinator of the entire study was Dr. C. Eugene Strandberg, associate professor at Eastern Illinois University, Charleston, Illinois. Other members of the study team were Dr. J. Page Crouch, associate professor at Clemson University; Dr. Ervin A. Dennis, professor at the University of Wisconsin-Stout, Menomonie, Wisconsin; Dr. David Morrill, assistant professor at the University of Maine at Portland-Gorham; Dr. Z. A. Prust, professor at Arizona State University; Mr. Selah Bond, Jr., director of Editorial Publication at the Graphic Arts Research Center of the Rochester Institute of Technology; and Mr. William F. Flack,

ERIC--2  
June 25, 1973

coordinator of personnel development, Professional and Finishing Markets Division, Eastman Kodak Company. This study team worked on the project for approximately two years.

In my opinion, this unique study of manpower needs in the graphic arts industry, with the recommendations for education that are included, deserves inclusion in the ERIC system. Please let me know whether it is acceptable, and whether you need any more copies of the Report.

Very truly yours,

*(Miss) Frances J. Sullivan*

Frances J. Sullivan, Copy Coordinator  
Graphics Markets Division

FJS:pak  
Enc.

cc: Dr. C. E. Strandberg

COMPLETE REPORT

KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY

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## COMPLETE REPORT

### KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY

## INTRODUCTION

The massive Graphic Arts Industry Manpower Study sponsored by Eastman Kodak Company is believed to be the first nationwide attempt by any organization to meet a need that has been unfulfilled in more than three centuries of printing in America. There was a need for a bench mark from which the graphic arts industry could define its manpower needs for at least a decade -- and which educators could use in planning curricula to meet those needs.

Some studies of the graphic arts industry have been done on a statewide and regional basis, while others have attempted to cover a single facet of the industry nationally. Research, however, has failed to disclose any prior effort to obtain a comprehensive picture of industry needs nationwide. One major result of this lack of information has been the inability of educators to plan courses that not only meet the present needs of the graphic arts industry, but also adequately prepare their students to cope with the accelerating changes in technology.

The need for a comprehensive study of the graphic arts industry was stated most succinctly by Dr. Jack Simich, Education Director of the Graphic Arts Technical Foundation:

"There are many kinds of education programs being conducted throughout the United States. Graphic communications, graphic arts, visual communications, and printing are being taught

in industrial arts, vocational education, technical education, fine arts, and journalism. It is being taught in junior high school, senior high school, junior/community colleges, and college or university. To date, there has been no attempt made at the national level to ascertain what constitutes a good program in terms of meeting industry needs, or even what those needs are at the national level."

The challenge to fill this need was answered by Eastman Kodak Company in 1971, when it asked five noted graphic arts educators with extensive backgrounds in the field to conduct its landmark study. They were asked to provide a description of the current manpower force, as well as to identify trends in manpower growth according to the kinds of personnel that will be needed, the knowledge and skills they will require, and the backgrounds that will qualify them to meet the needs of the graphic arts industry.

The Kodak Graphic Arts Industry Manpower Study is expected to serve as a tool that the industry can use in determining its present and future manpower needs. In addition, as schools in most states are required by law to have representatives of industry serving on their vocational education advisory boards, the study is designed to provide a guide to both graphic arts industry leaders and educators in determining the kinds of curricula needed to educate students to qualify for jobs in their chosen trade.

## BACKGROUND FOR THE MANPOWER STUDY

Almost a year of meticulous planning that involved all segments of the printing industry went into the design of a survey format and the construction of the two confidential questionnaires that were used in the study. Throughout most of 1971, suggestions and advice from representatives of the 20 graphic arts organizations supporting the study were analyzed and collated by the five-man study team (see page 6). These men used the information to build the most effective and relevant survey possible, and to develop questionnaires designed to obtain the maximum amount of information.

### OBJECTIVES OF THE STUDY

The Kodak Graphic Arts Industry Manpower Study had two major objectives:

1. To determine the current status of industry manpower. The study was to provide a profile of people now employed in the industry; to describe the training available to them; and to determine the turnover rates in the various production areas, the average age of employees in these areas, and other information necessary to building a foundation of understanding of the current manpower situation on the national level.
2. To predict manpower needs for the seventies. The objective was to determine knowledge and skill requirements for the various production areas, and to determine the production areas where advances in technology have created demands for new people. The study did not attempt to predict the numbers of people that would be required by the graphic arts industry, however.



## ORGANIZATION OF THE STUDY

### Geographical Regions

One of the first steps taken in the actual survey was the division of the country into five geographical regions: the eastern region, which was bounded by Ohio and West Virginia on the west; the southeastern region, which was bounded by Kentucky and Virginia on the north and by Tennessee and Mississippi on the west; the midwestern region; the southwestern region, which included Arkansas and Louisiana; and the western region, which included Wyoming, Montana, Washington, Oregon, and California. This division not only balanced the kinds of companies in each region, but also enabled members of the study team, who lived in several of these regions, to visit companies and local graphic arts organizations to validate the survey questionnaires.

### The Manpower Survey Questionnaire

The questionnaire developed for the printers was mailed initially to the owners or managers of 5,000 companies in the United States. There was an equal division among those companies with 1 to 9 employees and those with 10 or more employees. In addition, the list of companies was further broken down by major industry classification. The sampling of companies in a region was based on a representative number of companies from each classification, rather than on the total number of companies in that region.

The first mailings were made by several of the supporting organizations, who carefully checked their mailing lists to avoid duplication. When the first responses were received, they were checked by size, major

industry classification, and region. As a result, a second mailing was made to increase the size of the sample.

When all the questionnaires were received, it was found that 1,033 of the 5,000 companies, or more than 20 percent of the total, had responded to the survey. Statisticians determined this response to be more than adequate for this type of survey, given the representative numbers of respondents from each area of the industry.

In the final breakdown, it was determined that 48 percent of the respondents employed 1 to 9 persons, 29 percent employed 10 to 25 persons, and 23 percent employed 26 or more persons. This meant that the respondents generally were representative of the industry, since 48 percent of the companies employed 9 persons or less and 52 percent employed 10 persons or more.

As expected, the respondents provided data for the industry profile. They gave valuable information on major industry classifications and production processes, and indicated the sources from which they were obtaining their skilled personnel, as well as sales and management personnel. The data that they provided also indicated company growth, personnel requirements, and information on the employment and retention of employees.

#### The Manufacturer Survey Questionnaire

The second questionnaire prepared by the manpower project staff was mailed to 150 manufacturers of graphic arts equipment. It yielded a

response of 29 percent (44 returns). This questionnaire provided data on equipment produced, according to major industry classification and production process. The responses also indicated whether new equipment would require more or fewer operational and maintenance personnel, and whether increased technical knowledge and job skills would be required to operate and maintain the equipment. The data provided by the manufacturer survey verified the data provided by the printer's survey. The data also provided valuable information on the directions in which the industry will move in the future.

#### The Technological Forecast

The "Summary Survey of Graphic Arts Technology" prepared by the Graphic Arts Research Center of the Rochester Institute of Technology was intended to summarize the present status of graphic arts technology. It was also prepared according to major production areas. As it was intended to, the technological forecast identified technological trends in these major production areas and provided verification for the trends revealed in both the manpower study and manufacturer survey.

#### THE MANPOWER STUDY PROJECT STAFF

To assist in conducting the Graphic Arts Industry Manpower Study, Eastman Kodak Company selected a five-man study team. These men were chosen for the task because of their broad experience in graphic arts technology and education, and because of their proven research abilities. (A secondary, but still important, consideration in the selection of these men was the location of their educational institutions in relation to the five key geographical areas.) These are the members of the project staff:

Dr. C. Eugene Strandberg. Coordinator of the study team was Dr. C. Eugene Strandberg, associate professor at Eastern Illinois University, Charleston, Illinois. Dr. Strandberg, a graduate of Hutchinson Community College, Hutchinson, Kansas, received his Bachelor of Science and Master of Science degrees from Kansas State College at Pittsburg. He did advanced work at the University of Missouri and at Texas A&M University, from which he received his doctorate in education in 1963.

Dr. Strandberg taught graphic arts in high schools in both Kansas and Texas before becoming a graduate assistant at Texas A&M. He served as an assistant professor at Kansas State from 1963 to 1965 before assuming his present post at Eastern Illinois University. While at Kansas State, he was coordinator of printing production services for the college, directing a teaching staff of six and a production staff of about 18. As coordinator of the printing facilities, he was responsible for all phases of printing production, for copy layout to both offset and letterpress presswork, and finally, bindery.

Dr. J. Page Crouch. Associate professor at Clemson University, Dr. Crouch has been a moving force in efforts to initiate graphic arts instruction in industrial arts programs in the southeast, particularly in the Carolinas. Dr. Crouch received both his Bachelor of Arts and Master of Arts degrees in industrial arts from San Diego State College, and was awarded his doctorate in education from the University of Missouri. He taught at San Diego State College and at Hickman High School, Columbia, Missouri, before assuming his present post at Clemson, where he teaches both professional and graduate courses in the graphic arts.

He is the project director of the Graphic Arts Inventory for Education, which is funded by the U.S. Department of Health, Education, and Welfare and is further supported by the Printing Industry of the Carolinas. Dr. Crouch also initiated and coordinated the efforts of the current Graphic Arts Curriculum Project for vocational programs in South Carolina.

Dr. Ervin A. Dennis. A professor in the Department of Graphic Communications at the University of Wisconsin-Stout, Menomonie, Wisconsin, Dr. Dennis is a graduate of Norfolk Junior College, Norfolk, Nebraska. He received his Bachelor of Arts and Master of Arts degrees from Colorado State College, and earned his doctorate in education at Texas A&M University. He majored in industrial education, with further emphasis on curriculum and instruction, as well as counseling and guidance.

Dr. Dennis taught graphic arts for four years at Central High School, Fargo, North Dakota, before joining the graphic arts department at California State College, California, Pennsylvania. He later joined the graphic arts department at Texas A&M. He has been at Stout State University since 1966.

Dr. David Morrill. Dr. David Morrill is an assistant professor in graphic communications at the University of Maine at Portland-Gorham. He was graduated from Beverly Trade High School, Beverly, Massachusetts, where he studied printing. He later attended Boston University and George Washington University. He received his Bachelor of Science degree from Moorhead State College, Moorhead, Minnesota, and after doing

graduate work at Western Washington State College, studied for his doctorate in education at Texas A&M University.

For three years, Dr. Morrill worked as a lithographer at Wilkscraft C. Printing, Beverly, Massachusetts, and served as a graphic arts instructor in the engineering division of the U.S. Army at Fort Belvoir, Virginia. He was also a teaching assistant and instructor in graphic arts at Central High School, Fargo, North Dakota. He assumed his present position at the University of Maine after receiving his doctorate in 1970.

Dr. Z. A. Prust. Dr. Prust is professor and chairman of the Graphic Communications Department at Arizona State University. He received his Bachelor's degree from the University of Wisconsin-Stout, his Master's degree from the University of Minnesota, and his doctorate in education from the University of Northern Colorado. He began his teaching career at Farnsworth Junior High School, Sheboygan, Wisconsin, and later taught at Phoenix Union High School and Phoenix College, both in Phoenix, Arizona. He was a visiting professor at Utah State University before taking his present position at Arizona State.

For a time, Dr. Prust was co-owner of a printing company, the Rock Ledge Printing Service, and before that, he worked in job shops and book publishing firms. He has been honored as the Printing Man of the Year in Arizona by the Phoenix Club of Printing House Craftsmen, has received the Award of Merit of the Graphic Arts Education Association, and has won the Outstanding Contributor Award of the Arizona Industrial Education Association.

#### THE TECHNOLOGICAL FORECAST STAFF

The "Summary Survey of Graphic Arts Technology" formed a major part of the Graphic Arts Industry Manpower Study. This section, describing the state of the art and indicating future trends, was compiled, evaluated, and written from materials in the extensive files of the Graphic Arts Research Center of the Rochester Institute of Technology. The data compiled was correlated with the industry survey and the manufacturer survey. The following persons were responsible for the report:

Mr. Herbert Phillips. Although not a member of the team that researched the study, Mr. Phillips directed the construction of the technological forecast. He is Director of the Graphic Arts Research Center at the Rochester Institute of Technology.

Mr. Selah Bond, Jr. Mr. Bond is Director of Editorial Publication at RIT's Graphic Arts Research Center. He prepared the "Summary Survey of Graphic Arts Technology" with the assistance of Kathleen Spangler, a technical writer on his staff. Mr. Bond is a graduate of Sodus High School, Sodus, New York, and attended the Rochester Institute of Technology. He was employed as a technical writer by Bausch & Lomb, Inc., Rochester, New York, and by Brooks Research Company, East Rochester, New York. For the last 10 years, he has been writer, editor, and director of editorial publication at RIT's Graphic Arts Research Center. Mr. Bond is the editor of "Graphic Arts Progress," a monthly publication of the Research Center.

## PROJECT LIAISON DIRECTOR

To coordinate the activities of the study staff and the Graphic Arts Research Center, Eastman Kodak Company appointed as liaison director a man who has had broad experience in both graphic arts and education.

Mr. William F. Flack. Mr. Flack is the Education Specialist in Eastman Kodak Company's Professional and Finishing Markets Division. He has been responsible for the development of programs designed to aid educators in the teaching of graphic arts as well as photography. An important aspect of his work is in the area of visual communication education.

Mr. Flack received his Bachelor's degree from the State University of New York at Oswego, New York. He received his Master's degree from the University of Maryland. He taught graphic arts in public schools and in the Industrial Education Department of the University of Maryland. Later he was employed as assistant education director of the Graphic Arts Technical Foundation and served as acting director of the Education Council of the Graphic Arts Industry.

## COOPERATING ORGANIZATIONS

In constructing the survey, the project staff had some assistance from the Printing and Publishing Industries Division of the U.S. Department of Commerce. Also, although the Graphic Arts Industry Manpower Study was sponsored and coordinated by Eastman Kodak Company, it could not have been as extensive or complete without the cooperation of the graphic arts organizations that helped plan and conduct the survey. Those



industry organizations that cooperated with Kodak in behalf of the study are the American Platemakers Association; Graphic Arts Technical Foundation; Flexographic Technical Association; Gravure Technical Association; In-Plant Printing Management Association; International Typographical Composition Association; National Association of Printers and Lithographers; National Association of Greeting Card Manufacturers; National Printing Equipment Association, Inc.; Printing Industries of America; Printing Platemakers Association; Research and Engineering Council of the Graphic Arts Industry; and Screen Printing Association International.

Other organizations that provided substantial assistance to the project were Local 1 of Amalgamated Lithographers of America; International Association of Printing House Craftsmen; International Typographical Union; International Graphic Arts Education Association; Graphic Arts International Union; National Association of Litho Clubs; and Technical Association of the Graphic Arts.

### **SUMMARY OF THE KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY**

What follows is a summary of the data that resulted from the Graphic Arts Industry Manpower Study, including the Survey of Printers, the Manufacturer Survey, and the "Summary Survey of Graphic Arts Technology." The material highlights the most important information contained in the study data. For the complete data, see the appendices at the end of this report.

## MAJOR INFERENCES DRAWN FROM THE STUDY

1. More people were required in all phases of offset lithography. The growth of the offset lithographic printing boom of the sixties is continuing unabated. The lithographic printing method was being used by 71 percent of the printers surveyed. Of these, 58 percent reported that their production had increased since January, 1968. Manufacturers of offset printing equipment also reported that the production of such equipment had increased.
2. Letterpress, although still a widely used method of printing (46 percent of the respondents reported some use of this method), showed a significant decline. According to 53 percent of those who used letterpress printing methods, the amount of production time devoted to the process had decreased. Only 16 percent reported that production time had increased. Moreover, new designs in equipment for letterpress printing tended to be improvements in versatility, speed, or capability, rather than new breakthroughs in technology. Indications were that there would be few, if any, new people required in the letterpress area.
3. On the whole, manufacturers reported that their new equipment would require about the same number of operational and maintenance personnel. The greatest demand for more personnel was for camera operators, the next greatest for operators of offset platemaking equipment, followed by operators for sheet-fed offset presses.
4. The major problem of the industry was the shortage of qualified personnel in all areas -- production, sales, and management.

5. Vocational-technical schools and in-plant training programs apparently were not considered to be adequate sources of manpower for the graphic arts industry. Respondents reported that for entry-level positions they preferred to hire graduates of general high school programs who had good work habits and good attitudes toward the graphic arts industry. Significantly, although employers wanted college graduates for sales and management positions, few preferred colleges as a source for obtaining these types of personnel. Instead, employers preferred to promote persons from within their own companies or to hire applicants with previous experience in other companies.
  
6. Printers must make their occupations more attractive if they are to obtain the capable young people that they seem to need. While the industry preferred to hire dependable and ambitious persons with good attitudes and initiative, at the same time these employers were unconcerned with the promotion potential of personnel. Graphic arts companies provided few opportunities for either horizontal or vertical mobility.
  
7. Despite predictions of the early advent of the four-day work week in the graphic arts industry, more than 81 percent of the survey respondents reported that they were not even considering shortening the work week. Present use of the four-day work week seemed limited largely to the western region; 35- and 37 1/2-hour weeks were reported mostly by unionized or partially unionized companies.
  
8. Schools must shift their emphasis to the pre-press areas (including layout and design, photocomposition, paste-up and copy preparation, and

camerawork), to offset printing, to screen process printing, and to gravure printing. These areas should form the foundation on which all new vocational-occupational education programs should be based.

9. Printers need to recognize that they are part of the "communications industry." In the future, a knowledge of how to apply ink to paper may not be sufficient as the graphic arts industry evolves from a craft orientation to a science orientation. If printers are to remain competitive in their field, it will be necessary for them to keep pace with changing technology and its application to their business.

#### MAJOR INDUSTRY CLASSIFICATIONS

In order to clarify the background from which the major inferences were drawn, it is necessary to give a current description of the major classifications into which the work of the graphic arts industry is divided. The classifications of printing include in-plant, general commercial, trade plant (typesetting, etc.), book publications, business forms, greeting cards, and packaging. The condensed data presented below have been taken from both the printer survey and the manufacturer survey. On the whole, these data have been mutually supporting.

*In-Plant.* Twenty percent of the survey respondents reported doing in-plant printing. Of these, 61 percent reported doing in-plant work 81 to 100 percent of the time. Of the companies doing in-plant printing, 43 percent reported that production had increased, 11 percent said that it had decreased, and 46 percent reported that it had not changed.

Of the 44 equipment manufacturers, 35 (or 79 percent) indicated that they produced equipment for in-plant printing. Of these 23 reported an increase in the production time devoted to this equipment, one reported a decrease, and 11 reported no change.

General Commercial. The data showed that 51 percent of the companies were engaged in general commercial printing, and that half of these companies devoted more than 80 percent of their total production time to this type of work. Of those who did general commercial printing, 41 percent reported an increase in production, 15 percent reported a decrease, and 44 percent reported no change.

Forty-one (or nearly 93 percent) of the manufacturers produced equipment for general commercial printing; 28 of these manufacturers reported that the amount of production time devoted to this type of equipment had increased, two reported a decrease, and 11 reported that it had not changed.

Newspaper and Commercial. Of the total number of survey respondents, 13 percent reported doing newspaper and commercial printing. Approximately 41 percent showed an increase in production, 15 percent reported a decrease in production, and 44 percent said that production had not changed. More than half of the respondents who did newspaper and commercial printing devoted more than 80 percent of their production time to this type of work.

Thirty-three (or approximately 75 percent) of the manufacturers produced and marketed equipment for newspaper and commercial printing. Increased production time for the manufacture of this equipment was reported by 15 of these manufacturers, while four reported a decrease, and 14 reported that production time had not changed.

Trade Plant. The survey showed that 14 percent of all companies were in the trade plant category; 42 percent of the companies reported an increase in such work, 20 percent reported a decrease, and 38 percent reported no change. In this area, 43 percent indicated that they devoted less than 20 percent of their total production time to this type of work, while only 33 percent said that they spent more than 80 percent of their time on the trade plant work.

Twenty-eight (or approximately 64 percent) of the responding manufacturers produced equipment for trade plant print. Of these 12 reported an increase in the production of such equipment, four indicated a decrease, and 12 said that production had not changed.

Book Publications. Ten percent of the responding companies said that they did book publications work, but more than half of these devoted less than 20 percent of their total production time to this type of printing. Increases in production were reported by 54 percent of these companies, while 14 percent indicated decreases in production and 32 percent reported no change.

While 34 (or 77 percent) of the responding manufacturers reported making equipment for book publications work, only 11 of these said that production had increased. Another 11 reported a decrease, and 12 reported no change.

Business Forms. Of the total number of survey respondents, 15 percent indicated that they were printing business forms. Approximately 58 percent of these companies said that they were printing business forms less than 20 percent of the time. An increase in production was reported by 42 percent of these companies, decreases were reported by 12 percent, and no change in production was reported by 46 percent.

Equipment for printing business forms was manufactured by 30 (or 68 percent) of the respondents. Of these, 18 showed an increase in production, four a decrease, and eight no change.

Greeting Cards. Only 4 percent of the survey respondents indicated that they printed greeting cards; of these, 68 percent devoted less than 20 percent of their total production time to this type of work. Increases in the production of greeting cards were reported by only 22 percent of the companies, while 19 percent reported a decrease and 59 percent indicated no change in production.

Equipment for this classification of printing was being manufactured by 24 (or 55 percent) of the respondents. Eight of these manufacturers reported an increase in the production time devoted to this type of equipment, five reported a decrease in production time and 11 reported no change.

Packaging. A total of 6 percent of the responding companies reported printing packaging materials, with 69 percent of these companies indicating that this work involved less than 20 percent of their total production time. Increases were reported by 48 percent of these companies, 7 percent reported decreases in production time, and 45 percent reported no change.

Printing equipment for packaging materials was manufactured by 27 (or 61 percent) of the respondents, with 11 of these manufacturers reporting an increase in equipment production, five reporting a decrease, and 11 reporting no change.

#### PRINTING PRODUCTION PROCESSES

Nowhere is the dramatic shift from hot metal to cold type more strongly emphasized than in the data on printing production processes taken from both the printer and manufacturer surveys. Printers were asked to indicate the percentage of time they devoted to each printing process and to report whether this percentage represented an increase, decrease, or no change from the production levels for the previous three years. The manufacturers were asked to report the percentage of time they devoted to the manufacture of equipment for each printing process and to indicate whether this represented an increase, decrease, or no change from the production levels for the three-year period.

Offset Lithography. Of the companies responding to the survey, 71 percent reported doing some work in offset lithography. Approximately 58 percent of these indicated that production had increased during the



three-year period, 7 percent reported a decrease, and 35 percent reported no change. Of the offset lithographers, 57 percent reported that they used this printing process more than 80 percent of the time.

Of the 44 manufacturers who responded to the survey 33 (or 75 percent) reported manufacturing equipment for offset lithography; 16 of these said that more than 80 percent of their production time was devoted to the manufacture of this equipment. Twenty-seven of these manufacturers said that production had increased, two reported that it had decreased, and four reported no change.

Letterpress. Printing by the letterpress method was reported by 46 percent of those who responded to the survey. However, 72 percent of these said that they used the process less than 40 percent of the time. Increased production was reported by only 16 percent of these printers, while 53 percent reported decreased production, and 31 percent said that production had not changed.

Seventeen (or approximately 39 percent) of the manufacturers who responded said that they produced equipment for letterpress printing. It is interesting to note that of the 17<sup>7</sup> manufacturers who reported producing equipment for letterpress printing, 12 reported that this equipment involved less than 20 percent of their production time. Four letterpress equipment manufacturers noted that production had increased over the three-year period, nine said that production had decreased, and four said that it had not changed.

Gravure. Two percent of the survey respondents reported using the gravure process for printing; of these, 43 percent used the process for more than 80 percent of their production. Increases in production were reported by 43 percent of the respondents who did gravure printing, decreases were reported by 22 percent, while 35 percent reported no change.

Nine (or 20 percent) of the responding manufacturers produced equipment for gravure printing, with five of these reporting an increase in the production of this equipment, one a decrease, and three no change.

Screen Process. Only 3 percent of the printers used the screen process printing method. Of these, 54 percent reported that they used the process less than 20 percent of the time, while 37 percent used it more than 80 percent of the time. Increases in production were reported by 37 percent of these printers, 17 percent reported a decrease, and 46 percent reported no change in production.

Screen process printing equipment was produced by eight (or 18 percent) of the manufacturers with five of these reporting an increase in production of this equipment, one reporting a decrease, and two reporting no change.

Flexography. Use of the flexographic printing method was reported by only 2 percent of the respondents, 40 percent of whom reported using the process less than 20 percent of the time. Increases in the use of

flexography were reported by 60 percent, while 20 percent reported decreases and 20 percent indicated no change.

Only five (or 11 percent) of the manufacturers said that they produced flexographic printing equipment. One of these reported an increase in production, while four reported no change. No decreases were reported.

Letterset. Only 2 percent of the printers reported using this method, and of these, 60 percent indicated that they used it less than 20 percent of the time. Fifty percent of these printers indicated that production had increased, 5 percent said that it had decreased, and 45 percent reported no change.

Four (or nine percent) of the responding manufacturers produced letterset equipment. Two reported an increase in production and two reported no change. No decreases were reported.

Electrostatic. Four percent of the printing companies said that they used the electrostatic method of printing. Of these 74 percent reported that the process was used less than 20 percent of the time. Of the printers who used this method, 83 percent showed an increase in production and 17 percent reported no change. Again, there were no decreases reported.

Only two (or 5 percent) of the manufacturers reported producing equipment for the electrostatic printing method. They did not indicate whether or not production had increased.

## SKILLED OCCUPATION PERSONNEL

### The Need for Skilled Occupation Personnel

The graphic arts industry's need for skilled occupation personnel was emphasized by the many companies that considered the shortage of qualified applicants their most significant problem. Companies reported net increases in the number of employees in almost every production area during the study period.

In the pre-press area, photographic and strike-on composition departments were reported to have experienced the greatest net gains in personnel, with an average increase of 1.14 employees per department. Imposition and lock-up departments were reported to have the lowest net gains; a gain of only .09 employee per department was reported by the responding companies.

Among the printing production processes, offset areas experienced the greatest gains in personnel. Web-fed offset press departments had an average net gain of 4.86 employees. While it appeared that gravure presswork departments had experienced an amazingly large net gain of 13.09 employees per department, it must be taken into consideration that just two companies were responsible for this gain.

Survey respondents reported that only one production area experienced a net loss in the number of employees during the study period. This was the hot metal composition area, where an average of .15 employee per department was lost since 1968.

The fact that the number of skilled employees increased in almost every department was in itself significant. However, when this was coupled with the data from manufacturers regarding personnel requirements for new equipment, it became apparent that not only had the number of skilled occupation employees increased during the last three years, but more employees would probably be needed in the future.

In the pre-press areas, the greatest percentage of equipment manufacturers reported that new camera equipment would require increases in both operational and maintenance personnel. Manufacturers of imposition and lock-up equipment, however, indicated that new equipment would require fewer operational personnel.

As for the printing production processes, the offset areas again had the strongest indications of future growth. Manufacturers indicated that sheet-fed offset press equipment would require increases in both operational and maintenance personnel. Fewer operational and maintenance personnel would be required for hot metal composition equipment, manufacturers reported.

Based on the data, it is fair to assume that skilled employees will be needed in almost every production area, but especially in the offset areas. In the areas related to hot metal composition, however, fewer skilled employees will be needed. When the data on the printing production process is also taken into consideration, it becomes clear that offset printing is in the ascendancy, while letterpress printing is on the decline, two facts that will have a strong influence on the needs for skilled personnel.

### Preparation of Skilled Occupation Personnel

According to the data, it appears evident that persons considering employment in the graphic arts industry should have a background in the pre-press areas and in offset-related areas. While letterpress printing was still commonly used, in general it was on the decline, and will probably offer fewer employment opportunities in the future.

Giving students a basic orientation to relief printing as background for employment in the graphic arts remains desirable. While letterpress generally showed a significant decline, specialized areas such as photo-engraving remain viable processes that may require new people.

It is interesting to note that respondents preferred that new employees have a general high school education rather than a vocational or college education. The only exception to this was reported in the area of layout and design, where respondents indicated an almost equal preference for a community or technical college education and a general high school education. This lack of emphasis on technical training was further supported by the fact that respondents ranked an interest in the graphic arts industry more important than technical training in the employment of personnel.

These data are surprising in view of two other factors. First, when asked to rank problems in the employment of skilled occupation personnel, respondents ranked poor trade knowledge and skills second only to the shortage of qualified applicants. Second, manufacturers and printers both reported that technical knowledge requirements and job skill requirements had increased during the study period.

Printers were asked to indicate whether technical knowledge requirements had increased, decreased, or not changed since January, 1968. Increased requirements were indicated in most of the pre-press areas and in the offset-related areas. Significant decreases were reported in technical knowledge requirements for the areas of hot metal composition, letter-press presswork, and bindery and finishing.

Respondents were also asked to report whether job skill requirements had increased, decreased, or not changed. As before, increased skills were needed in the pre-press and offset-related areas. The largest decrease was reported for hot metal composition.

Manufacturers were asked what technical knowledge was required of operational and maintenance personnel for new equipment related to each of the production areas. They were also asked to indicate whether the knowledge requirements had increased, decreased, or not changed during the study period. The areas of technical knowledge included photography, mathematics, electronics, chemistry, and mechanics. Generally, requirements for a knowledge of photography had increased for both operational and maintenance personnel in those areas in which a technical knowledge of photography was deemed necessary. Where mathematics was required, manufacturers reported that requirements had remained relatively stable; few decreases were reported, however. Requirements for a technical knowledge of electronics had definitely increased in those areas where such a background was necessary. In many production areas, requirements for chemistry had remained stable or had increased. Few decreases were noted here. Finally, in most areas, requirements for a technical knowledge of mechanics had increased or had not changed.

In view of a situation where technical knowledge requirements have definitely increased in many production areas, it is indeed contradictory that companies placed so little emphasis on the technical knowledge of new employees and on their educational background in printing skills. It must be assumed, therefore, that new employees are being given on-the-job training or retraining. This assumption is supported by the data.

It was found that about 61 percent of the respondents participated in retraining programs. Of these, nearly half said that company training personnel conducted these programs. The next greatest source of retraining was public and private educational institutions, followed by trade unions. The use of union retraining programs was found to increase with an increase in company size. This means that smaller companies cannot rely on unions for personnel training, and that the burden of this training rests, most often, on the employers.

#### Retention of Skilled Occupation Personnel

The survey respondents considered a good attitude and work habits and dependability to be the most desirable characteristics in all personnel. This is verified by their responses to the question regarding problems in the retention of skilled occupation personnel: The greatest problem, according to the respondents, was the poor work habits and attitudes of the employees. It is again contradictory for the companies to have desired dependable, hard-working employees on the one hand, while on the other hand, they reported that they offered these employees little mobility between production areas and little opportunity for upward advancement. The industry may not be offering enough job mobility to exemplary employees.



Inadequate technical knowledge and skills were considered the second greatest problem in the retention of skilled occupation personnel. This was not surprising, in view of the facts that companies preferred to hire persons with a general education rather than a vocational-technical background in the graphic arts, and that retraining was often done on an informal, one-to-one basis.

#### SALES/MANAGEMENT PERSONNEL

##### The Need for Sales Personnel

The data revealed a substantial need for sales personnel in the graphic arts industry. The shortage of qualified applicants, for example, was reported as the most important problem in the employment of sales personnel. During the three-year study period, sales departments experienced a net gain of 1.03 employees. In 1971 alone, a net gain of .36 employee was reported. The average number of employees in sales departments was reported to be approximately four.

##### The Need for Management Personnel

The shortage of qualified applicants was also reported as the major problem in the employment of management personnel. This area seemed to be particularly vulnerable during periods of economic depression, because respondents reported a net decrease of .26 employee per department from 1968 to 1971. This appeared to reflect the economic decline of that period. In 1971, however, the situation apparently stabilized, for respondents reported a net gain of .11 employee. There were reported to be slightly more than four employees per management department.

### The Preparation of Sales and Management Personnel

When asked where sales and management personnel had been hired from, respondents indicated that they were primarily employed from within the company. (It is interesting to note, however, that 42 percent of the respondents preferred to hire for management positions personnel who did not have a background in sales.) The second most frequent source of sales and management personnel was other graphic arts companies. Institutions of higher education were generally ranked lower in preference, with four-year colleges and universities slightly favored over technical and community colleges. Employers, therefore, expressed a definite preference for experienced persons to fill sales and management positions.

This information increased in significance when it was realized that companies preferred that their sales and management personnel have a college or university background. While colleges and universities seemed to have the greatest potential for providing the industry with new personnel, these sources were not being used extensively. This suggests that perhaps educational institutions are not preparing graduates to meet the needs of the industry or are not adequately promoting the value of their "product." The industry, however, may need to review its personnel selection procedures and hiring policies and to take a closer look at its aptitude testing devices. There is a strongly indicated need for future research and study in the preparation of sales and management personnel for the graphic arts industry.

About 80 percent of the respondents indicated that technical knowledge requirements for sales and managerial positions had increased since

January, 1968. According to more than 70 percent of the companies, job skill requirements had increased also. It is interesting to note, therefore, that for both sales and management employees, poor knowledge and ability were ranked in importance second only to the shortage of qualified applicants as an employment problem.

#### The Retention of Sales and Management Personnel

The major problem in the retention of both sales and management personnel was inadequate ability. While the industry professed a desire for experienced personnel, it appears that the personnel it hired were not fulfilling the on-the-job requirements of the positions. The second most critical problem was reported to be inadequate wage scale compared with other businesses. The graphic arts industry must review its wage structure for sales and management people.

For management personnel, the inability to work with skilled occupation employees was a problem of some significance. This suggests that the persons being hired for management positions are not adequately prepared in management skills and lack insight into the problems of skilled employees.

A problem of sales personnel was reported to be an inability to adapt to retraining. Companies must take a closer look at their retraining procedures to see if they are fulfilling their intended purpose.

As stated before, the procedures that concern the hiring, preparation, and retention of sales and management personnel offer fertile ground for

further research. Sales and management courses in the colleges and universities must be examined closely and should be modified as necessary to meet the real needs of the industry. The graphic arts industry should, as previously mentioned, take a closer look at hiring policies and retraining programs. It appears that there is much room for improvement here, also.

#### THE WAGE FACTOR

Inadequate wages were not reported to be a major problem in hiring and retraining skilled, sales, and management personnel. However, it must be remembered that the survey forms were filled out by persons in management-level positions who more than likely were responsible for setting wage scales. It is possible, therefore, that these persons may not have reported wages as a problem area.

Wages were a more significant problem in small companies than in large companies. All companies, however, should re-examine their wage scale to be sure that they are competitive with other industries. Otherwise, the industry may lose some of the manpower it needs or may fail to attract career-minded young people.

#### MINORITY AND SPECIAL GROUP EMPLOYMENT

More than half of the survey respondents employed members of special groups. These included physically or mentally handicapped persons, women, persons recently discharged from the military, and the hard-core unemployed. It was found that most of these groups were employed more successfully in large companies than in small companies. Women, however, were employed more successfully in small companies.

### The Employment of Specialists

Almost 73 percent of the survey respondents employed specialists. Most often, specialists were employed for production control and estimating. Quality control specialists were employed less frequently by the industry.

Few of the responding companies employed specialists for safety management and environmental control. This was surprising, in view of recent government legislation in these areas. It is expected that because of the growing concern of environmental protection groups and increased enforcement of the Occupational Safety and Health Act of 1970, safety and environmental control specialists will be needed by the industry in increased numbers.

### RECOMMENDATIONS FOR EDUCATION

Following are recommendations for education drawn from the Graphic Arts Manpower Study.

1. It is recommended that new people, in increased numbers, be prepared for production and for managerial opportunities in the graphic arts industry of the seventies. While all types of printing should be explored, schools should place special emphasis both on developing people for employment in the in-plant and general commercial areas and on the offset lithographic process.
2. Education programs should place increased emphasis on developing students' interest in the graphic arts industry.

3. The type of education program that would be of the most benefit to both the industry and the student would be a broad, industrial-arts-type program designed to explore the technology which underlies the graphic arts and to determine and develop interest in this area. These programs should stress the development of such characteristics as good work habits and attitudes, dependability, and ambition.

4. Graphic arts programs at all levels must shift their emphasis to the areas of layout and design, photocomposition, paste-up and copy preparation, camerawork, stripping, offset platemaking, sheet-fed offset presswork, and bindery and finishing. Continued substantial emphasis on the development of understanding and skills in letterpress printing is inconsistent with the contemporary needs of the industry.

5. Instructional programs should place additional emphasis on developing technical knowledge in science-oriented areas, which are becoming increasingly important to graphic arts technology. These areas include chemistry, electronics, mathematics, photography, and mechanics.

6. Vocational and occupation-oriented education, training, and retraining programs must place emphasis on the development of contemporary job skills in most graphic arts areas. Special emphasis should be placed on skill-building activities in offset lithography, screen process printing, flexographic printing, and in related areas.

7. Responses to the survey suggest the need for accelerated development of industry education and retraining programs.

8. Colleges and universities must expand their efforts in developing sales and management personnel for the industry. These new programs should place emphasis on the development of an understanding of the technology and its application to the communication process. Additionally, college and university sales and management programs for the graphic arts should place high value on cooperative work-study activities.

9. Graphic arts programs beyond the high school level should include the areas of safety and environmental control as integral parts of the curriculum. It is also recommended that the curricula at the college level include some instruction in the application of computers to graphic arts technology in management.

10. Community colleges, colleges, and universities must offer updated programs to meet the need for new sales personnel presently required by the graphic arts industry. New programs should be heavily oriented toward job experience.

11. Colleges and universities with graphic arts management programs should consider offering continuing education activities in the unique aspects of graphic arts management, with emphasis on technological growth and development of students.

**APPENDIX I**

**SURVEY FORM -- KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY**



# Graphic Arts Industry Manpower Study

Sponsored by Eastman Kodak Company

RETURN TO: Graphic Arts Industry Manpower Study • Eastman Kodak Company  
Department 942 • 343 State Street • Rochester, New York 14650

**NOTICE**

**INSTRUCTIONS**

- Respond to all items as they relate to your company
- The *industry classifications* and *production areas* used in this survey may not be the exact description used in your company. Please use the classifications and areas listed which most closely match the descriptions used in your company and answer questions accordingly
- Please complete the form and return it in the envelope provided as soon as possible
- If you wish to have your personal copy of the study results, fill in and mail the enclosed card (The card is provided to enable you to receive the study results without signing the survey form itself)

**DEFINITION OF TERMS USED**

- Code No* (at top right above) is confidential to this study and will be used *only* to
  - determine those companies that have not responded for our follow-up with a second mailing of the survey form
  - enable categorization of study results by geographical area
- Skilled Occupations* includes all nonmanagement personnel, ranging from trainees through experienced craftsmen
- Major Industry Classifications* refers to the type of production accomplished in your plant (This is the same industry classification used by the U.S. Commerce Department)

1. Write in the percent of production time spent by your plant in each major industry classification. Also, place a check mark in the proper column(s) to indicate whether this percent has increased, decreased, or not changed since January, 1968

Major Industry Classification	Percent of Production Time		
	Increased	Decreased	Not Changed
IN PLANT (captive)			
GENERAL COMMERCIAL			
NEWSPAPER AND COMMERCIAL			
TRADE PLANT (typesetting etc)			
BOOK PUBLICATIONS			
BUSINESS FORMS			
GREETING CARDS			
PACKAGING			
OTHER			
Total	100%		

2. Write in the percent of production time devoted to each printing process in your plant. Also, place a check mark in the proper column(s) to indicate whether the use of each process has increased, decreased, or not changed since January, 1968

Printing Process	Percent of Production Time		
	Increased	Decreased	Not Changed
OFFSET LITHOGRAPHY			
LETTERPRESS			
GRAVURE			
SCREEN			
FLEXOGRAPHY			
LETTERSET			
ELECTROSTATIC			
OTHER			

3. The total number of skilled occupational personnel in your plant is (write-in actual number) \_\_\_\_\_

ITEMS 4-15: Answer each item by placing a check mark in the appropriate box.

- The skilled occupations in your plant are
  - all union
  - all non-union
  - both union and non-union
- The standard hourly work week without overtime for skilled occupations (first shift) is
  - 35 hours
  - 36 1/2 hours
  - 37 1/2 hours
  - 40 hours
  - Other \_\_\_\_\_
- Overtime work for skilled occupations is
  - non-existent
  - increasing
  - decreasing
  - seasonal
- A four-day work week for skilled occupations
  - is in use
  - was used and discontinued
  - is being considered
  - will soon begin
  - is not being considered
- The majority of skilled occupations offer (check only one in each group)
  - much mobility between production areas (example from composition to press operation)
  - little
  - much opportunity for upward advancement
  - little
- Re-training programs for skilled occupations are now conducted by: (check all that apply)
  - trade unions
  - trade associations
  - company training personnel
  - public or private school classes
  - outside agencies or consultants
  - are not conducted
  - other \_\_\_\_\_

- Specialists are employed specifically for (check all that apply)
  - estimating
  - production control
  - quality control
  - safety management
  - environmental control
  - labor relations
  - computer programming
  - in-plant education programs
  - other(s) \_\_\_\_\_
- Special groups who have had success in skilled occupation areas are
  - physically handicapped
  - mentally handicapped
  - hard-core unemployed
  - minority group persons
  - women
  - recently discharged military persons
  - other(s) \_\_\_\_\_
- Members of your sales staff have been employed from
  - other graphic arts companies
  - community and technical colleges
  - from within the company
  - colleges and universities
  - other(s) \_\_\_\_\_
- Members of the management staff have been employed from
  - other graphic arts companies
  - community and technical colleges (sales)
  - from within the company (non-sales)
  - from within the company (sales)
  - colleges and universities
  - other \_\_\_\_\_
- Indicate all current uses of electronic computers (do not include desk calculators)
  - typesetting
  - production control
  - estimating
  - payroll
  - inventory
  - machine productivity
  - employee efficiency
  - job costing
  - employment records
  - other \_\_\_\_\_
- If electronic computers are used for any of the above do you
  - own the computer
  - purchase computer time from another organization

**PRODUCTION AREAS**

**ITEMS 16-20:** Write in your response to these items for each production area that applies to your plant.

	Layer and Dyeing	Hot Metal Compression	Photographic and Strike On Compression	Impression and Strike On	Plate-Up and Lay-Up	Colorwork	Splicing	Platemaking	Letterpress Platemaking	Graphic Platemaking	Screen Platemaking	Other Platemaking	Offset Platemaking (Sheet-Feed)	Letterpress Presswork	Graphic Presswork	Screen Presswork	Screen Process Presswork	Finishing and Finishing	Sales	Management	Other
16 Number of persons hired in each production area since January 1971																					
17 Number of persons that have left each production area since January, 1971																					
18 Number of persons presently employed in each area																					
19 Number of persons in each area three years ago																					
20 Estimate the average age of employees in each area																					

**ITEMS 21-27:** Place a check mark  as response to these items for each production area that applies to your plant.

	Layer and Dyeing	Hot Metal Compression	Photographic and Strike On Compression	Impression and Strike On	Plate-Up and Lay-Up	Colorwork	Splicing	Platemaking	Letterpress Platemaking	Graphic Platemaking	Screen Platemaking	Other Platemaking	Offset Platemaking (Sheet-Feed)	Letterpress Presswork	Graphic Presswork	Screen Presswork	Screen Process Presswork	Finishing and Finishing	Sales	Management	Other
21 Production areas added since January, 1968																					
22 Production areas eliminated since January, 1968																					
23 Use of trade services from January, 1968, to present for each area have																					
increased																					
decreased																					
not changed																					
not been used																					
24 The DFSIRED education level for new employees in each area is																					
less than high school																					
general high school																					
vocational high school																					
community or technical college																					
college or university																					
25 Since January 1968, technical knowledge requirements in each area have																					
increased																					
decreased																					
not changed																					
26 Since January, 1968, job skill requirements in each area have																					
increased																					
decreased																					
not changed																					
27 Due to automation, the number of employees in each area has																					
increased																					
decreased																					
not changed																					

**ITEMS 28-37:** Rank each item by placing a number in the space provided at the left of the items. (The most important item to you would be 1, second most important item 2, etc.)

- |   |  |
|---|--|
| <p>28 Problems in the employment of skilled occupation personnel:</p> <ul style="list-style-type: none"> <li>___ shortage of qualified applicants</li> <li>___ poor trade knowledge and skill</li> <li>___ inadequate wage scale compared with other industries</li> <li>___ others _____</li> </ul> <p>29 Problems in the retention (holding) of skilled occupation personnel.</p> <ul style="list-style-type: none"> <li>___ inability to get along with fellow employees</li> <li>___ inadequate wage scale compared with other industries</li> <li>___ inadequate technical knowledge and skill</li> <li>___ inability to adapt to retraining</li> <li>___ poor work habits and attitude</li> <li>___ others _____</li> </ul> <p>30 Problems in the employment of sales personnel.</p> <ul style="list-style-type: none"> <li>___ shortage of qualified applicants</li> <li>___ poor knowledge and ability</li> <li>___ inadequate wage scale compared with other businesses</li> <li>___ others _____</li> </ul> <p>31 Problems in the retention of sales personnel</p> <ul style="list-style-type: none"> <li>___ inability to get along with fellow employees</li> <li>___ inadequate wage scale compared with other businesses</li> <li>___ inadequate sales ability</li> <li>___ inability to adapt to retraining</li> <li>___ others _____</li> </ul> <p>32 Problems in the employment of management personnel</p> <ul style="list-style-type: none"> <li>___ shortage of qualified applicants</li> <li>___ poor knowledge and ability</li> <li>___ inadequate wage scale compared with other businesses</li> <li>___ others _____</li> </ul> | <p>33 Problems in the retention of management personnel</p> <ul style="list-style-type: none"> <li>___ inability to get along with fellow management persons</li> <li>___ inadequate wage scale compared with other businesses</li> <li>___ inadequate management ability</li> <li>___ inability to adapt to retraining</li> <li>___ inability to work with skilled occupation personnel</li> <li>___ others _____</li> </ul> <p>34 Desirable characteristics in the initial employment of all personnel:</p> <ul style="list-style-type: none"> <li>___ technical training</li> <li>___ previous job experience</li> <li>___ interest in the graphic arts industry</li> <li>___ personal appearance</li> <li>___ other _____</li> </ul> <p>35 Desirable characteristics in the retention of all personnel</p> <ul style="list-style-type: none"> <li>___ ability to get along with people</li> <li>___ ability to communicate</li> <li>___ promotion potential</li> <li>___ attitude and work habits</li> <li>___ dependability</li> <li>___ ambition and initiative</li> <li>___ other _____</li> </ul> <p>36 Preferred sources of sales staff</p> <ul style="list-style-type: none"> <li>___ other graphic arts companies</li> <li>___ advancement through the company</li> <li>___ community and technical colleges</li> <li>___ colleges and universities (4-year)</li> <li>___ other _____</li> </ul> <p>37 Preferred sources of management staff</p> <ul style="list-style-type: none"> <li>___ other graphic arts companies</li> <li>___ advancement through the company</li> <li>___ community and technical colleges</li> <li>___ colleges and universities (4-year)</li> <li>___ other _____</li> </ul> |
|---|--|

**COMMENTS:** Please write in any comments that you have concerning this study, and more generally, on the need for people in both your plant and in the graphic arts industry as a whole. Attach additional sheets as necessary



**APPENDIX II**

**DATA -- KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY**

DATA -- KODAK GRAPHIC ARTS INDUSTRY MANPOWER STUDY

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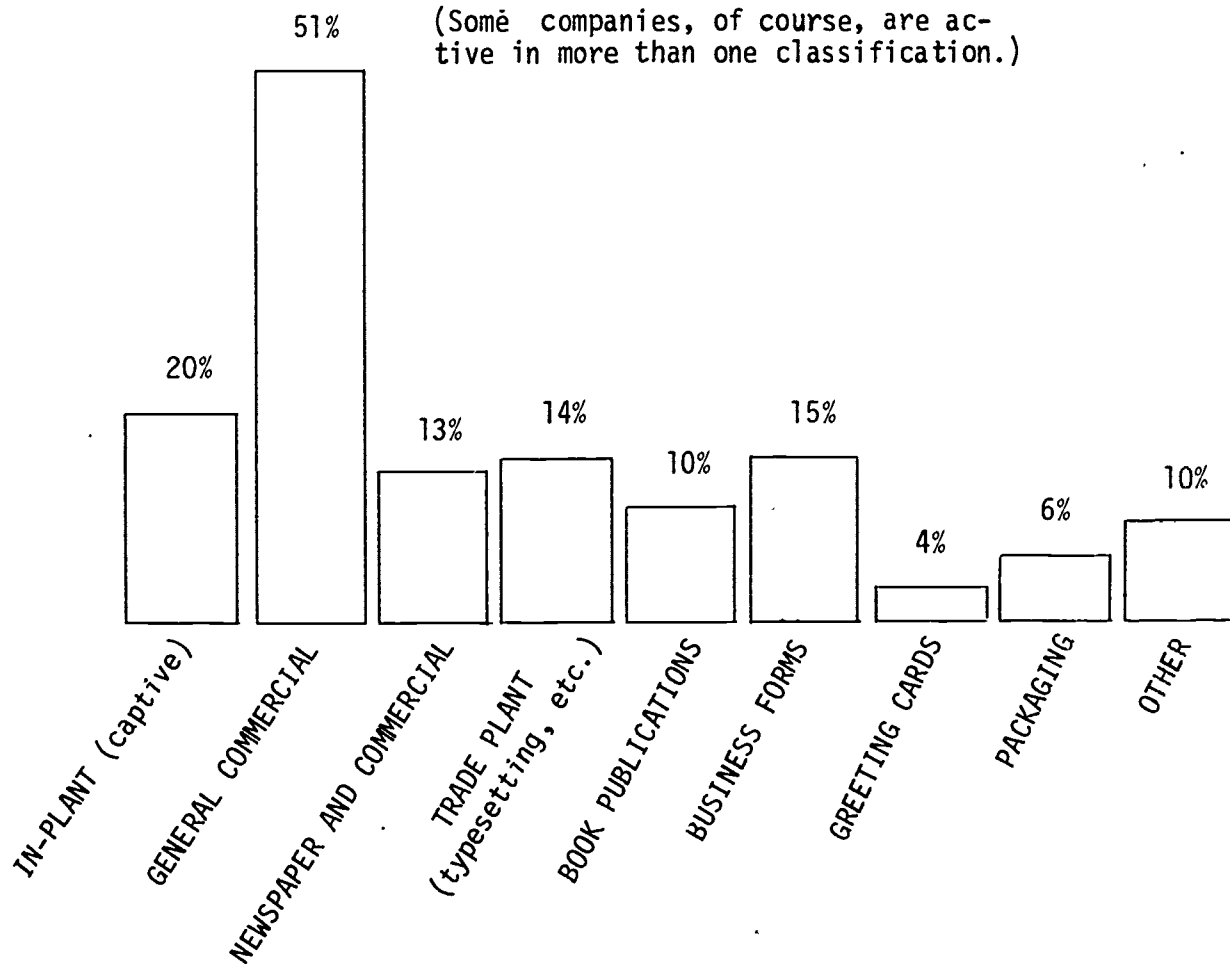
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## QUESTION 1

WRITE IN THE PERCENT OF PRODUCTION TIME SPENT BY YOUR PLANT IN EACH MAJOR INDUSTRY CLASSIFICATION. ALSO, PLACE A CHECK MARK IN THE PROPER COLUMN(S) TO INDICATE WHETHER THIS PERCENT WAS INCREASED, DECREASED, OR NOT CHANGED SINCE JANUARY, 1968.

### PERCENT OF COMPANIES IN STUDY ACTIVE IN EACH MAJOR INDUSTRY CLASSIFICATION

(Some companies, of course, are active in more than one classification.)



#### IN-PLANT (CAPTIVE)

Of the 1,033 respondents to the survey, 207 companies, or 20 percent, reported that they were involved in in-plant printing. Of these companies, 61 percent indicated that 80 to 100 percent of their production time was spent on in-plant printing operations. It is interesting to note

## QUESTION 1 - continued

that companies doing in-plant printing 20 to 80 percent of the time showed substantially greater increases than those involved in this type of work less than 20 percent or more than 80 percent of the time. On the whole, very little decrease was reported.

Of the responding small companies, 50 percent reported that the volume of in-plant printing had increased. Only 40 percent of the medium-size companies reported an increase in in-plant printing. This is slightly less than the national average of 43 percent. The volume of in-plant printing had increased according to only 28 percent of the large companies. It appeared that the larger the company, the less likely an increase in the volume of in-plant printing work.

This trend is also supported by the reported decreases in the percentage of production time spent on in-plant printing. Small companies indicated fewer decreases than the national average of 11 percent, while large companies showed somewhat more decreases.

## GENERAL COMMERCIAL

General commercial printing was done by 51 percent of the survey respondents, or 518 companies. More than half of these companies spent more than 80 percent of their production time doing this type of printing. Forty-one percent of the responding companies indicated that the percentage of production time spent on general commercial printing had increased. However, 44 percent indicated that the volume of work had not changed. Only 15 percent reported that they had experienced a decrease in the volume of general commercial work.

## QUESTION 1 - continued

Generally, there were no great differences in the data reported by various company sizes and locations. One exception should be noted, however. In the western region, only 27 percent of the companies reported that the percentage of production time spent on general commercial printing had increased. This is much lower than the national average of 40 percent.

## NEWSPAPER AND COMMERCIAL

Of the total number of survey respondents, 137 companies, or 13 percent, did newspaper and commercial printing. Almost half of these reported that this type of work involved 80 percent or more of their production time. Companies doing newspaper and commercial printing indicated that their volume of work had remained stable in the past three years; 47 percent reported that the percentage of time spent on this type of work had not changed. Decreases were noted by only 17 percent of the responding companies. The greatest increases were reported among those companies who spent 20 to 40 percent of their production time doing newspaper and commercial printing. The fewest increases were reported by those companies that spent more than 80 percent of their production time doing this type of printing. Only 26 percent of these companies reported an increase in the volume of newspaper and commercial printing, as compared to 36 percent nationally.

It is interesting to note that 58 percent of the large companies surveyed reported that the percentage of production time spent on newspaper and commercial work had increased. This is much higher than the national average of 36 percent. Small companies reported the fewest increases.

## QUESTION 1 - continued

Only 9 percent of the responding companies in the southeastern region reported an increase in the volume of newspaper and commercial printing. In this region, 36 percent of the responding companies indicated a decrease, as compared to 17 percent of the companies nationally. Fifty percent of the companies reporting from the western region reported an increase in the percentage of production time spent on newspaper and commercial printing.

## TRADE PLANT (TYPESETTING, ETC.)

Fourteen percent of the survey respondents, or 142 companies, did work which fell into the trade-plant category. The greatest percentage (43 percent) reported that up to 20 percent of their production time was spent on this type of work. Another 33 percent indicated that this work involved more than 80 percent of their production time. The amount of production time spent on trade plant work had increased, according to 42 percent of the companies, and had not changed for 38 percent. Twenty percent of the companies had experienced a decrease in the amount of production time devoted to trade-plant work. This was the highest percentage of companies reporting a decrease for all the major industry classifications.

When the data were examined for all companies that reported spending more than 80 percent of their total production time on trade-plant work, it was found that the smaller the plant, the less increase in production time. Only 21 percent of the small companies reported an increase, while 40 percent of the large companies experienced an increase.



## QUESTION 1 - continued

With only two exceptions, there were substantially no differences among the various regions. In the western region, 56 percent of the companies reported increases in the percentage of production time spent on trade-plant work, while 42 percent of the companies reported increases nationally. Only 26 percent of the companies in the southwestern region, however, reported an increase.

## BOOK PUBLICATIONS

Approximately 10 percent of the survey respondents, or 108 companies, reported that they were involved in book publications work. More than half of these companies indicated that book publications printing represented less than 20 percent of their production time. The amount of production time spent on this type of printing had increased, according to 54 percent of the companies. This was the most significant indication of increased production of all the major industry classifications. The amount of production time spent on this work had not changed for 32 percent of the companies.

Book publications printing appeared to be concentrated in the eastern and southeastern regions. More than half of the responding companies who printed books and publications were located in these two regions. It is interesting to note that in the southwestern and western regions, virtually no respondents reported spending more than 60 percent of production time on book publications printing.

With only one exception, more than 50 percent of the respondents in each region reported that the percentage of production time for book publica-

## QUESTION 1 - continued

tions printing had increased. The exception was the southwestern region, where only 30 percent reported an increase and 50 percent reported that production time had not changed. The increase was considerably lower than the national average of 54 percent.

## BUSINESS FORMS

Almost 15 percent of the survey respondents, or 150 companies, reported that they were involved in the printing of business forms. Of these companies, 58 percent indicated that less than 20 percent of their time was spent on the printing of business forms. Only 13 percent of the companies printed business forms more than 80 percent of the time. Of the companies involved in this type of printing, 42 percent reported that the percentage of production time spent on business forms had increased, while 46 percent said that it had not changed.

As for the regions, two developments are worth noting. First, in the southwestern region, among companies that produced business forms more than 80 percent of the time, an increase was reported by 60 percent of the companies. This was much higher than the national average of 42 percent. Second, only 25 percent of the companies in the western region reported an increase in the production time for printing business forms. This was much lower than the national average.

## GREETING CARDS

Only 4 percent of the survey respondents, or 37 companies, produced greeting cards. Almost 70 percent of these companies reported that the printing of greeting cards involved less than 20 percent of their pro-

## QUESTION 1 - continued

duction time. It is interesting to note that 59 percent of the companies that printed greeting cards reported that the percentage of production time devoted to greeting cards had not changed, while 19 percent of the companies said that the percentage of production time had decreased. This was the second largest indication of a decrease in all the major industry classifications.

More than a third of the greeting card printers were located in the mid-western region. The percentage of production involved in printing greeting cards appeared to be stable, since 59 percent of the printers reported that the percentage had not changed. In the other four regions, variations in data appeared to be significant. When the data were examined more closely, however, it was found that differences were due to the small number of companies responding.

## PACKAGING

Approximately 6 percent of the survey respondents, or 58 companies, reported printing packaging materials. Of these companies, 69 percent reported spending less than 20 percent of their production time in this area, while 19 percent of the companies said that they spent more than 80 percent of their production time on packaging materials. According to 48 percent of the companies, the time spent on the printing of packaging materials had increased; 45 percent reported that it had not changed. Only 7 percent reported a decrease. This is the smallest percentage of companies reporting a decrease for all the major industry classifications.

## QUESTION 1 - continued

Approximately half of the packaging printers were located in the eastern region. The companies in this region, however, reported fewer increases in production than the national average of 48 percent. The highest percentages of companies reporting increases were in the southwestern and western regions, with 67 percent and 57 percent respectively.

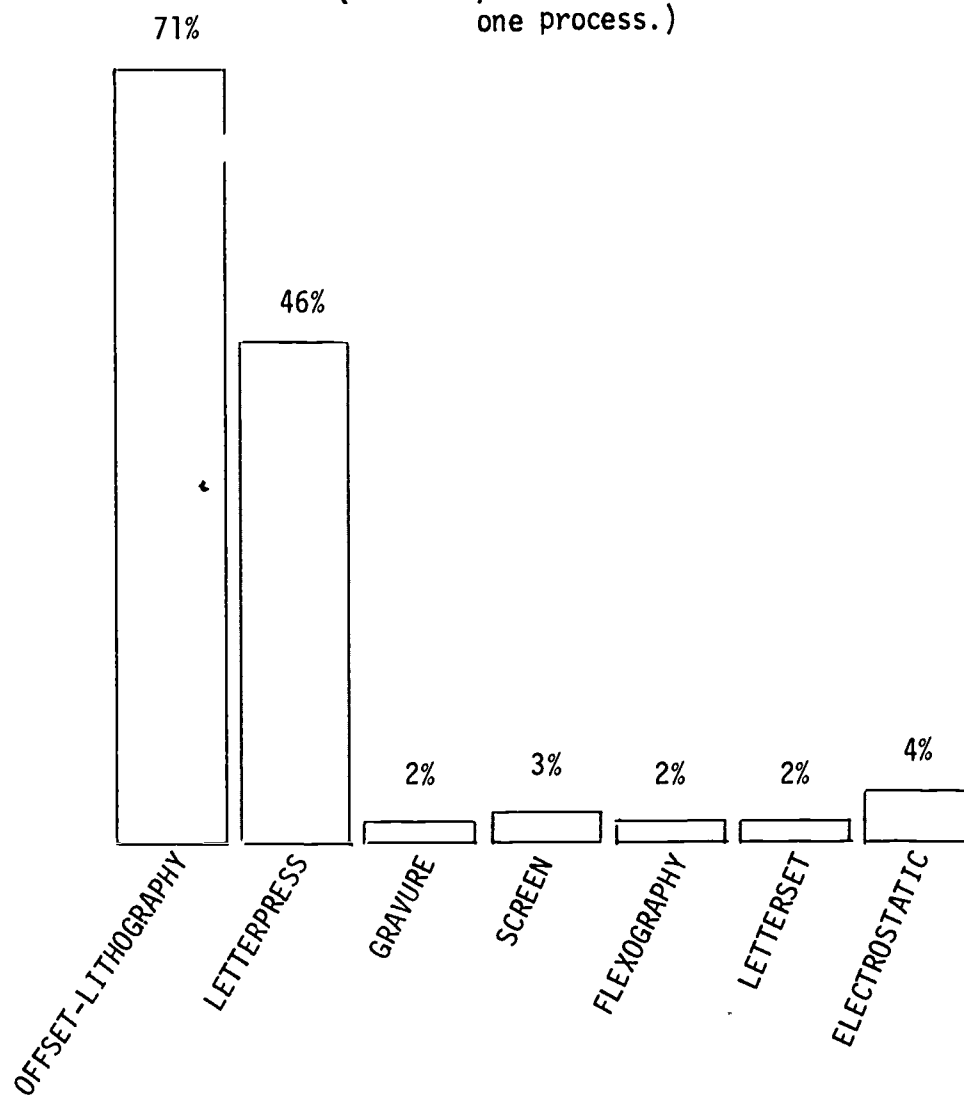
It appears that the larger the company, the more likely the volume of packaging work had increased. Only 37 percent of the small companies showed an increase, while increases were reported by 47 percent of medium, and 57 percent of large, companies.

**QUESTION 2**

WRITE IN THE PERCENT OF PRODUCTION TIME DEVOTED TO EACH PRINTING PROCESS IN YOUR PLANT. ALSO, PLACE A CHECK MARK IN THE PROPER COLUMN(S) TO INDICATE WHETHER THE USE OF EACH PROCESS HAS INCREASED, DECREASED, OR NOT CHANGED SINCE JANUARY, 1968.

PERCENT OF COMPANIES IN STUDY  
THAT USE EACH PRINTING PROCESS

(Some companies use more than  
one process.)



QUESTION 2 - continued

OFFSET LITHOGRAPHY

Of the 1,033 survey respondents, 71 percent, or 734 companies, indicated that they did offset lithography. More than half of these companies devoted more than 80 percent of their production time to the process. According to 58 percent of the companies that did offset lithography, the use of the process had increased; 35 percent of the companies reported that it had not changed.

It appeared to be true that the more production time devoted to offset lithography, the less likely that the use of the process had decreased. Of the companies that reported using offset lithography more than 80 percent of the time, only 5 percent said that the use of the process had decreased. More than 15 percent of the companies that used offset lithography less than 20 percent of the time reported that the use of the process had decreased.

It also appeared to be true that the more production time devoted to offset lithography, the more likely that the use of the process had increased. Only 38 percent of the companies that used offset lithography less than 20 percent of the time reported an increase in usage, while 51 percent of the companies that used the process more than 80 percent of the time reported an increase.

It is interesting to note that while 51 percent of the companies that did offset lithography more than 80 percent of the time reported increases, almost 75 percent of the companies that used the process 60 to 80 percent of the time reported an increase. This can be explained by the fact that

## QUESTION 2 - continued

a significant portion of those companies in the 80 to 100 percent group were printing exclusively by the offset method already. Therefore, they could not increase the amount of production time devoted to the process.

## LETTERPRESS

According to the data, 46 percent of the survey respondents, or 471 companies, were involved in letterpress printing. Approximately 72 percent of these companies devoted less than 40 percent of their production time to this process. Only 11 percent of the companies reported that letterpress printing involved more than 80 percent of their total production time. It is important to note that 53 percent of the companies doing letterpress printing reported a decrease in the use of the process, while only 16 percent said that usage had increased.

Decreases in the use of letterpress printing were prevalent among those companies who were the least involved in the use of the process. While only 7 percent of the companies that devoted 80 percent or more of their production time to the process reported a decrease, 58 percent of the companies that used letterpress printing less than 20 percent of the time reported decreases in usage.

## GRAVURE

Gravure printing was done by only 2 percent of the survey respondents, or 23 companies. Of these, 43 percent were involved in gravure printing more than 80 percent of the time, while 57 percent spent less than 80 percent of their production time on this printing process. The data indicated that the majority of companies involved in gravure printing

## QUESTION 2 - continued

were large companies with more than 26 employees. There were no significant differences among the various regions as to the number of gravure printers.

During the three-year study period, 43 percent of the respondents who did gravure printing reported that the use of the process had increased. According to 22 percent of the gravure printers, the use of the process had decreased, while 35 percent reported that usage of the printing process had not changed.

## SCREEN PRINTING

Screen printing was done by only  $3\frac{1}{2}$  percent of the survey respondents, or 35 companies. Of these, 54 percent were involved with screen printing less than 20 percent of the time, while 37 percent devoted more than 80 percent of their production time to the process. Very few companies reported that screen printing occupied between 20 and 80 percent of their production time. This seemed to indicate that screen printing was usually part of some other printing operation and represented less than 20 percent of the volume of production. Screen printing was done somewhat more by large companies than by small companies, and was done more frequently in the eastern, southeastern, and midwestern regions.

According to 37 percent of the respondents who were involved in screen printing, the use of the process had increased in the last three years; 46 percent, however, reported that use of the process had not changed. The use of the process had decreased for 17 percent of the companies. Large companies seemed to show more increases than companies overall;



## QUESTION 2 - continued

63 percent of the large companies reported that the use of the process had increased. None of the large companies reported that the use of screen printing had decreased. Only 21 percent of the small companies reported increases in the use of the process, while 14 percent reported decreases. The use of the process had not changed, according to 64 percent of the companies that used screen printing.

## FLEXOGRAPHY

Very few companies reported that they were using the flexographic method of printing. These companies represented  $1\frac{1}{2}$  percent of the total survey respondents, or 15 companies. Forty percent of these companies spent less than 20 percent of their production time on flexography. Another 26 percent reported that flexography involved between 40 and 60 percent of their production time, while 26 percent said that it involved more than 80 percent of their time.

Of those companies that reported doing flexography more than 80 percent of the time, 75 percent said that the use of the process had increased. This was greater than the percentage of companies overall that reported increases in the use of the process. (Sixty percent of the companies reported increases.) The use of the process had not changed, according to 20 percent of the companies, while another 20 percent reported that usage had decreased.

## LETTERSET

Letterset printing was being done by only 2 percent of the survey respondents, or 20 companies. Sixty percent of these companies reported doing

## QUESTION 2 - continued

letterset printing less than 20 percent of the time. Half of the companies doing letterset printing reported that use of the process had increased; another 45 percent said that it had not changed. Only 5 percent said that use of the process had decreased.

## ELECTROSTATIC

Four percent of the survey respondents, or 42 companies, indicated that they were doing electrostatic printing. The majority of these (74 percent) reported that this process involved less than 20 percent of their total production time. It was possible that many of these companies could have been producing electrostatic-type plates and considered this electrostatic printing. However, nothing conclusive could be determined, since the survey did not specifically ask for this type of information.

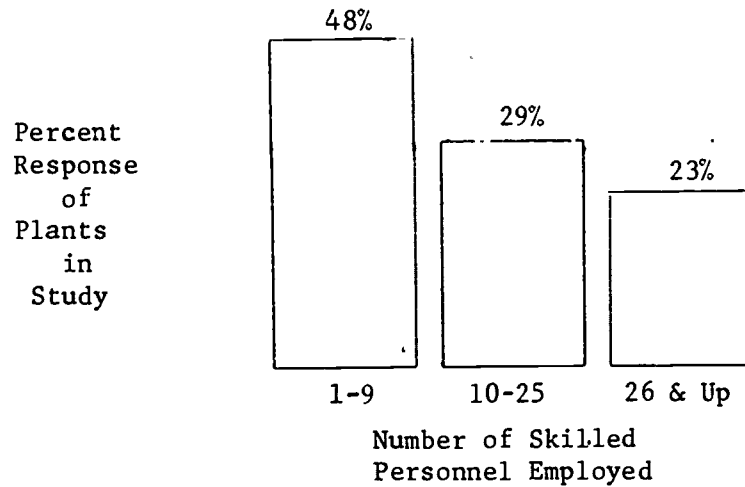
Increases in the use of the process were reported by 83 percent of the companies that did electrostatic printing. Another 17 percent said that the use of electrostatic printing had not changed. It is interesting to note that no decreases were reported.

Small companies reported the greatest use of electrostatic printing techniques; 23 of the 42 companies doing electrostatic printing were small companies. There were no variations in data among the various regions.

**QUESTION 3**

THE TOTAL NUMBER OF SKILLED OCCUPATIONAL PERSONNEL IN YOUR PLANT IS

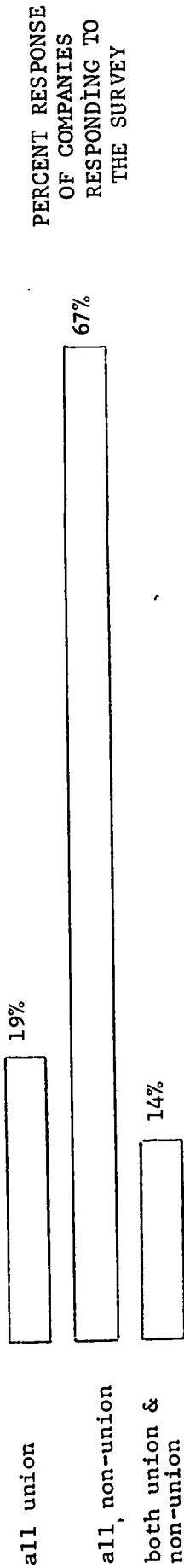
(WRITE IN ACTUAL NUMBER) \_\_\_\_\_.



In looking at the survey response to this question, we found that 48 percent of the plants had 1 to 9 employees, 29 percent had 10 to 25 people, and 23 percent reported employing 26 or more.

#### QUESTION 4

THE SKILLED OCCUPATIONS IN YOUR PLANT ARE:

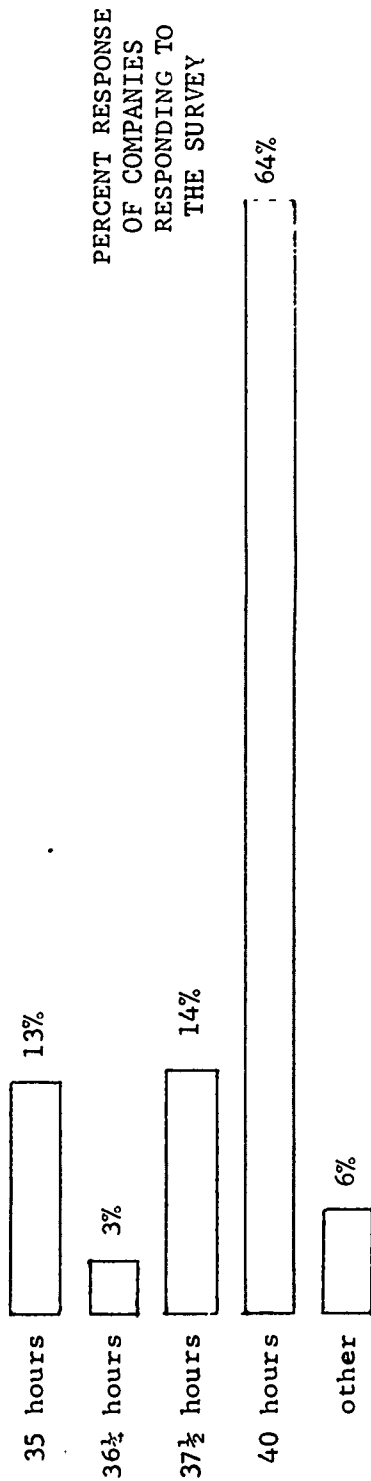


In terms of the number of companies responding, the survey indicated that the skilled occupations in the graphic arts industry were predominantly non-union. Of the total number of large companies responding to the survey, 60 percent indicated that, to some extent, skilled occupations were held by union members. Of the total number of medium-size companies reporting, 33 percent indicated that skilled occupations were unionized to some extent, while 67 percent reported that skilled positions were totally non-union. Of the small companies answering the survey, 18 percent responded that skilled occupations were union-held to some extent, and 82 percent reported that skilled positions were totally non-union.

Unionization of skilled occupations was most prevalent in the eastern, midwestern, and western regions. The southeastern region reported the fewest companies with union-held skilled occupations, with only 7 percent of the responding companies in that region indicating that skilled occupations were all union, and 17 percent of the companies indicating that the occupations were both union and non-union.

Because union-held skilled occupations were more prevalent in the eastern, midwestern, and western regions, and because the majority of graphic arts companies in these predominantly urban areas were medium- to large-size companies, it is possible that the majority of people working in the industry in these regions were union members.

## THE STANDARD HOURLY WORK WEEK WITHOUT OVERTIME FOR SKILLED OCCUPATIONS (FIRST SHIFT) IS:



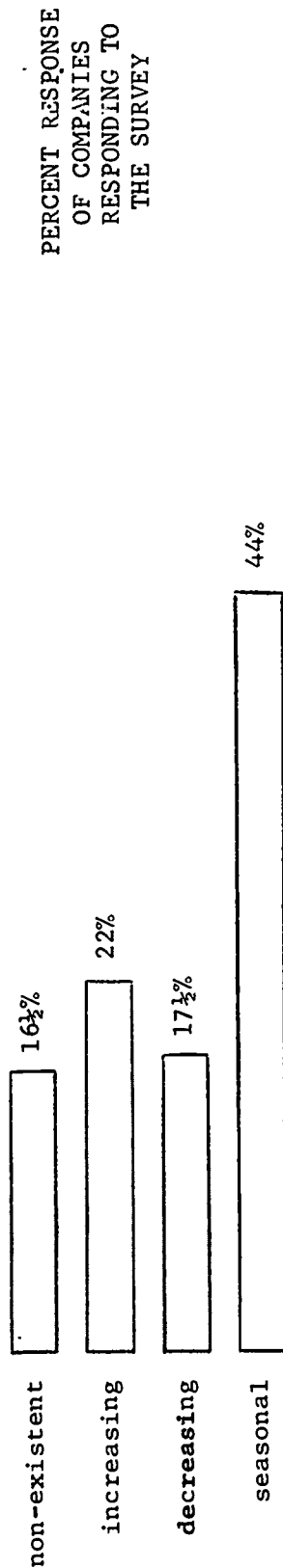
Respondents to the survey indicated that the most common standard hourly work week was the 40-hour week. The 40-hour week was reported as being used by 64 percent of all companies responding to the survey. However, in the various regions, the percentage of companies using the 40-hour week ranged from approximately 50 percent (in the eastern region) to 75 percent (in the southeastern region).

The most common shorter weeks were reported to be the 35- and 37 1/2-hour work weeks. These shorter weeks were

reported as being used by approximately 30 percent of the total survey respondents. Shorter work weeks were reported predominantly by larger companies, and were most prevalent in the eastern region. This trend may be attributed to the large number of companies reporting union activity in this region. Fewer companies in the southeastern region reported using these shorter work weeks than did any other region. This could be explained by the fact that the southeastern region reported the lowest number of unionized companies (only 7 percent of all companies reporting from that region were unionized).

### QUESTION 6

OVERTIME WORK FOR SKILLED OCCUPATIONS IS:

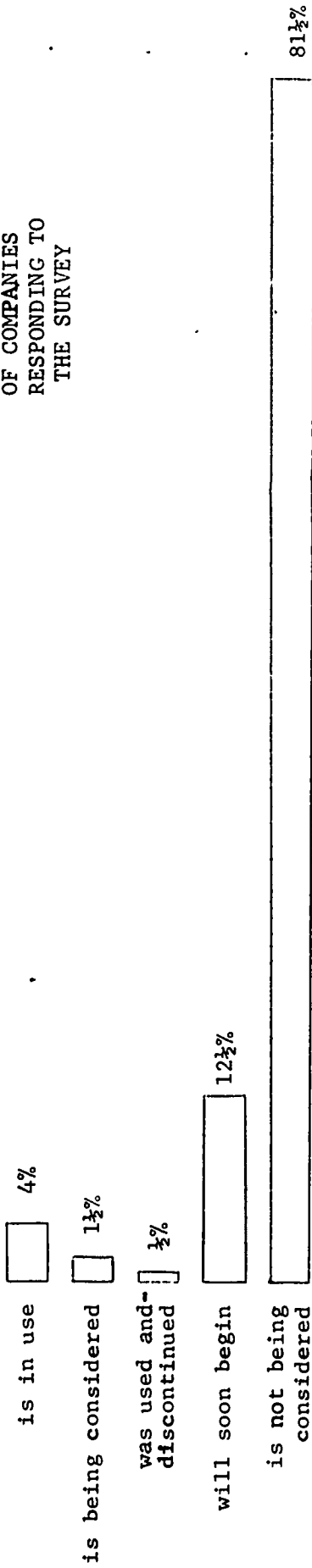


Survey respondents have shown that there was no distinctive pattern in overtime work, except that it was generally seasonal. On the whole, overtime work was somewhat less common in small companies than in medium and large companies.

In the western region, 54 percent of the survey respondents reported that overtime was seasonal. When the data were analyzed, it was found that 81 percent of the large companies in this region reported overtime as being seasonal. In the same region, all medium-size companies responding to the survey indicated that overtime work was common.

### A FOUR-DAY WORK WEEK FOR SKILLED OCCUPATIONS

#### PERCENT RESPONSE OF COMPANIES RESPONDING TO THE SURVEY



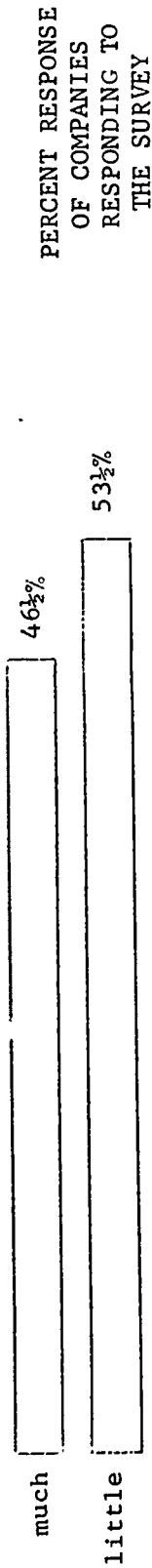
A four-day work week for skilled occupations was used by 4 percent of the survey respondents. More than 12 percent of those reporting indicated that they would soon begin to use a four-day work week. Less than 2 percent of the respondents reported that they were considering the use of the shorter work week, while less than 1 percent of the respondents said that the four-day work week was used and discontinued. The majority of survey respondents, however, reported that the use of the four-day work week was not being considered. These comprise 81½ percent of the total

number of survey respondents.

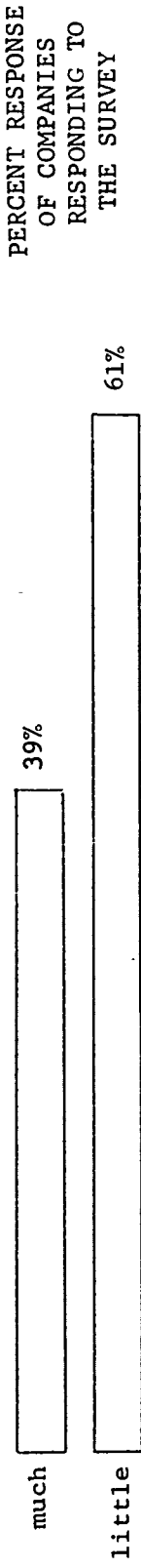
It is interesting to note that 21 percent of the companies in the western region indicated that they would soon begin to use the four-day work week. The majority of survey respondents in each of the five regions indicated, however, that they were not considering the use of a shorter work week. The percentages ranged from 67 percent (medium-size companies in the midwest) to 89.9 percent (small companies in the midwestern region).

**QUESTION 8**

A. THE MAJORITY OF SKILLED OCCUPATIONS OFFER MOBILITY BETWEEN PRODUCTION AREAS:



B. THE MAJORITY OF SKILLED OCCUPATIONS OFFER OPPORTUNITY FOR UPWARD ADVANCEMENT:



This was a two-part question. The first part dealt with horizontal mobility, the mobility between production areas (for example, from composition to press operation). The second part of the question concerned vertical mobility, the opportunity for upward advancement and promotion.

The survey indicated that there was a definite relationship between the size of a company and mobility between

production areas. The larger the company, the less mobility between production areas; conversely, the smaller the company, the more mobility between production areas.

There appeared to be little opportunity for upward advancement overall, the survey respondents indicated. Company size and opportunity for upward advancement, however, appeared to be related. The larger the company, the more opportunity for upward advancement.



**QUESTION 9**

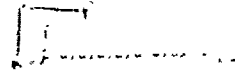
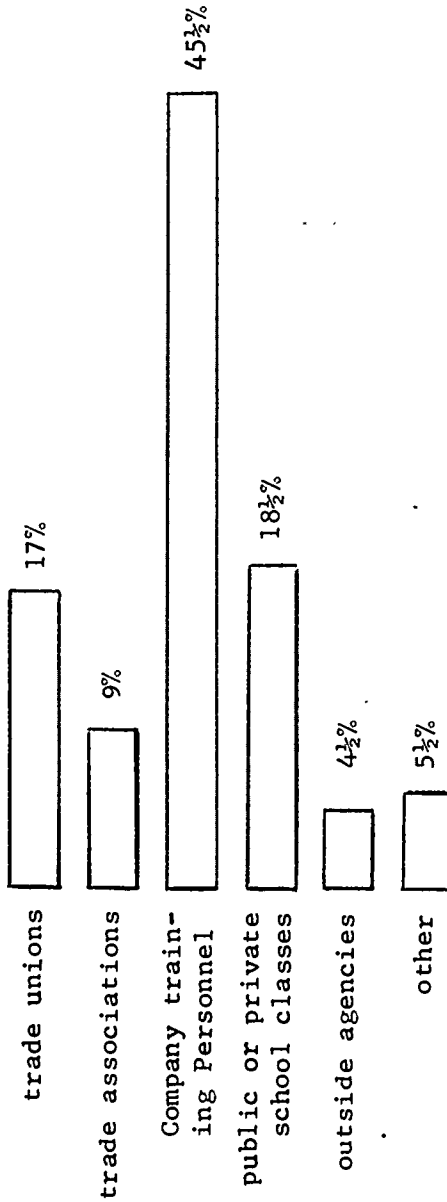
**A. RETRAINING PROGRAMS FOR SKILLED OCCUPATIONS:**

PERCENT RESPONSE  
OF COMPANIES  
RESPONDING TO  
THE SURVEY



**B. RETRAINING PROGRAMS FOR SKILLED OCCUPATIONS ARE NOW CONDUCTED BY:**

PERCENT RESPONSE  
OF COMPANIES  
RESPONDING TO  
THE SURVEY



QUESTION 9 - continued

It was found that 39 percent of the survey respondents conducted no retraining programs whatsoever for skilled occupations. Of these, the majority were small companies. More than half of the small companies indicated that no retraining programs were conducted. Only 18 percent of the large companies reported that no retraining programs were conducted.

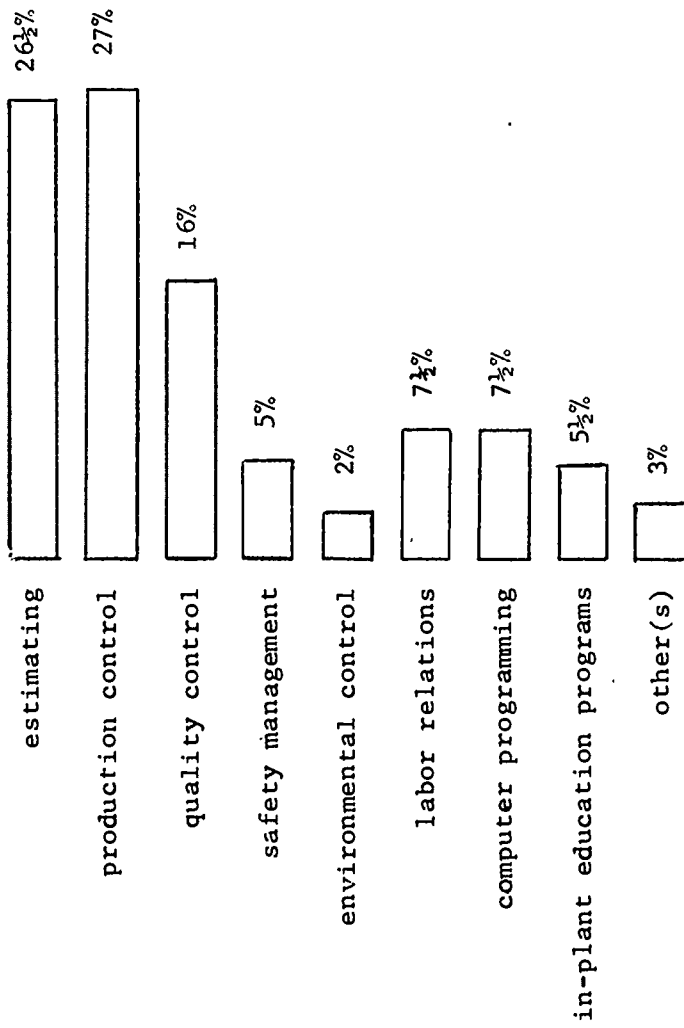
Retraining programs were reported to be conducted by 61 percent of the respondents. Of these, approximately half responded that retraining was conducted by company training personnel, 18½ percent replied that it was conducted by public and private schools, and 17 percent indicated that retraining was conducted by trade unions.

There seems to be a relationship between company size and the use of unions as the principal source of retraining for skilled occupations. As company size increased, the use of union retraining increased also.

As could be expected, there was a relationship between unionization and the use of trade unions as a retraining source. The southeastern region, which had the lowest percentage of companies reporting unionization (Question 4), also had the lowest percentage of companies indicating trade unions as a source of retraining for skilled personnel.

**QUESTION 10**

*SPECIALISTS ARE EMPLOYED SPECIFICALLY FOR:*



PERCENT RESPONSE OF COMPANIES  
ANSWERING THIS QUESTION

QUESTION 10 - continued

ERIC  
Full Text Provided by ERIC

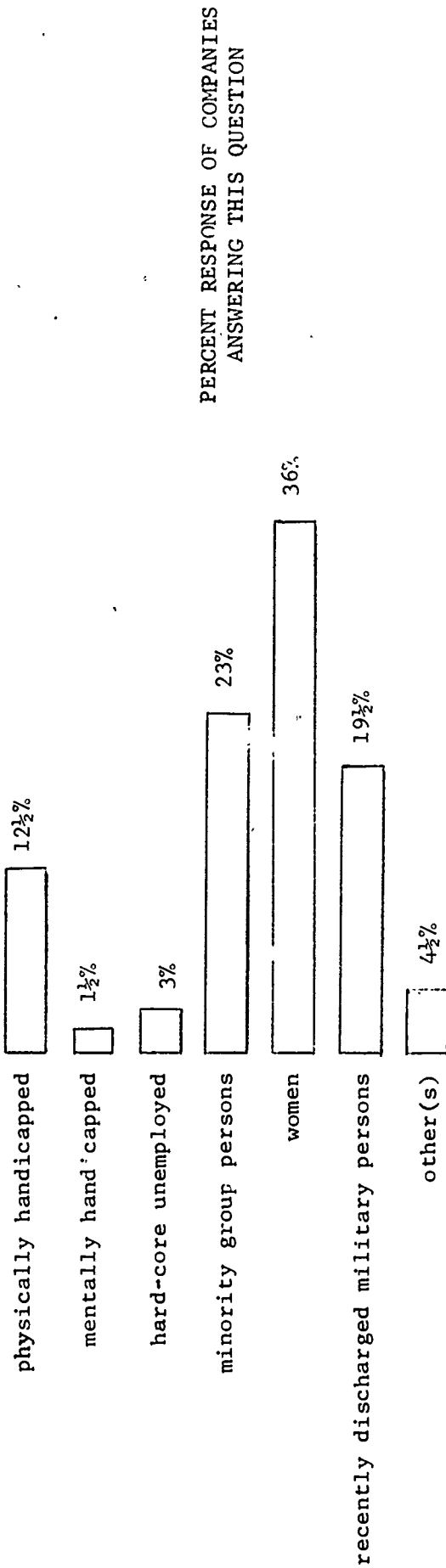
Approximately 73 percent of all survey respondents reported employing specialists. The use of specialists was generally unrelated to company size and location. Of those employing specialists, more than 25 percent employed specialists for both estimating and production control. Quality control specialists were employed by more than 15 percent of the respondents. The percentages of the remaining categories appeared to be relatively insignificant. It was found that medium-size companies employed specialists for estimating and production control more frequently than either large or small companies.

The remaining 26 percent of the companies that answered this survey form did not respond to this item. Small companies comprised more than 70 percent of these nonrespondents. It was concluded that the item was omitted because small companies generally did not employ specialists.

It is interesting to note that only 5 percent of the survey respondents indicated that they employed specialists for safety management and only 2 percent reported employing environmental control specialists. In view of recent governmental legislation in these areas, it is rather surprising that these percentages are so low.

## QUESTION 11

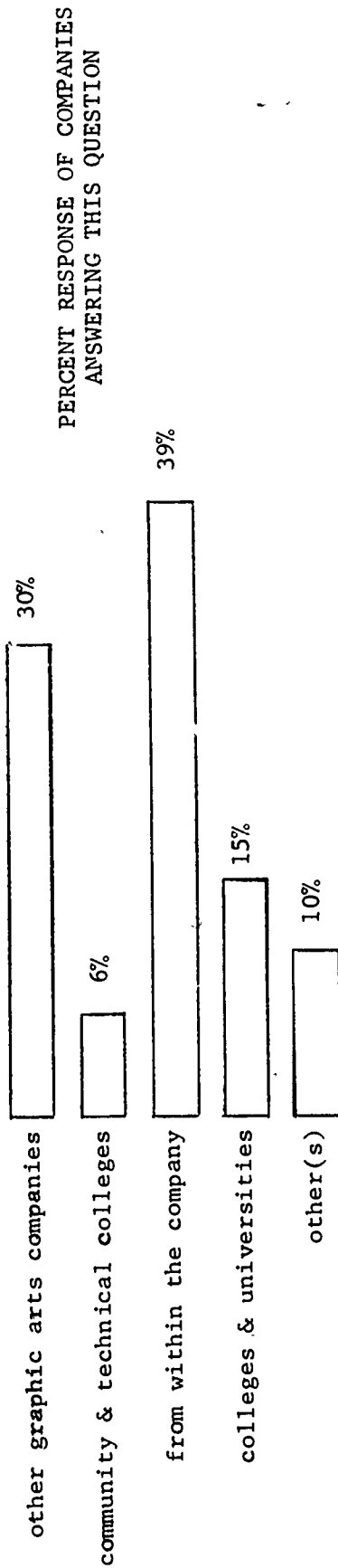
SPECIAL GROUPS WHO HAVE HAD SUCCESS IN SKILLED OCCUPATION AREAS ARE:



Special groups were successfully employed in skilled occupations by 58 percent of the total survey respondents. Generally, special groups appeared to be employed more often in large companies than in small companies. Women had more overall success in skilled occupations than any other special group, followed by minority group persons and recently discharged military persons. As plant size increased, however, minority group persons were employed more often and women were employed less often in skilled occupations. Women had more success in small companies than in large companies. Of the total number of survey respondents, 42 percent did not respond to this item. The majority of nonrespondents were small and medium companies. It was assumed that special groups were not employed in skilled occupations as frequently in these companies as in large companies.

**QUESTION 12**

MEMBERS OF YOUR SALES STAFF HAVE BEEN EMPLOYED FROM:



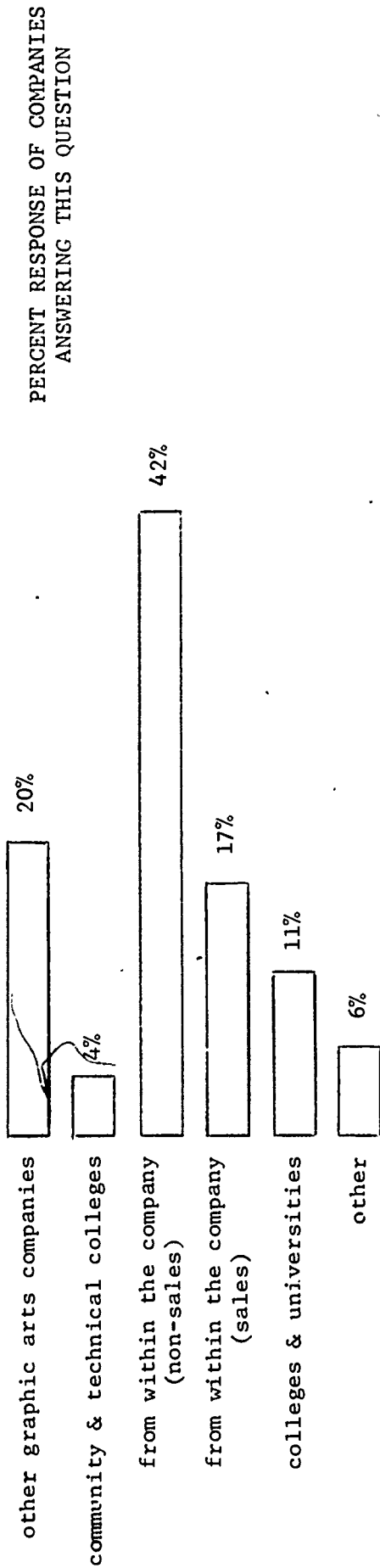
This question was answered by approximately 75 percent of the total number of survey respondents. Of those reporting, 39 percent employed members of their sales staff from within their own company and 30 percent employed them from other graphic arts companies. Colleges and universities were reported as a source of sales staff by 15 percent of the respondents. This seemed to indicate that employers required experienced persons for the sales staff of a company. These appeared to be persons who were familiar with the company and its operations or who were knowledgeable

about the graphic arts industry in general. Company size and location had no apparent relationship to the source of the sales staff.

Approximately 70 percent of the survey respondents did not answer this question. Of these, the majority (approximately 70 percent) were small companies. This may indicate that small companies generally had no sales staff per se.

**QUESTION 13**

MEMBERS OF THE MANAGEMENT STAFF HAVE BEEN EMPLOYED FROM:



PERCENT RESPONSE OF COMPANIES ANSWERING THIS QUESTION

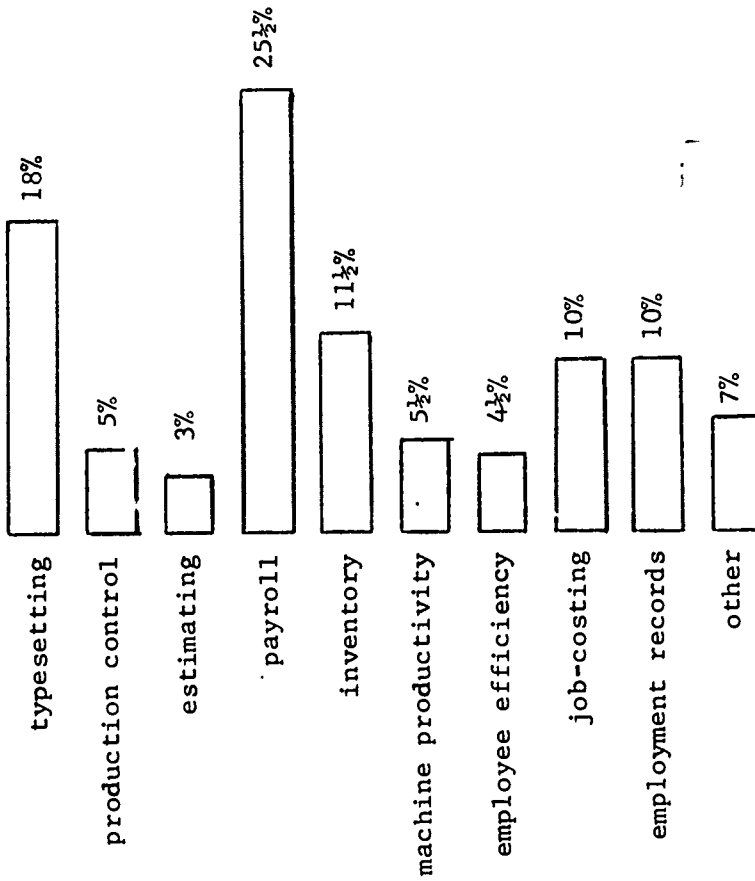
This question was answered by 89 percent of the survey respondents. Company size and location did not appear to have any relationship to the source of the management staff. According to the data, 42 percent of these respondents indicated that members of their management staff were most frequently employed from within the company (but not from the sales staff). Other graphic arts companies were the next most frequent source of management personnel. A total of only 11 percent reported that they used colleges and universities as the source of their management staff.

As in Question 12, this seemed to indicate a preference for experienced personnel who were familiar with company operation or with the graphic arts industry in general.

Of the 11 percent of the survey respondents who did not answer this question, 85 percent were small companies where, often, the only "management staff" was the owner himself. This question, therefore, may not have related directly to many small companies.

**QUESTION 14**

INDICATE ALL CURRENT USES OF ELECTRONIC COMPUTERS (DO NOT INCLUDE DESK CALCULATORS):



PERCENT RESPONSE OF COMPANIES ANSWERING THIS QUESTION

Approximately 50 percent of the survey respondents did not answer this question. The majority of nonrespondents were small companies. It was assumed from the lack of response that small companies generally did not use computers. question, 25 percent used computers for payroll and 18 percent used them for typesetting. Inventory, job-costing, and employment records were the next most frequent uses of computers. The use of computers was generally unrelated to company location.

Of the 50 percent of the respondents who did answer this



**QUESTIONS 16-20**

WRITE IN YOUR RESPONSE TO THESE ITEMS FOR EACH PRODUCTION AREA THAT APPLIES TO YOUR PLANT:

16. NUMBER OF PERSONS HIRED IN EACH PRODUCTION AREA SINCE JANUARY, 1971.
17. NUMBER OF PERSONS THAT HAVE LEFT EACH PRODUCTION AREA SINCE JANUARY, 1971.
18. NUMBER OF PERSONS PRESENTLY EMPLOYED IN EACH AREA.
19. NUMBER OF PERSONS IN EACH AREA THREE YEARS AGO.
20. ESTIMATE THE AVERAGE AGE OF EMPLOYEES IN EACH AREA.

**LAYOUT AND DESIGN**

Of the 1,033 survey respondents, 340 companies, or 33 percent, employed people for layout and design departments. The average age of these employees was 34.7 years. The average number of employees in a department was 1.94. In 1971, the number of persons hired for layout and design departments was, on the average, .56. Companies reported that in the same year .33 person per department terminated employment. This meant that in 1971, companies experienced a net gain of .23 employee. During the three-year period from 1968 to 1971, companies reported a net gain of .49 employee.

Medium-size companies reported a net gain in 1971 that was larger than the national average. While .23 employee had been gained per department by the industry as a whole, .77 employee was gained per layout and design department in medium-size companies. Small companies reported a net gain of .47 employee per department, which was also considerably higher than the average.

QUESTIONS 16-20 - continued

#### PASTE-UP AND COPY PREPARATION

The number of companies that reported having a paste-up and copy preparation department was 358. This represented 34 percent of the survey respondents. The average age of employees in these departments was 33.2 years. In these departments, there were reported to be an average of 2.62 employees. In 1971, an average of .62 person was hired per paste-up and copy preparation department. An average of .34 employee left each department. This resulted in a net gain of .28 employee per department. From 1968 to 1971, the net gain was .91 employee per paste-up and copy preparation department.

It is interesting to note that during 1971, while there was a net gain of only .28 employee per department for all company sizes, there was an increase of 1.72 employees per department in large companies. Also, during the previous three years, the average increase was .91 employee per department; however, a gain of 1.77 employees per department was reported by large companies. Small companies reported a net gain of only .38 employee per department during the three-year period.

The southwestern region was found to have an increase of 1.84 employees per paste-up and copy preparation department between 1968 and 1971. This was compared to an increase of .91 employee per department for all regions. In 1971, companies in the southeastern region reported a net gain of only .02 employee per department, as compared to .28 for all regions. On the whole, 33 percent of the companies having a paste-up and copy preparation department reported an increase in the number of employees in these departments. Only 14 percent had decreases in the number of employees.

## QUESTIONS 16-20 - continued

## CAMERAWORK

Camerawork departments were the second most common department in the graphic arts industry. The number of departments was exceeded only by sheet-fed offset press departments. It was reported that 537 companies, or or 51 percent of the respondents, had camerawork departments. In these departments, the average age of the employees was 36.5 years. There was an average of 1.98 persons employed in each camerawork department. The survey respondents who had camerawork departments reported hiring .35 employee per department in 1971, but they also reported that .24 employee per department left in the same year. They gained an average of .11 employee per department in 1971. The net gain per department for the three-year period was .52 employee.

In 1971, companies in the midwestern region experienced a decrease of .03 employee per department. This contrasted significantly with the net gain of .11 employee per department nationally.

## STRIPPING

Of the survey respondents, 435 companies, or 42 percent, had stripping departments. Employees in these departments were 37.2 years old, on the average. The number of employees in each stripping department averaged 3:42, of which .58 were hired per department during 1971. In the period between 1968 and 1971, the net gain of employees in stripping departments averaged .78 person per department.

When the net gains were examined, it was found that companies in the midwestern region varied considerably from the national averages. For

## QUESTIONS 16-20 - continued

the three-year period, companies in the midwestern region reported an increase of 1.03 employees per department, as compared to only .78 nationally. During 1971, however, companies in the midwestern region reported a net loss of .17 employee per department, while companies nationally reported a net gain of .17 employee per department.

## PHOTOGRAPHIC AND STRIKE-ON COMPOSITION

Of the 1,033 survey respondents, 291 companies, or 28 percent, reported having a photographic and strike-on composition department. The average age of employees in these departments was 30.5 years. Each department employed an average of 2.67 employees. During 1971, .87 person per department was hired, while in the same year, .38 person left each department. The net gain for the year was .49 employee per department. For the three-year period, however, each photographic and strike-on composition department experienced a net gain of 1.14 employees.

A net gain of .68 employee per department was reported by companies in the midwestern region in 1971; this was the highest net gain reported for any region. In the western region, the net gain was .58 employee per photographic and strike-on composition department. The gains for these two regions were significantly higher than the net gain of .49 employee per department nationally. The least gain was reported by companies in the southwestern region; a net gain of only .30 employee per department was reported in 1971.

When the data were examined by company size, it was found that large companies reported the greatest increases in the number of employees in

## QUESTIONS 16-20 - continued

photographic and strike-on composition departments. During 1971, these companies reported a net increase of .92 employee per department, as compared to .49 employee per department for the industry as a whole.

## HOT METAL COMPOSITION

Of the survey respondents, 307 companies had a hot metal composition department. These represented 29 percent of the respondents. The average age of employees in hot metal composition departments was 42.2 years. Departments averaged 4.30 employees each. The number of persons hired for each department in 1971 was .83; however, .90 employee per department left during the same year. The result was a net loss of .07 employee per department during 1971. During the previous three years, hot metal composition departments experienced a net loss of .15 person per department.

The net loss that occurred between 1968 and 1971 can be explained in part by a loss of 1.03 employees from each hot metal composition department in large companies. Medium and small companies reported a smaller loss of manpower for these departments during the same period. In all, 24 percent of the companies with such departments reported a loss of personnel. Increases in personnel, however, were reported by 38 percent of the companies.

## IMPOSITION AND LOCK-UP

Companies that reported having imposition and lock-up departments numbered 160; this represented 15 percent of the survey respondents. The average age of employees in these departments was the second highest for

## QUESTIONS 16-20 - continued

the industry, 43.2 years. An average of 1.54 persons were employed in each imposition and lock-up department. Companies reported hiring an average of .20 employee per department in 1971, and losing an average of .12 employee. The net gain for the year was .08 employee per department. The net gain for the three years prior to 1971 was .09 employee per department, only slightly higher than for 1971.

Companies in the southeastern region reported the only variation in net gain for both the one-year and three-year time periods. While the industry as a whole reported a net increase of .07 employee per department, companies in the southeastern region reported a net loss of .12 person per department. During the previous three years, the industry reported a net increase of .09 employee per department; the southeastern region, however, reported a net decrease of .15 employee per department.

## OFFSET PLATEMAKING

Of the 1,033 survey respondents, 426 companies, or 41 percent, indicated that they had an offset platemaking department. The average age of employees in these departments was 34.3 years. Each department was staffed by an average of 2.05 persons. In 1971, companies reported hiring an average of .35 employee per offset platemaking department; .17 employee per department left during the same year. The net gain for 1971, then, was .17 employee per department. The net gain for the three-year period was .61 employee per department.

Companies in the western region reported a net gain of only .20 employee per department between 1968 and 1971. This was significantly lower than

## QUESTIONS 16-20 - continued

the net gain of .61 employee per department for the industry as a whole.

## OFFSET PRESSWORK (SHEET-FED)

A total of 621 companies, representing 60 percent of the survey respondents, reported having sheet-fed offset press departments. These departments were the most common type of production area in the graphic arts industry. The average age of employees in these departments was 35.1 years. An average of 5.6 persons were employed in each department. Companies reported hiring an average of 1.08 employees per department in 1971. During the same period, .73 employee left each department. The net gain for the year, then, was .36 employee per department. In the three years prior to this, the net gain was .74 employee per sheet-fed offset press department.

Among the regions, there were no significant variations in net gains for 1971. Although the eastern region had more sheet-fed offset press departments than any of the regions, these departments experienced less growth than the departments in other regions. The southeastern region reported that companies had a higher net gain in personnel than the national average; 1.48 employees were gained during the period between 1968 and 1971. The national average for this period was .74 employee per department.

## OFFSET PRESSWORK (WEB-FED)

Web-fed offset press departments were found in 119 companies, representing more than 11 percent of the survey respondents. The average age of employees in these departments was 32.1 years. The average department

## QUESTIONS 16-20 - continued

employed 8.9 persons. In 1971, an average of 1.35 persons were hired for each web-fed offset press department, while .61 employee left. There was a net gain, then, of .75 employee in 1971. However, during the three years prior to 1971, the net gain was 4.86 persons per department. This gain can be explained in part by the net of web-fed offset press departments in large companies. A net gain of 11.5 employees per department was reported for 1968 to 1971.

Companies in the midwestern region reported net gains that were considerably larger than those of the other regions. The average increase was 11.58 employees per department for the three-year period. Little growth was reported for departments in the other regions, with companies in the southwestern region reporting the smallest net gain for the three-year period. During 1971, the eastern region had a substantial net gain of 1.81 employees per department, as compared to the national average of .75. The southeastern region reported the smallest net increase for the one-year period.

## LETTERPRESS PLATEMAKING

Fifty companies, representing 4 percent of the survey respondents, reported having letterpress platemaking departments. The average age of employees in these departments was 41.1 years. The departments employed an average of 4.77 persons. In 1971, an average of .40 person was hired per department. This was offset, however, by a decline of .40 person per department in the same year. The result was no net gain for the year. During the three-year period from 1968 to 1971, the net gain for letterpress platemaking departments was only .29 employee per department.



## QUESTIONS 16-20 - continued

When the data were examined by regions, it was found that during 1971, the net increase varied greatly. The largest net gain was reported by companies in the eastern region; the net increase was 8.64 employees per department. There was no increase in personnel in the southeastern region, since no companies in that region reported having a letterpress platemaking department. A net decrease of .26 employee was reported in the midwestern region. Companies in the southwestern and western regions reported net increases of .09 and .13 employee, respectively. The national average, therefore, is not really indicative of activities in letterpress platemaking departments throughout the country; rather, it tends to reflect activities in the eastern region.

When the data were examined by company size, it was found that increases were reported only by large companies, while medium and small companies reported decreases in the number of employees in each letterpress platemaking department. It can be assumed, therefore, that more persons are employed in these departments in large companies in the eastern region than are employed by any other company size in any other location.

## LETTERPRESS PRESSWORK

It was reported that 350 companies, or 33.8 percent of the survey respondents, had letterpress press departments. The average age of employees in these departments was 42 years. An average of 2.55 employees worked in each letterpress press department. In 1971, companies reported hiring an average of .42 employee per department. However, they also reported that an average of .69 employee per department left in the same year. This resulted in a net loss of .27 employee per department. During the

## QUESTIONS 16-20 - continued

previous three years, though, there was a net gain of only .19 employee per department.

During 1971, while letterpress press departments experienced a decline in personnel nationally, departments in the southwestern and western regions reported gains of .19 and .28 employee, respectively. From 1968 to 1971, all regions reported a negligible gain, with the exception of the eastern region. A decrease of .32 employee per department was reported for the letterpress press departments in that region. It is interesting to note that in 1971 large companies reported losing an average of 1.27 employees per department.

## FLEXOGRAPHIC PLATEMAKING

When the data on flexographic platemaking were examined, it was found that only 8 of the 1,033 responding companies did this type of work. These companies represented only .8 percent of the survey respondents. The average age of employees in flexographic platemaking departments was reported to be 42.5 years. An average of .50 person per department was hired in 1971, while .11 person per department terminated employment. The net gain for the year, therefore, was .39 employee per department. However, for the period between 1968 and 1971, a net gain of 1.44 employees per department was reported.

For the one-year period, companies in the eastern region showed a decrease in the number of persons employed in each department. This was a decrease of .50 employee per department. In the southeastern region, an increase of 2 employees per department was reported. There were no

Flexographic platemaking departments reported the highest percentage, and only one was reported in the western region.

#### FLEXOGRAPHIC PRESSWORK

Of the 1,033 survey respondents, 18 companies, or 1.7 percent, reported that they had flexographic presswork departments. The average age of employees in these departments was 39.1 years. An average of 7 employees worked in each flexographic presswork department. During 1971, 1.37 persons were hired for each department, while .41 person per department left. The net gain for the year, then, was .98 employee. The net gain for 1968 through 1971 was 2.78 employees per department.

When the data were examined, the companies in the western region were found to have reported no increases in the number of employees during 1971. In the same period, the southwestern region experienced a growth of 1.66 employees per department; this is higher than the national average. During the three years prior to this, in which the net gain nationally was 2.78 employees per department, the southeastern region reported an average net gain of .95 employee.

#### GRAVURE PLATEMAKING

Of the total number of survey respondents, 19 companies, or 2 percent, reported that they had gravure platemaking departments. The average age of employees in these departments was 43.9 years, the oldest reported for any production area. An average of 22.8 persons worked in each department. During 1971, 1.24 employees were hired for each department, while 1.5 employees left. For the year, then, companies experienced a

OPERATIONS 1963-71 - continued

net loss of 1.19 employees. The net gain for 1968 through 1971 was 1.33 employees.

#### GRAVURE PRESSWORK\*

Of the 1,033 survey respondents, 21 companies, or 2 percent, reported that they had gravure presswork departments. The average age of employees in these departments was 41.5 years. An average of 5.40 employees worked in each of these gravure presswork departments. In 1971, companies reported a net loss of 3.23 employees per department. In the preceding three years, however, companies experienced a net gain of 13.09 employees per department.

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\*While the data for gravure platemaking and presswork given above accurately represented information taken from the survey forms, several factors must be taken into account. The data seemed to indicate that gravure printing experienced greater net gains during the three-year period and greater net losses during the one-year period than any other production area. This was due to two large companies that reported substantial increases in the number of employees from 1963 to 1971. (These may have been two new companies that were hiring start-up personnel.) These same companies reported large net losses of employees during 1971. Because relatively few gravure printers responded to the survey, these two companies caused a great deviation in the data from the norms established by the rest of the industry. It would seem, therefore, that there is a need for further study of gravure printing before meaningful conclusions can be drawn.

SCREEN PROCESS PLATEMAKING

SCREEN PROCESS PLATEMAKING

Screen process platemaking departments were found in 27 companies, representing 2.93 percent of the survey respondents. The average age of employees in these departments was 31 years. In these departments, 1.52 persons were employed, on the average. The average number of persons hired for screen process platemaking in 1971 was .67 employee per department; .08 person per department left during the same year, resulting in a net gain of .59 person per department in 1971. The net gain for the three-year period, however, was .37 employee per department.

Companies in the southwestern region reported that in 1971, the net gain in screen process platemaking departments was 1.43 employees per department. These same companies also reported an increase of .71 employee per department during the three years prior to 1971. Companies in the western region reported neither an increase nor a decrease for either the one-year period or the three-year period.

#### SCREEN PROCESS PRESSWORK

It was reported that 25 companies, or 2.42 percent of the survey respondents, had screen process presswork departments. The employees in these departments were reported to be the youngest of any production area surveyed, their average age being 30 years. An average of 6.16 employees worked in screen process presswork departments. In 1971, 2.56 employees were hired, while 1.52 employees left. The net gain for the year was 1.04 employees per department. For the previous three years, the net gain was 1.3 employees per department.

QUESTIONS 16-20 - continued

During 1971, the eastern region was found to have a net gain of 1.8 employees in screen process presswork departments. The smallest increase was reported by companies in the southeastern region, which reported a net gain of only .30 employee per department for that year. Companies in the eastern region reported gaining a substantial number of employees during 1971, but in the three years prior to that time, they experienced a net loss in the number of employees per department. During 1968 to 1970 companies in the midwestern region reported the highest net gain of all the regions. The screen process press departments in that region increased by 4.1 employees per department. In the western and eastern regions, a decline in the number of employees was reported. For the western region, this net loss was 2.5 employees per department; for the eastern region, the loss was .60 employee per department.

#### BINDERY AND FINISHING

The third most common department in the graphic arts industry was the bindery and finishing department; 535 companies, or 51.79 percent of the respondents, reported employing personnel for bindery and finishing operations. The average age of employees in these departments was 40.3 years. An average of 9.88 persons were employed in each department. In 1971, companies reported hiring an average of 1.63 persons for the bindery and finishing department. They also reported that an average of 1.76 persons left these departments during the same year. The result is a net decrease of .13 employee per department for the year. For the three-year period, the companies reported a net increase of 1.54 employees per department. The western region was found to have the smallest net gain in the number of bindery and finishing employees, with an increase of only .17 employee per department.

## SALES PERSONNEL

### SALES

Sales personnel were employed by 448 companies, or 43.37 percent of the survey respondents. The average age of sales employees was 39.3 years. The average number of persons working in each sales department was 3.92 employees. In 1971, companies hired an average of .69 employee per department. In the same year, an average of .32 employee per department left, resulting in a net gain of .37 employee per sales department. In the previous three years, the net gain in these departments was 1.03 employees per department. Fifty percent of the companies with sales departments reported that the number of employees had increased, while only 15 percent reported that the number of sales employees had decreased.

### MANAGEMENT

Management personnel were employed by 386 companies, or 56.72 percent of the survey respondents. The average age of management personnel was 42 years. On the average, 4.22 persons per company were employed for management. In 1971, companies hired an average of .37 employee per department; .27 employee per department left during the same year. The net gain for the year was only .11 employee per department. However, in the three years prior to 1971, companies experienced a net loss of .26 employee per management department.

It is evident that the decrease in management personnel from 1968 to 1971 occurred in the large companies. The net loss averaged 2.06 employees per department. These decreases occurred mainly in the eastern region, where companies reported a net loss of 3.59 employees per department. By

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1971, however, the employment situation for management personnel in the eastern region appeared to have stabilized.

## QUESTIONS 21-27

21. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
22. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
23. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
24. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
25. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
26. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.
27. THE NUMBER OF EMPLOYEES IN EACH AREA HAS: INCREASED, DECREASED, NOT CHANGED.

## LAYOUT AND DESIGN

Of all the respondents who reported having a layout and design department, 18 percent had added that department within the last three years. Approximately 82 percent of the survey respondents used trade services for layout and design work. Of these companies, 51 percent reported that the



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use of such services had increased, and 31 percent indicated that usage had not changed since 1968.

According to 35 percent of the respondents, the desired education level for new employees in layout and design departments was a general high school education; 32 percent, however, desired these employees to have a community or technical college background.

The technical knowledge requirements for layout and design had increased during the last three years, according to 72 percent of the respondents. About 26 percent reported no change in technical knowledge requirements for this production area. Seventy percent of the companies also reported that since January, 1968, job skill requirements had increased, while 28 percent said that skill requirements had not changed.

Automation has had little apparent effect on the number of personnel in layout and design departments.

#### PASTE-UP AND COPY PREPARATION

Approximately 16 percent of the respondents who reported having a paste-up and copy preparation department had added that department during the last three years. More than 75 percent of the respondents used trade services for paste-up and copy preparation. Of these, 60 percent said that the use of such services had increased, and 25 percent reported that usage had not changed.

QUESTIONS 21-27 - continued

The desired education level for new employees in paste-up and copy preparation departments was reported as being the high school level, 46 percent of the respondents favoring a general education, and 27 percent favoring a vocational education. It is interesting to note that 21 percent of the companies specified a community or technical college education for new employees in this production area.

The companies indicated that in the last three years the technical knowledge requirements for paste-up and copy preparation had increased. This was the opinion of 70 percent of the respondents. About 28 percent said that requirements had not changed. Job skill requirements had also increased, according to 66 percent of the companies; 30 percent reported that job skill requirements had not changed during the past three years.

Automation had not affected the number of employees in paste-up and copy preparation departments.

#### CAMERAWORK

Camerawork departments had been added in the last three years by 14 percent of the companies that reported having such departments. About 82 percent of the responding companies used trade services for camerawork. Of these, 56 percent indicated that the use of such services had increased; however, 23 percent reported a decrease in the use of trade services for camerawork.

Companies indicated that they desired new camera operators to have a high school education, 43 percent specifying a general education and 32

1968-1977 - number  
percent requiring a vocational education. Another 22 percent of the  
panies indicated that new camera operators should have a minimum of  
technical college background.

According to 79 percent of the respondents, technical knowledge required  
in the camerawork area had increased. About 73 percent of the compa-  
nies also agreed that job skill requirements had increased.

Apparently, automation has had little effect on the number of employees  
in camerawork departments.

#### STRIPPING

Eleven percent of the survey respondents who had stripping departments  
had added these departments within the last three years. Trade services  
were used for stripping by 68 percent of the responding companies. More  
than half of these companies reported that the use of trade services for  
stripping had increased since January, 1968, while 21 percent reported  
that usage had decreased.

Again, a high school education was specified by employers; 47 percent  
wanted employees to have a general high school education, and 35 per-  
cent wanted their stripping personnel to have a vocational high school  
education. About 21 percent of the companies reported that the desired  
education level for new stripping personnel was community or technical  
college.

QUESTIONS 21-27 - continued

The technical knowledge required for stripping had increased, according to 67 percent of the companies, while 31 percent reported that requirements had not changed. Job skill requirements for stripping personnel had also increased since 1968, according to 63 percent of the respondents; 34 percent indicated, however, that skill requirements had not changed.

Automation apparently had little effect on the number of employees in stripping departments.

#### PHOTOGRAPHIC AND STRIKE-ON COMPOSITION

It is significant to note that of the survey respondents who reported having photographic and strike-on composition departments, 27 percent had added those departments since January, 1968. Trade services were used for this production area by 77 percent of the companies, however. Of those companies that used trade services, 65 percent said that the use of the services had increased, while 21 percent reported that usage had decreased.

The desired education level for new personnel in photographic and strike-on composition departments was general high school, according to half of the respondents; 28 percent of the companies required a vocational high school education.

Technical knowledge requirements had increased, according to 78 percent of the respondents. Twenty percent reported that requirements had not changed during the past three years. Job skill requirements had increased since January, 1968, 73 percent of the companies reported, while 22

POSITIONS 21-27 - continued

percent of the companies said that skill requirements had not changed.

Automation, generally, had not resulted in a change in the number of photographic and strike-on composition employees. However, 25 percent reported that the number of employees had increased because of automation.

#### HOT METAL COMPOSITION

Only 3.4 percent of the survey respondents who reported having a hot metal composition department had added that department in the last three years. Another 2.8 percent of the survey respondents had eliminated hot metal composition departments during the same period. About 82 percent of the companies reported using trade services for hot metal composition. Of these, 41 percent said that the use of these services had decreased, 32 percent reported that usage had not changed, and only 27 percent reported an increase in usage of trade services.

Half of the companies desired that new employees have at least a general high school education; 35 percent required a vocational high school education.

Since January, 1968, technical knowledge requirements for hot metal composition had not changed, according to 56 percent of the respondents, while 38 percent said that requirements had increased. More than half of the respondents indicated that job skill requirements had not changed; 40 percent reported that they had increased.

QUESTIONS 21-27 - continued

Seventy percent of the companies reported that automation had not changed the number of employees in hot metal composition departments. However, 24 percent of the companies indicated that due to automation, the number of employees in hot metal composition departments had decreased.

#### IMPOSITION AND LOCK-UP

Of the survey respondents who reported having an imposition and lock-up department, only 1.3 percent had added that production area since January, 1968. However, 1.4 percent of the responding companies indicated that they had eliminated imposition and lock-up departments during the same period. About 42 percent of the respondents used trade services for imposition and lock-up. Of these, half said that the use of such services had not changed, 27 percent said that usage had increased, and 23 percent reported a decrease in usage.

The majority of respondents desired that new employees in this production area have at least a high school education, 45 percent preferring a general high school education and 39 percent specifying a vocational high school education.

According to 42 percent of the companies, technical knowledge requirements had increased during the past three years, while 53 percent reported no change. Job skill requirements had not changed during the same period, according to 54 percent of the companies. Forty percent said that job skill requirements for imposition and lock-up had increased.

PAGES 21-27 - continued

The majority of companies agreed that automation had not affected the number of employees in this production area.

#### OFFSET PLATEMAKING

About 7.5 percent ~~of the~~ companies that reported having an offset platemaking department had added that department during the past three years. During that time, trade services were used by 63 percent of the survey respondents. Of these, 54 percent reported that the use of trade services for offset platemaking had increased, while 30 percent reported that it had not changed.

Again, 50 percent of the companies desired that new offset platemakers have at least a general high school education, with 34 percent specifying a vocational high school education.

Requirements for technical knowledge, in the opinion of 65 percent of the respondents, had increased since 1968. Thirty percent reported that these requirements had not changed. During the same period, job skill requirements had also increased in offset platemaking, according to 61 percent of the respondents; 34 percent felt that job skill requirements had not changed.

Automation did not appear to influence the number of employees in these platemaking departments.

#### OFFSET PRESSWORK (S. D)

Of the respondents who reported having a sheet-fed offset press depart-

... 50 percent of them that department in the last three years. 19 percent of these companies reported using trade services for sheet-fed offset presswork. Of these companies, 55 percent reported an increase in usage of trade services and 31 percent reported no change.

General high school and vocational high school were specified as the desired education level for new sheet-fed offset press operators by 40 percent and 37 percent of the respondents, respectively.

According to 69 percent of these companies, technical knowledge requirements for sheet-fed offset press operators had increased during the last three years. About 28 percent of the companies reported that requirements had not changed. Since January, 1968, job skill requirements had increased, according to 66 percent of the departments, while 29 percent reported no change.

Automation reportedly had no effect on the number of sheet-fed offset press operators.

#### OFFSET PRESSWORK (WEB-FED)

Of the companies that reported having web-fed offset press departments, 19 percent had added that department within the last three years. About 43 percent of the companies used trade services for this type of work. Of these companies, 55 percent said that usage had increased since 1968, while 31 percent said that usage had decreased.



## QUESTIONS 21-27 - continued

The desired education level of new web-fed offset press operators was general high school; this was reported by 45 percent of the companies. Vocational high school education was preferred by 45 percent of the companies.

Seventy percent of the respondents said that technical knowledge requirements for web-fed offset press operators had increased since January, 1968; 27 percent reported no change, however. Again, 69 percent reported that job skill requirements had increased during the same three-year period, while another 27 percent reported no change.

Automation, once again, had little effect on the number of web-fed offset press operators.

## LETTERPRESS PLATEMAKING

Of the survey respondents who reported having a letterpress platemaking department, only 2.1 percent had added that department in the last three years. During the same period, 1.1 percent of the survey respondents indicated that they had eliminated this production area. About 53 percent of the respondents reportedly used trade services for letterpress platemaking. Of these, 37 percent said that their usage of such services had decreased, and 32 percent said that the use of trade services had increased or had not changed.

The companies desired that new platemakers have at least a general high school education; this was specified by 59 percent of the respondents. Another 25 percent required a vocational high school education.

## QUESTIONS 21-27 - continued

In the last three years, technical knowledge requirements for letterpress platemakers had increased (according to 56 percent) or had not changed (according to 41 percent). It was reported by 56 percent of the companies that job skill requirements had also increased, while 39 percent indicated that requirements had not changed.

Automation had little effect on the number of letterpress platemakers.

## LETTERPRESS PRESSWORK

Of the survey respondents who reported having letterpress press departments, only 3 percent reported that this production area had been added since January, 1968. About 64 percent of the respondents reported using trade services for letterpress presswork. Of these companies, 41 percent reported that their use of such services had not changed in the last three years, and 32 percent reported that usage had increased. However, 28 percent of the companies reported a decrease in the use of trade services for letterpress presswork.

As for the desired education level of new letterpress press operators, 49 percent of the companies specified a general high school education, while 36 percent preferred a vocational high school education.

Since January, 1968, technical knowledge requirements for letterpress presswork had not changed, according to 52 percent of the respondents, while 40 percent reported an increase in requirements. As for job skill requirements, 53 percent reported no change in the past three years, while 41 percent reported an increase.

## QUESTIONS 21-27 - continued

Automation apparently had no effect on the number of employees in this production area.

## FLEXOGRAPHIC PLATEMAKING

Thirteen percent of those companies having a flexographic platemaking department had added that production area in the last three years.

Only 17 percent of the respondents reported using trade services for flexographic platemaking. Of these, 55 percent indicated that the use of these services had not changed, while 32 percent reported that usage had increased.

More than half of the companies reported that the desired education level for new flexographic platemakers was general high school. About 28 percent specified a vocational high school education.

Approximately 48 percent of the companies reported that technical knowledge requirements had not changed and another 48 percent indicated that they had increased. An increase in job skill requirements was reported by 77 percent, while 23 percent reported no change in requirements during the last three years.

The number of employees in flexographic platemaking departments remained relatively unchanged, according to 79 percent of the respondents; however, 16 percent of the companies reported that automation had caused a decrease in the number of flexographic platemakers.

## QUESTIONS 21-27 - continued

## FLEXOGRAPHIC PRESSWORK

About 4.8 percent of the respondents who reported having a flexographic presswork department had added that department since January, 1968.

During that same period, 16 percent of the respondents reported using trade services for flexographic presswork. Of these companies, 60 percent indicated that their usage of such services had not changed and 25 percent indicated that usage had increased.

For new employees in this production area, the respondents specified that a high school education was desirable; 44 percent of the respondents specified a general education, while 44 percent specified a vocational education.

Since January, 1968, technical knowledge requirements for flexographic presswork had increased, according to 69 percent, and 31 percent said that requirements had not changed. Job skill requirements apparently had increased during the same three-year period, according to 77 percent of the respondents; 23 percent reported no change in requirements.

Automation was reported to have little effect on the number of flexographic press operators.

## GRAVURE PLATEMAKING

Five percent of the respondents who reported having a gravure platemaking department had added that production area during the last three years. About 16 percent of the responding companies reported using trade services for gravure platemaking. Of these, 55 percent indicated

## QUESTIONS 21-27 - continued

unchanged usage of trade services, while 27 percent reported increased usage.

Again, a general high school education was favored for new gravure platemakers by 48 percent of the companies. About 37 percent favored a vocational high school education.

The technical knowledge requirements for gravure platemakers had increased, according to 55 percent of the companies; 41 percent said that requirements had not changed during the last three years. Increased job skill requirements were reported by 65 percent of the companies, while 35 percent indicated that requirements had not changed.

Automation had a negligible effect on the number of gravure platemakers, with 81 percent of the companies reporting no change in the number of employees and 19 percent reporting a decrease.

## GRAVURE PRESSWORK

Of the companies that reported having a gravure presswork department, 14 percent had added that production area in the past three years. Fifteen percent of the responding companies indicated that they used trade services for gravure presswork. Of these companies, 63 percent reported that the use of such services had not changed, while increased usage was reported by 21 percent. Sixteen percent, however, indicated a decrease in usage of trade services for gravure presswork.

## QUESTIONS 21-27 - continued

A high school education was desired for new gravure press operators, with a general education favored by 47 percent and a vocational education favored by 41 percent.

During the last three years, technical knowledge had increased, according to 58 percent of the companies; no change in technical knowledge requirements was indicated by 36 percent. During the same three-year period, 63 percent of the companies indicated that job skill requirements had increased. About 31 percent said that requirements remained unchanged.

Automation had no apparent effect on the number of employees in gravure presswork departments.

## SCREEN PROCESS PLATEMAKING

Of the survey respondents who reported having a screen process platemaking department, 24 percent had added that production area within the last three years. About 26 percent of the survey respondents used trade services for screen process platemaking. Of these, 65 percent indicated that the use of these services had not changed, 19 percent reported that usage had decreased, and only 16 percent reported increased usage.

The desired education level for new screen process platemakers was general high school; 44 percent of the companies specified this level of education. Vocational high school education was favored by 37 percent of the companies.

## QUESTIONS 21-27 - continued

Since January, 1968, technical knowledge requirements had increased, according to 61 percent of the companies, or had not changed, according to 32 percent. Of the companies surveyed, 68 percent said that job skill requirements had increased during the past three years, while 30 percent reported a decrease in requirements during the same three-year period.

Automation apparently had little effect on the number of screen process platemakers.

## SCREEN PROCESS PRESSWORK

It is significant to note that 20 percent of the companies that reported having a screen process presswork department had added that department since January, 1968. Thirty percent of the respondents used trade services for screen process presswork. Of these, 59 percent reported that usage had not changed, 24 percent reported increased usage, and 17 percent reported decreased usage of trade services.

A general high school education was favored by 47 percent of the companies; 26 percent specified a vocational high school education for new screen process press operators.

A quarter of these respondents reported that technical knowledge requirements for screen process presswork had not changed, while 66 percent reported an increase in technical knowledge requirements since January, 1968. Job skill requirements, however, had increased, according to 75 percent of the companies. About 19 percent reported no change in requirements.

## QUESTIONS 21-27 - continued

Automation had slight effect on the number of screen process press operators, with 15 percent of the companies reporting a decrease in employment in this production area.

## BINDERY AND FINISHING

Of the survey respondents who reported having a bindery and finishing department, 8.3 percent had added that department since January, 1968. It is interesting to note that 83 percent of the respondents used trade services for bindery and finishing. Of these, 55 percent reported increased usage of trade services, 29 percent reported that usage had not changed, and 16 percent reported a decrease in the usage of trade services for bindery and finishing work.

Again, 62 percent of the companies desired that new bindery and finishing personnel have a general high school education, while 23 percent specified a vocational high school education. About 56 percent of the companies reported that in the last three years technical knowledge requirements for bindery and finishing work had increased, and 41 percent reported that requirements had not changed. Job skill requirements had increased, too, according to 52 percent of the companies; 42 percent reported no change in requirements during the three-year period.

Automation had a slightly negative effect on the employment levels for bindery and finishing personnel. While 76 percent of the companies reported no change in employment levels, 15 percent reported that automation had caused a decrease in the number of bindery and finishing personnel.



## QUESTIONS 21-27 - continued

## SALES

Of the companies that reported having sales departments, 6.2 percent had added that area since January, 1968. Trade services were used in by 46 percent of the companies surveyed. Of these, 48 percent reported increased usage and 46 percent reported that usage of these services had not changed.

For sales personnel, a college or university education was desired by 47 percent of the responding companies. Another 28 percent specified a community or technical college background.

It is significant to note that 78 percent of the companies reported that the technical knowledge requirements for sales personnel had increased since 1968; 21 percent said that there had been no change in requirements. Significant, too, is the fact that 72 percent of the responding companies indicated that job skill requirements had increased, while 27 percent reported that requirements had not changed.

## MANAGEMENT

Of the companies that reported having a management department, only 2.8 percent had added that department in the last three years. Approximately 45 percent of the respondents reported using trade services in the management area. Of these, 51 percent reported that usage of such services had not changed and 45 percent reported increased usage.

A college or university education was the desired education level for management personnel; 55 percent of the companies specified this level

QUESTIONS 21-27 - continued

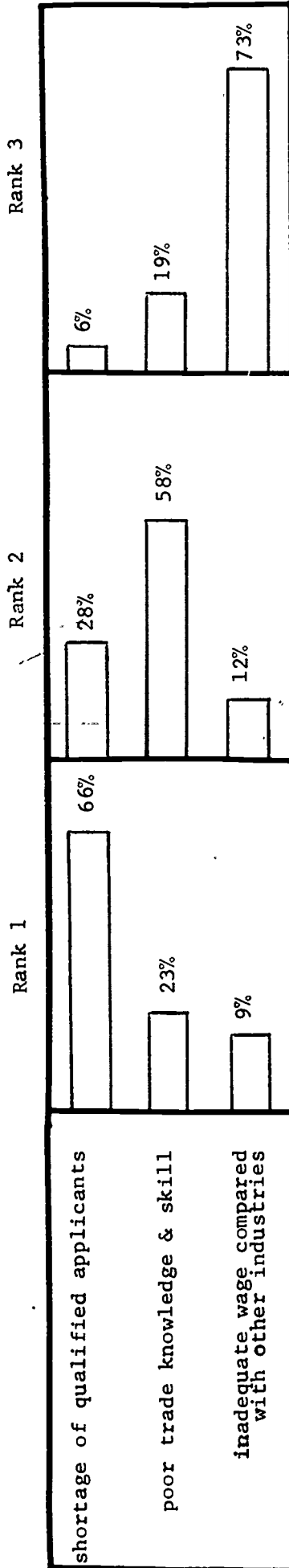
of education. Approximately 22 percent specified a community or technical college background for new management personnel.

It is significant to note that 80 percent of the responding companies reported that technical knowledge requirements for management personnel had increased, while 19 percent reported no change. Significant, too, is the fact that 75 percent reported that job skill requirements had increased; 23 percent reported no change..

RANK EACH ITEM BY PLACING A NUMBER IN THE SPACE PROVIDED AT THE LEFT OF THE ITEMS. (THE MOST IMPORTANT ITEM TO YOU WOULD BE 1, SECOND MOST IMPORTANT ITEM 2, ETC.)

**QUESTION 28**

PROBLEMS IN THE EMPLOYMENT OF SKILLED OCCUPATION PERSONNEL:

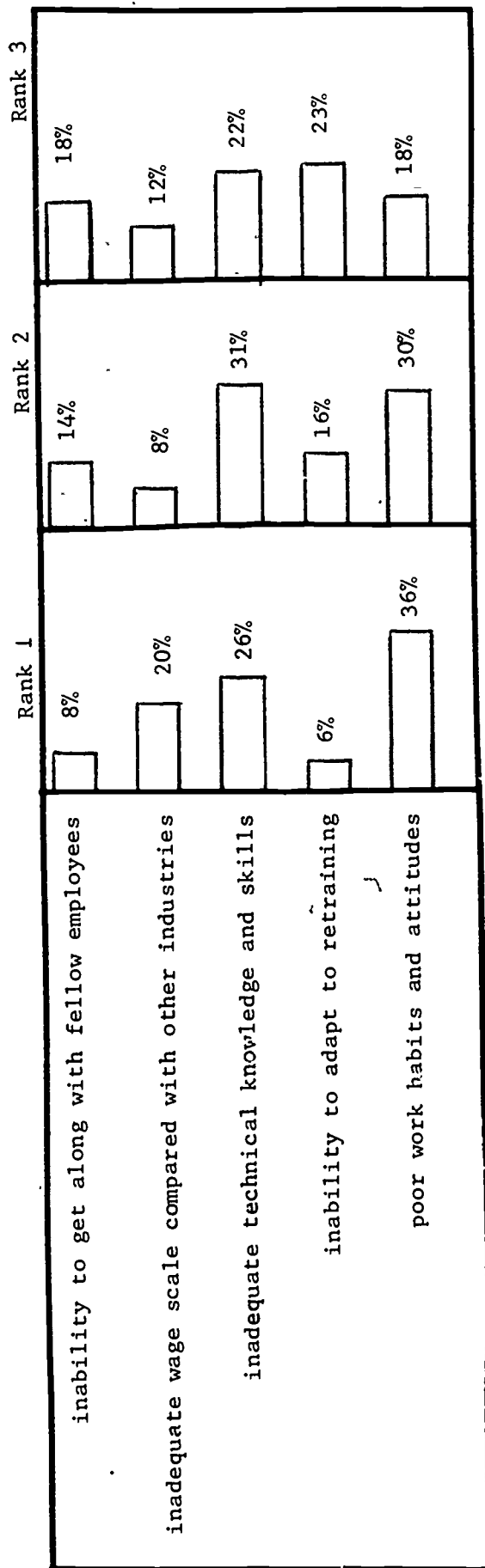


The most significant problem in the employment of skilled occupation personnel was the shortage of qualified applicants. Although the shortage appeared to be prevalent in larger companies, it generally affected all regions and all company sizes. While the shortage of qualified applicants was still ranked first by small companies, there was a shift of emphasis from shortage of qualified applicants to poor trade knowledge and skill. Consistently ranked third was inadequate wage scale compared with other industries.

Please note that the category of "others" has been left off the graphs for Questions 28-37 for the sake of convenience. Responses in that category were never greater than 5 percent.

## QUESTION 29

### PROBLEMS IN THE RETENTION (HOLDING) OF SKILLED OCCUPATION PERSONNEL:

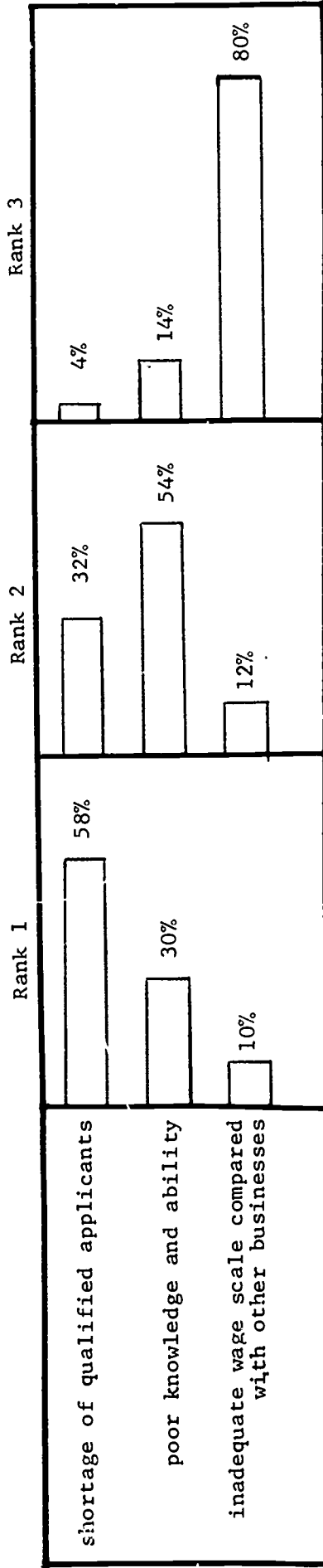


Survey respondents indicated that the most significant selections. There were no clear-cut differences among the other listed problems.

problem in the retention of skilled occupation personnel was poor work habits and attitudes. Inadequate technical knowledge and skill and inadequate wage scale, however, were also identifiable problems in the first-ranked

The data illustrated no significant differences in ranking among the various company sizes and locations.

PROBLEMS IN THE EMPLOYMENT OF SALES PERSONNEL:



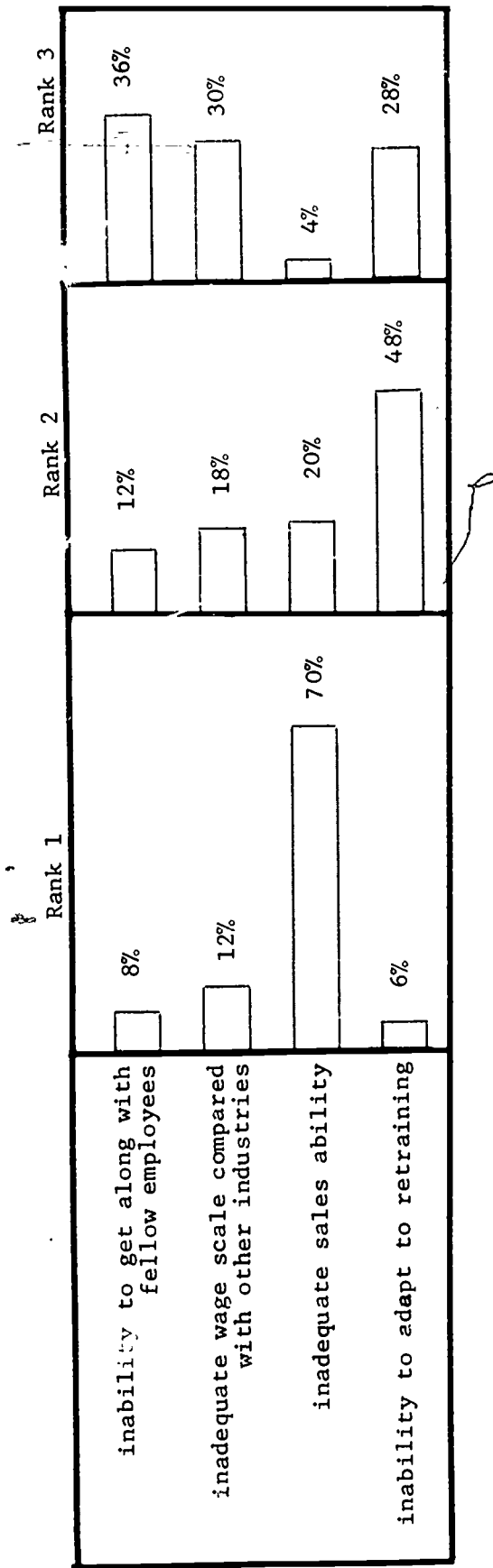
The shortage of qualified applicants was the most significant problem in the employment of sales personnel. Survey respondents reported poor knowledge and ability as the next most important problem.

tance by the survey respondents. However, according to the data, it did appear to be emphasized more by small companies than by large companies. It was also apparent from data obtained from the rankings and from comments written on the survey forms that small companies frequently had more trouble than large companies in obtaining and retaining personnel.

There is further evidence here that inadequate wage scale was generally not considered to be a problem of great impor-

**QUESTION: 31**

*PROBLEMS IN THE RETENTION OF SALES PERSONNEL:*



4

The most significant problem in the retention of sales personnel was inadequate sales ability. Although this problem appeared to increase with an increase in company size, it was generally true for all company sizes and all regions.

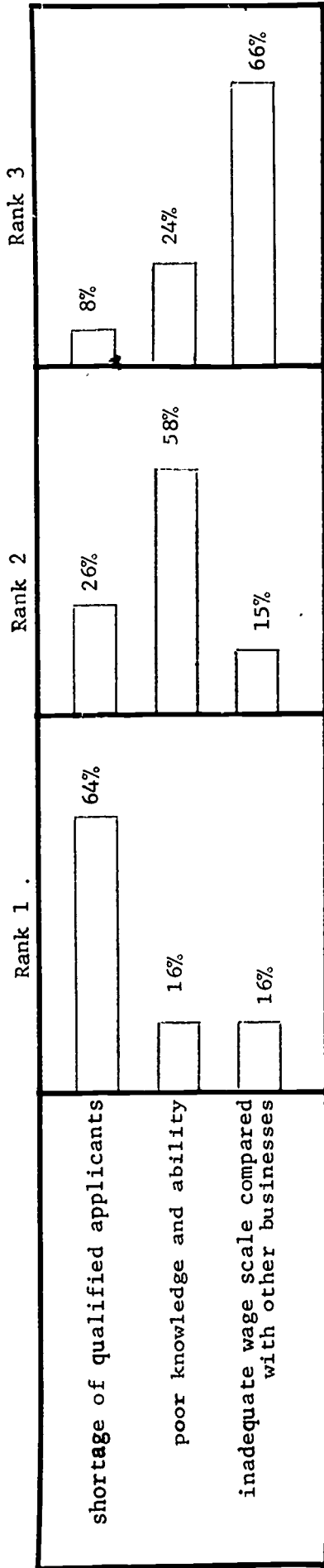
inability of sales personnel to adapt to retraining. This problem diminished with a decrease in company size.

Small companies indicated that inadequate wages were an important problem in the retention of sales personnel. This problem decreased as company size increased.

Large companies reported having greater problems with the

**QUESTION 32**

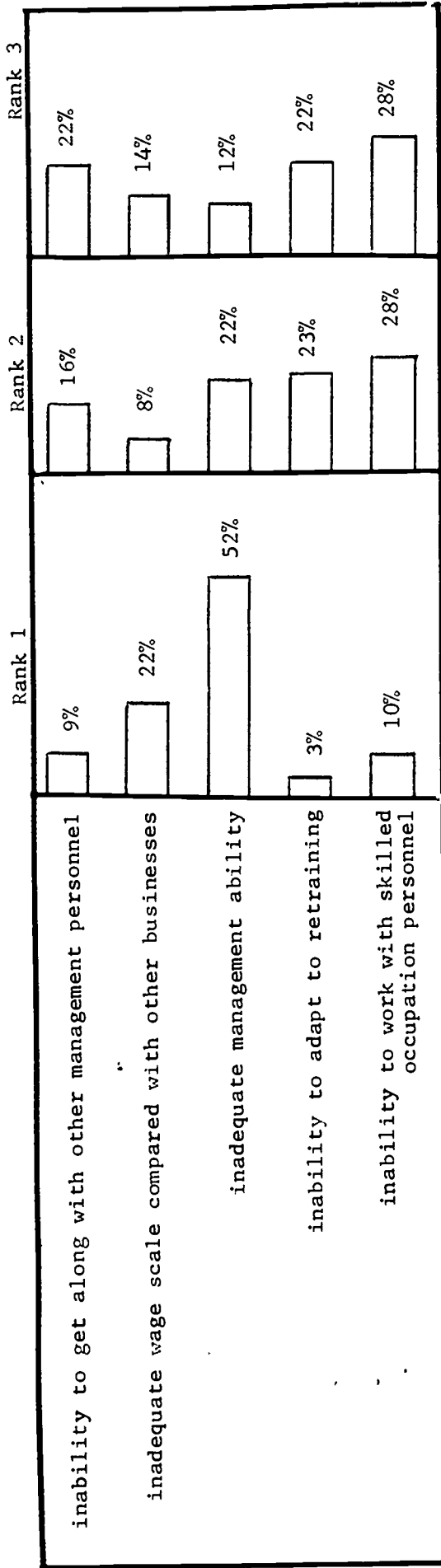
*PROBLEMS IN THE EMPLOYMENT OF MANAGEMENT PERSONNEL:*



Survey respondents reported that the shortage of qualified applicants was the most serious problem in the employment of management personnel. The problem of inadequate wage scale diminished in importance when compared to poor knowledge and ability, which was selected as the most significant problem in the second ranking. This was further evidence that inadequate wage scale was not of primary importance. However, small companies placed more emphasis on inadequate wage scale than large companies.

**QUESTION 33**

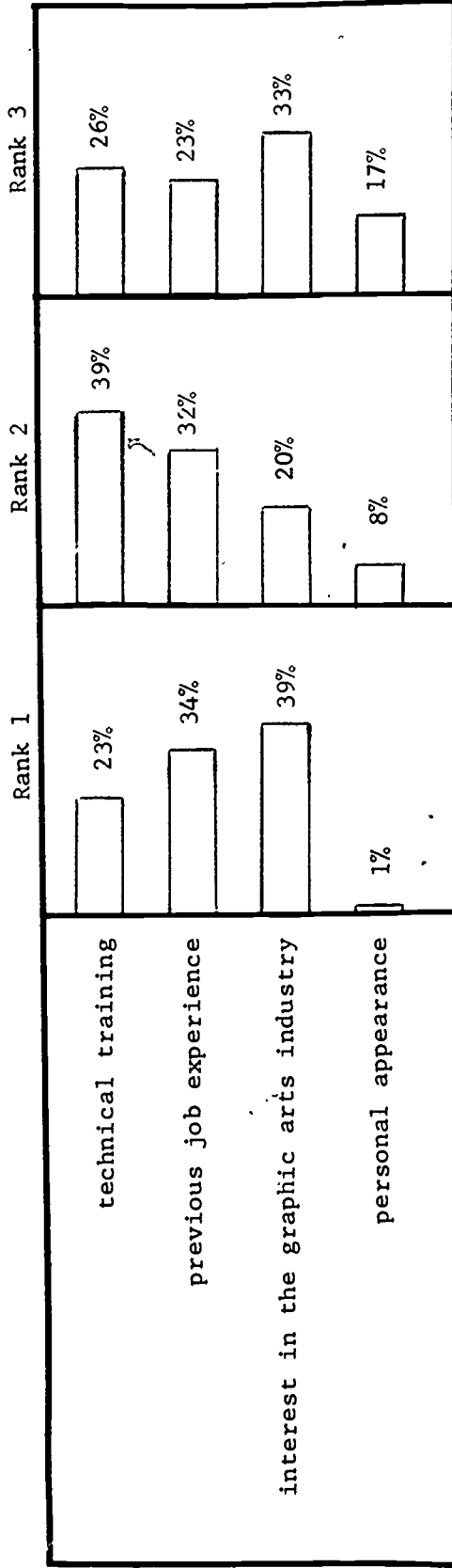
*PROBLEMS IN THE RETENTION OF MANAGEMENT PERSONNEL:*



Inadequate management ability was regarded by the majority of survey respondents as the single most important problem in the retention of management personnel. This was true for all company sizes and for all regions. The second most critical problem reported was inadequate wage scale; small companies reported this problem with slightly more frequency than large companies. A third significant problem appeared to be an inability of management personnel to work with skilled occupation personnel. This problem was unrelated to company size or location.



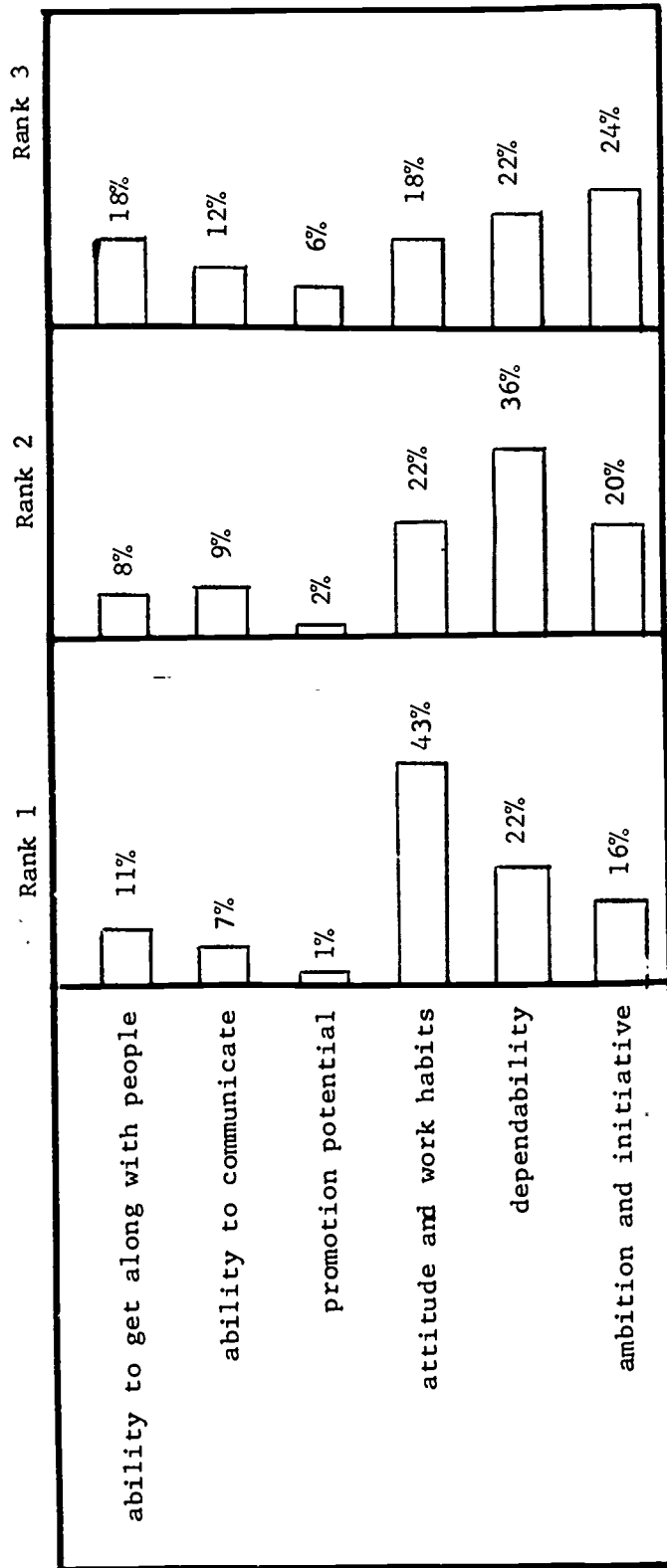
## QUESTION 34

DESIRABLE CHARACTERISTICS IN THE INITIAL EMPLOYMENT OF ALL PERSONNEL:

The majority of survey respondents indicated that the most desirable characteristic in the initial employment of all personnel was an interest in the graphic arts industry. However, previous job experience and technical training were ranked as desirable characteristics closely behind interest in the graphic arts industry. In the second ranking, survey respondents placed emphasis on the desirability of technical training, followed by previous job experience and interest in the graphic arts industry. No apparent differences among the responses of the various company sizes and locations were disclosed by the data. Employers evidently were more concerned with substantive matters such as a prospective employee's training and experience than with his personal appearance. The negligible importance of this item was reflected by the survey results.

**QUESTION 35**

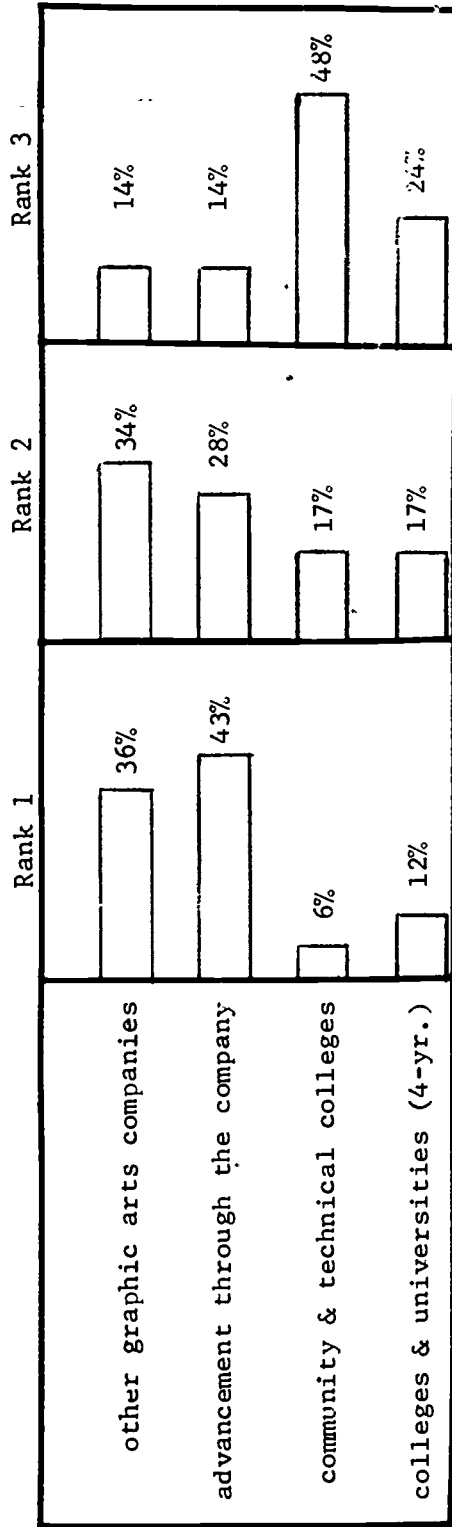
*DESIRABLE CHARACTERISTICS IN THE RETENTION OF ALL PERSONNEL:*



Attitude and work habits were consistently ranked higher than dependability and ambition and initiative as desirable characteristics in the retention of all personnel. Dependability, however, ranked the second highest ranking, and ambition and initiative the third highest ranking.

Survey respondents seemed to indicate that as employers they were more concerned with employee characteristics that helped maintain the smooth functioning of the graphic arts industry (such as attitude, work habits, and dependability) than with those that promised future promotability.

## PREFERRED SOURCES OF SALES STAFF:

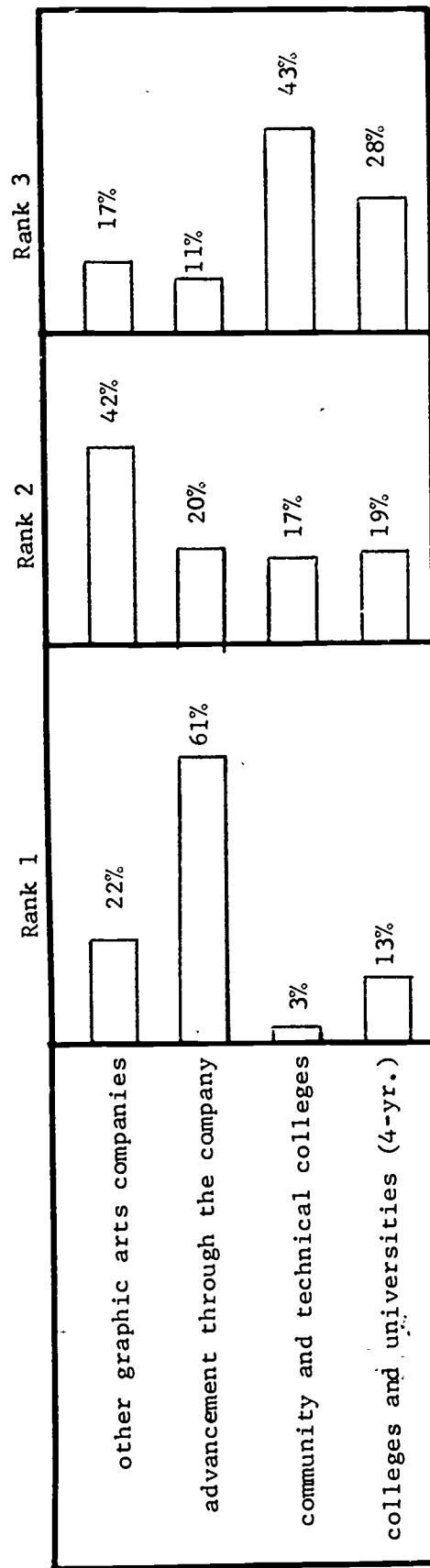


According to the survey respondents, the preferred source of company sales staffs was advancement through the company. Other graphic arts companies were ranked slightly lower as a preferred source. This data revealed that experience was more desirable to employers than formal education. Although educational institutions were always ranked lower than the graphic arts industry as a source of sales staffs, it is interesting to note that large companies demonstrated a slight preference for four-year institutions as a source of sales staffs, while small companies seemed to prefer community and technical colleges.

It is also interesting to compare regional responses to this item. As always, the graphic arts industry was ranked highest as a preferred source. However, the data concerning educational institutions indicated that regions known to have a large number of community and technical colleges ranked these higher than four-year institutions. Conversely, regions in which four-year colleges and universities were prevalent ranked these institutions higher than community and technical colleges.

### QUESTION 37

#### PREFERRED SOURCES OF MANAGEMENT STAFF:



As a preferred source of management staff, advancement far behind the graphic arts industry as a preferred source. through the company was favored very strongly by the survey respondents. This again revealed that as employers the survey respondents favored experience over formal education. All regions second in preference. Educational institutions were ranked and all company sizes indicated similar levels of preference.

## COMMENTS

*At the end of the survey form, space was provided for respondents to comment on the study or on the need for people in their plant or the graphic arts industry as a whole. Below are some of the more interesting comments that were received. They appear just as they were taken from the survey forms.*

- "Very happy to help. We need help. Ours is a dying industry. No one wants to get their hands dirty. Most high school graduates are going to college and others are pursuing jobs in industry where no apprenticeship is needed. Also wage scale is considerably higher. Craftsmanship and skill is out the window. The almighty dollar comes first!"
- "The vocational high schools should have a strengthened curriculum and more services to students and also lengthened programs for students."
- "There seems to be a problem of attracting high caliber trainees into the industry because of inadequate pay scales from apprentices to journeymen. Potential candidates can enter semi-skilled occupations such as truck driving and earn comparable pay scales in very short time."
- "Shortage of highly motivated, technically competent graphic arts people."
- "Our situation is unique. Everybody does everything. We have all learned the skills necessary for a small in-plant printing department."

- "I do feel that the graphic arts training received in high schools, especially in this area, should be required to place more emphasis on offset printing and cold-type composition. As a former member of apprentice committee of typographical union, I think schools could improve students spelling and punctuation skills."
- "Employees are difficult to obtain even in cyclically depressed times such as this, coupled with large union unemployment."
- "Tough competition keeps profits down and wages down. Labor is not paid in proportion to other industries."
- "Screening techniques desirable to eliminate turnover; select applicants who can develop skills."
- "Basically the whole industry has too many union card carrying members who are technically not qualified."
- "We are a small company. We train our men mostly and then they leave for better advancement, which I can't blame them. That is a problem with small commercial shops."
- "The most critical shortage in the industry lies in the sales end. Talented, well trained and knowledgeable sales people are difficult to contact, let alone hire. This is most closely followed by a lack of well-trained, enthusiastic people in skilled occupations. The prevalent attitude is 'how much can I get, and for how little effort, after all, look how much "they" are getting for doing so little'."

- "Poor company image of job requirements, both salary and equipment advancements."
- "Although we would prefer to hire more ~~qualified~~ people in any of our production areas, we usually wind up hiring someone with little experience and training them."
- "Personnel are available, but professionals are scarce. This industry needs to develop men who have pride in their profession. Not machinists, but skilled craftsmen. How to accomplish this? I don't know. Obviously something industry-sponsored and supported."
- "The small commercial shop (backbone of the industry) cannot find enough people desirous of learning the trade from the bottom up. Result will be a dearth of printers in not too distant future."
- "Being located in small city, the general problem of available trained personnel is definitely limited. Congratulations on this study -- it couldn't do anything but good."
- "We have found that the majority of individuals interviewed for positions want too much money for little or no skill. Skilled personnel want what only a unionized organization could supply. Vocational schools are not training students in up-to-date technology and methods."

- "Printing has changed in quality until help of a few years back cannot do the work of today! And wages have risen for qualified workers to a point that it is an impossible situation! Only persons directly involved in business are staying with us (owners, etc.)."
- "The industry, like all others, needs people that will take pride in their work, besides just collecting their wages at the end of the week."
- "Production areas: We employ multi-skilled people (examples: cameras, stripping, platemaking, one man layout and design personnel. Also do own paste-up and copy preparation). Since 1969 we have decreased personnel 50% but increased production by 30%."
- "Lack of any training ground for management personnel, also most applicants for pressroom jobs are so specialized in their experience they must be retrained to our needs."
- "You seem to stress an inadequate wage scale. Wages are not that different. What we need is an honest hour of work for an hour of pay."
- "Most difficult to find personnel with the integrity to do an honest day's work for an honest day's pay."
- "Would like to know if letterpress is actually fading out of the graphics field. Plenty of help is available but they just do not have any good work habits, and it is all what can the company do for me, never what can I do for the company. I for one would like to know how to get



people to take pride in their work, and not have the attitude that the company is getting rich and they are not getting their share."

- "We find that the printing in-plant shops are falling be'nd other industries in pay scales and this is causing problems in keeping qualified personnel and other related tradesmen."
- "Shortage in skilled employees in die cutting and offset (sheet-fed) presswork becoming increasingly more critical."
- "The schools that are supposed to teach graphic arts do not do so. Almost every college and university have started out to teach, and wind up printing all college and school material to 'save' money."
- "I would hope for a general improvement in the education made available to the high school student who seeks an alternative to a liberal arts education."
- "I would like to see U.S. Government sponsored program similar to program after World War II for apprentice training."
- "A good educational program to sell the industry to our young people and the opportunities it provides. Training facilities where desired skills can be taught."
- "I think the most important problem facing the industry today is the lack of accredited educational institutions, both local and national,

centralizing on computerized phototypesetting and paste-up and layout. A group effort has to be made by all concerned and affiliated with this industry to promote a formal training program so that the people can be kept abreast of technological changes in equipment as well as processes."

- "In this organization, we have gone from billings of \$28,000 in 1964 to billings of over 1/2 million for 1971. The growth is our biggest problem. We are looking for competent men and women who want to "give" in their effort to "receive". Have found shortage of people with 'aggressive attitude,' yet clear thinking."
- "Why all the problems? Any problem personnel eliminate themselves."
- "Our biggest problem is attitude. Pride in one's work has all but disappeared. There is little concern for quality, accuracy or even the condition of machinery and work areas. This lack of interest makes management hesitant about promoting from within, and about purchasing new and expensive machinery."
- "From the viewpoint of a small commercial printer, the old apprentice system is practically non-existent, and unless a young man is under some veterans or other manpower program, he cannot (if married) exist on the low wages paid to someone as a 'learner.' The only solution seems to be vocational-technical schools, and/or in-plant training conducted by an outside firm or organization - as the very small printer does not have the time or facilities."

- "I think a school should be set up to teach graphic arts."
  
- "Employment has been static in this company until now. We are preparing to have to cope with additional volume. Biggest single problem appears to be lack of skilled help coupled with desirable work habits and attitudes of those interviewed to date."
  
- "In our plant, our highly skilled and educated (out of 5 employees, 3 have college degrees), people are trying to put out a quality newspaper with antiquated machinery. Our biggest need is an opportunity to either share or consolidate with area shops in order to afford new equipment. Our overtime is a matter of 'have to' because of machinery which is not dependable and not enough income to change to offset."
  
- "We feel the need to specialize more and to turn to better automated equipment."
  
- "We have a great need in our industry for people who understand enough about each department, in his particular shop or plant, to give a reasonable quote or price to a customer. This is one of the big 'bugaboos' in the graphic arts today -- and why a lot of buyers of printing regard printers on the same level with used car salesmen and auctioneers. I can't say that I blame them if I were buying printing and getting prices double, triple and even more than some other printer quoting from the same specifications."

- "Printers are going to have to get closer together on prices or continue to suffer low profits on investments in the graphic arts. Respect will have to be restored that we once had in our industry. One way that may help would be for a company, such as yours, to send sample estimates to printers. Then, a glaring error could be pointed out and returned to him. I think this would get tremendous interest from printers interested in bettering their positions."
  
- "We try to hire a person who cares about himself, his company and both of their futures. Add to this a desire on their part to do an honest day's work and we can guarantee their success and ours. (Good habits and disciplines.)"
  
- "Lack of technical training facilities in this area."
  
- "More technical training needed."
  
- "99% of our people have extreme difficulty in adjusting to life's responsibilities. Most marriages are unstable. Most of our people are unable to handle money and credit. Most do not comprehend the political and economic factors of life. We have had in the past three drug problem employees. For our size this is unbelievable! Our experience has been that skilled employees can not fulfill management functions upon promotion."
  
- "Frankly believe too much emphasis on large web-fed. Not sufficient prospects for small commercial shops."

- "We are a small operation and, fortunately, have been able to hold our employees. However rising costs and wage demands may change this picture in the near future."
- "The main problems facing small independent owner and operators of printing businesses is obtaining long-term low-interest operating capitol loans and collecting accounts receivable."
- "Unions agree to provide skilled workmen; they are unable to do so. Each time we have had to employ new people they seem to be less efficient and not as well qualified. Attitudes are also a problem. Believe the unions should become more enlightened with regard to problems of management."
- "There is a crying need for trained personnel and even for dependable people with a good work attitude. Many want big pay but aren't worth the money."
- "However the need for well trained personnel is just as great, or greater, than large shops where there are 'many more logs on each wheel'."
- "People in general seem to be afraid to put that little extra into their jobs. I think this is where a lot of advancement and sales ability from within company is lost. Management will not promote people who only do what they get paid for."

- "Sophisticated designs and quality of work demanded today requires dedicated employees with the ability to continue to add to their skills."
  
- "A. Better public relations generally.  
B. Introduction of graphic arts in grade school and junior high school levels.  
C. Communicating the employment needs and opportunities of graphic arts."
  
- "Industry seems to have great specialists, i.e., cameramen, but few generalists who know all operations, i.e., camera, strip, plate, print. More rounded knowledge and work experience in more than one skill is badly lacking."
  
- "I do not believe that it is a question of more people in the industry, but rather a reduction in the number of plants, fewer marginal operations and a better work attitude on the part of most employees. Many published articles today tell how much graphic arts machinery is lying idle. This must be one of the most over-equipped industries in the U.S. today. The industry is not only over-equipped, but also the wage scale (both management and labor) is well beyond the stage where an industry can be judged healthy. All we need to is look at the profit (or loss) picture. We do not need more personnel, but better personnel and fewer of the plants to employ them."

- "Delighted to see this being done. Definition of job classifications is badly needed. Far too little time, money, intelligent effort is spent in in-plant training. As a result much out-of-plant training is ineffectual. Union classifications and restrictions need drastic overhaul."
  
- "Due to the lack of poor training in high schools, we would rather hire a man with ambition and a desire to learn and teach him ourselves. Men coming from a larger plant and seeking a position in our smaller one cannot seem to adjust to the more varied responsibilities he must take upon himself."
  
- "In a small plant such as ours, skilled workers for the combination jobs are almost non-existent. That is the reason we try to keep on the old employees and try to give them every advantage."
  
- "Need better materials to work with and must have them at lower prices. Manufacturers and suppliers cannot ignore rural America."
  
- "We need good help with interest, loyalty and ability."
  
- "Shortage of people who take pride in a skill."
  
- "Great need for technical schooling for plants requiring greater quality control standards and in the use of new equipment, materials and systems becoming available. Continuing technical education."

- "Not enough young people getting or taking opportunity for community college or equivalent technical training. Industry not well enough promoted for employment opportunity."
- "It is felt that general secondary training programs offered do not have the pulse of industry trends. The result is antiquated training for processes not found in general production use today."
- "We need people who are willing and eager to spend time learning and who are interested in doing a good job. 'I don't care, no skin off me' prevails now. We are all willing to train our own if it's worthwhile. The biggest problem is finding anyone for any level who is willing to work. Most seem to think they are doing you a favor by showing up some of the time. Almost all are overpaid in relation to their skill and productivity, but it is necessary, unfortunately, in order to get any employees. Most think they are extremely underpaid and that the owner is really making a killing. Schools are falling down on the job of turning out people who understand how business really works and the effort necessary to do a profitable job. Few know economic basics."
- "It is difficult to get someone who cares enough to show up on a regular basis to be trained at any salary."
- "We are highly automated where possible in production and manufacturing. We have grown with this and in most cases, because of automation. Automation has provided most jobs."



- "Union practices of 'hard line' job classifications and seniority has made it very difficult for a talented and ambitious young man or woman to enter and find their place in the printing industry."
- "Right now, our problems are finding work for people, not people for work, unfortunately."
- "Definitely the need is great in our area for highly skilled production people -- especially lithographic preparation and production. Also, in sales. Next the correct attitude is very important."
- "The need, as I see it, is for people with average intelligence, willingness to learn and work an honest day's worth with an interest in what they are doing. People must be willing to invest in themselves, both time and effort."
- "In my years in printing, I have come to the conclusion that due to union boundaries and limitations, it is almost impossible for any ambitious and interested person to gain a full rounded knowledge of the complete printing business. (There are few exceptions.)"
- "Many captive plants, and we are one of them, are not allowed to compete with industry. Our wage scales force the hiring of young people with no skills, since they will take a low pay job. Once they develop a little skill, they move on. For the purpose of your study you should recognize 'captive plants' as training area."

- "Interest in graphic arts has declined in past 10 years."
- "If economy picks up we will need more production personnel."
- "Need more quality related manpower."

**APPENDIX III**

**SURVEY FORM -- MANUFACTURER SURVEY**

**CONFIDENTIAL**

# Graphic Arts Industry Manpower Study

## MANUFACTURER SURVEY

*Sponsored by Eastman Kodak Company*

**RETURN TO:** Graphic Arts Industry Manpower Study • National Association of Printers and Lithographers  
230 West 41st Street • New York, New York 10036

**NOTICE**

**INSTRUCTIONS**

- 1 Respond to all items as they relate to equipment marketed by your company
- 2 The major industry classifications and production areas used in this survey may not be the exact descriptions used by your company. Please use the classifications and areas listed which most closely match the descriptions used in your company and answer questions accordingly.
- 3 Please complete the form and return it in the envelope provided as soon as possible

**DEFINITION OF TERMS USED**

- 1 *Operational Personnel* includes all skilled and unskilled equipment operators involved in printing production.
- 2 *Maintenance Personnel* includes all skilled and unskilled people involved in equipment maintenance and repair who are not also operational personnel.
- 3 *Major Industry Classification* refers to the type of production for which your company markets equipment

**1.** Place check mark(s) in spaces as appropriate for both columns A and B below.

PRODUCTION AREAS	A	B
	Check production areas for which new equipment has been marketed by your company since January 1968.	Check production areas for which your company has ceased marketing equipment since January 1968
Layout and Design		
Hot Metal Composition		
Photo and Strike on Composition		
Imposition and Lock up		
Paste up and Copy Preparation		
Camera work		
Stripping		
Offset Platemaking		
Letterpress Platemaking		
Flexographic Platemaking		
Gravure Platemaking		
Screen Process Platemaking		
Offset Presswork (Sheet)		
Offset Presswork (Web)		
Letterpress Presswork		
Flexographic Presswork		
Gravure Presswork		
Screen Process Presswork		
Bindery and Finishing		
Other		

**2.** Place check mark(s) in spaces as appropriate for both columns A and B below.

PRODUCTION AREAS	A			B		
	The number of operational personnel required for your new equipment marketed since January 1968 will			The number of maintenance personnel required for your new equipment marketed since January 1968 will		
	Increase	Decrease	Not Change	Increase	Decrease	Not Change
Layout and Design						
Hot Metal Composition						
Photo and Strike on Composition						
Imposition and Lock up						
Paste up and Copy Preparation						
Camera work						
Stripping						
Offset Platemaking						
Letterpress Platemaking						
Flexographic Platemaking						
Gravure Platemaking						
Screen Process Platemaking						
Offset Presswork (Sheet)						
Offset Presswork (Web)						
Letterpress Presswork						
Flexographic Presswork						
Gravure Presswork						
Screen Process Presswork						
Bindery and Finishing						
Other						

3. Five areas of technical knowledge are listed and numbered below:

1. Photography 2. Mathematics 3. Electronics 4. Chemistry 5. Mechanics

Write in one or more of the numbers listed above, in the spaces below, to best describe whether the technical knowledge required of both operational and maintenance personnel for new equipment marketed by your company since January 1968, has increased, decreased, or not changed.

**EXAMPLE:**

PRODUCTION AREAS	Operational Personnel			Maintenance Personnel		
	Increased	Decreased	Not Changed	Increased	Decreased	Not Changed
Hot Metal Composition	2 3	5	1 4	3, 5	2	1 4

**NOTE:** This example is not meant to be correct but is used only to illustrate positioning of numbers in columns.

PRODUCTION AREAS	Operational Personnel			Maintenance Personnel		
	Increased	Decreased	Not Changed	Increased	Decreased	Not Changed
Layout and Design						
Hot Metal Composition						
Photo and Strike on Composition						
Imposition and Lock up						
Paste up and Copy Preparation						
Camera work						
Stripping						
Offset Platemaking						
Letterpress Platemaking						
Flexographic Platemaking						
Gravure Platemaking						
Screen Process Platemaking						
Offset Presswork (Sheet)						
Offset Presswork (Web)						
Letterpress Presswork						
Flexographic Presswork						
Gravure Presswork						
Screen Process Presswork						
Bindery and Finishing						
Other						

4. WRITE-IN the percent of your company's equipment production for each process in 1971, and CHECK whether present production has increased, decreased, or not changed since January 1968.

	% in 1971	Increased	Decreased	Not Changed
Offset Lithography				
Letterpress				
Gravure				
Screen Process				
Flexography				
Electrostatic				
Letterset				
Other				

5. RANK each major industry classification in numerical order in relation to the amount of your company's equipment marketed to each classification. The largest market will be No. 1. Also, check whether each classification's use has increased, decreased, or not changed since January, 1968.

MAJOR INDUSTRY CLASSIFICATION	Rank	Increased	Decreased	Not Changed
In Plant (Captive)				
General Commercial				
Newspaper and General Commercial				
Trade Plant (Typesetting, platemaking)				
Book Publications				
Business Forms				
Greeting Cards				
Packaging				
Other				

**COMMENTS:** Please write in any comments that you have concerning this study, and more generally, on the need for people in the graphic arts industry as a whole. Attach additional sheets as necessary.

**APPENDIX IV**

**DATA -- MANUFACTURER SURVEY**

DATA -- MANUFACTURER SURVEY

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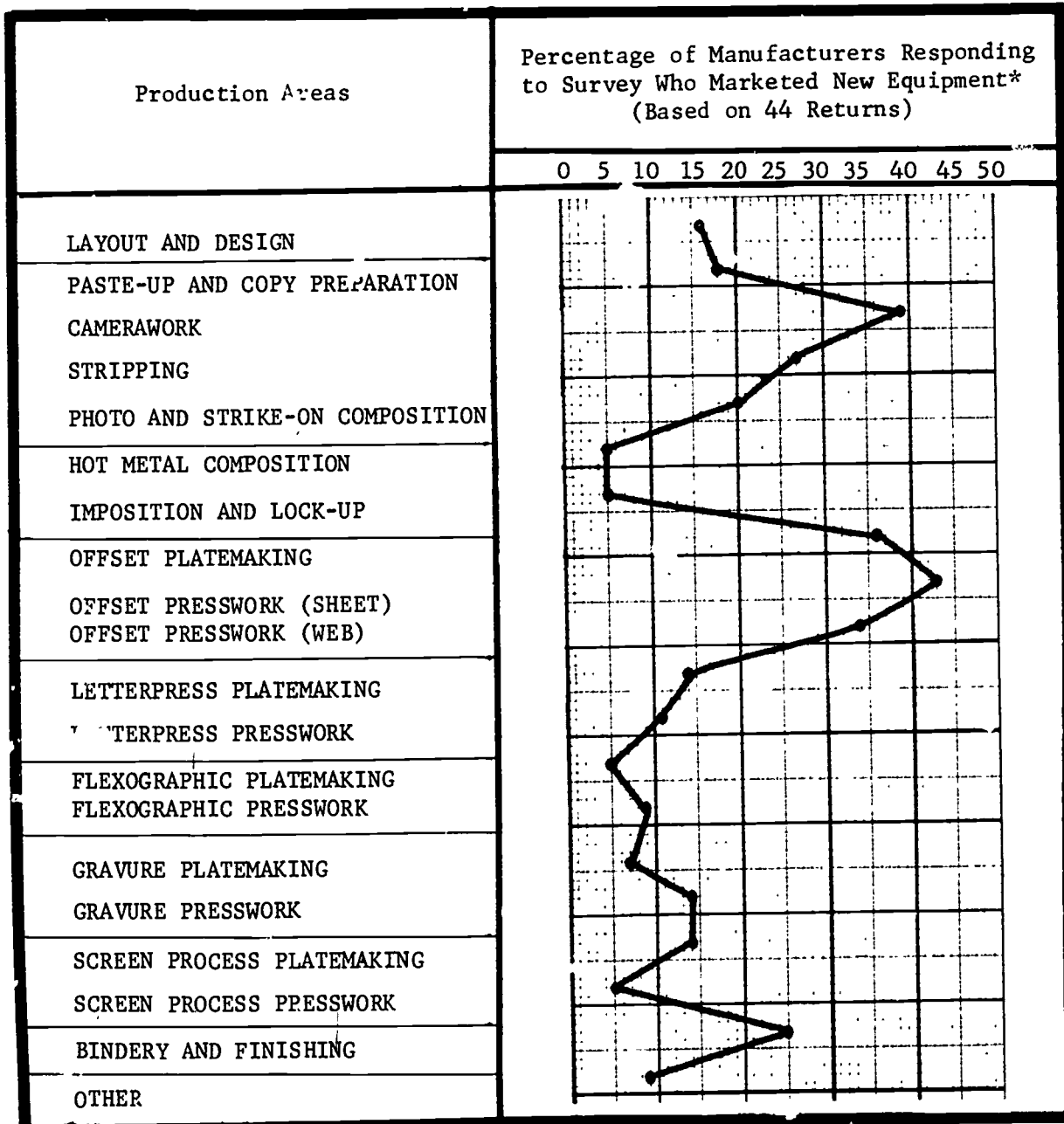
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**QUESTION 1**

PLACE CHECK MARK(S) IN SPACES AS APPROPRIATE FOR BOTH COLUMNS A AND B BELOW.

- A. CHECK PRODUCTION AREAS FOR WHICH NEW EQUIPMENT HAS BEEN MARKETED BY YOUR COMPANY SINCE JANUARY, 1968.



\*Note that most responding manufacturers produced equipment for more than one production area.

## QUESTION 1 A - Continued

## LAYOUT AND DESIGN

New equipment was marketed in this production area by 16 percent of the responding manufacturers.

## PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION

In areas relating to prepress preparation, the largest percentage of manufacturers marketed new equipment for camerawork, followed by equipment for stripping. A moderate percentage of manufacturers indicated that they marketed new equipment for photo and strike-on composition and for paste-up and copy preparation.

## HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP

The data strongly indicated that relative to other production areas, there was considerably less activity in the marketing of new equipment in these areas. The percentages of manufacturers who marketed new equipment in these areas were minimal.

## OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)

Of the responding manufacturers, the largest percentages reported that they marketed new equipment for these offset printing areas. This was a strong indication of growth in offset printing.

## LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK

This data indicated that there was much less activity in the marketing of new letterpress equipment than in the marketing of new offset equipment.

## QUESTION 1 A - Continued

## FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK

New equipment was marketed for both the platemaking and presswork areas of flexography. However, the percentages of manufacturers who indicated that they marketed new equipment in these areas were minimal.

## GRAVURE PLATEMAKING AND GRAVURE PRESSWORK

Platemaking and presswork equipment was marketed for gravure printing. However, the percentages of manufacturers who marketed gravure equipment were minimal.

## SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK

The greater percentage of manufacturers in the flexography and gravure areas indicated that they marketed new equipment for presswork. Conversely, in the screen process area, the greater percentage of manufacturers reported marketing new equipment for platemaking. The percentages for screen platemaking and flexographic presswork, however, were approximately the same.

## BINDERY AND FINISHING

A moderately high percentage of manufacturers reported marketing new bindery equipment. This may be attributed to the very high percentage of manufacturers who marketed new offset press equipment.

## OTHER

The marketing of new laminating equipment was indicated by responding manufacturers on the survey form. This, however, was the only equipment

## QUESTION 1 A - Continued

explicitly mentioned. It was assumed that other auxiliary types of equipment were marketed also.

## QUESTION 1 B:

## PRODUCTION AREAS FOR WHICH COMPANIES CEASED TO MARKET EQUIPMENT

There was no indication that manufacturers have ceased to market equipment in any one area. Manufacturers who responded to the survey reported that new equipment was marketed in all areas. Single manufacturers in each of six production areas reported a cessation in the marketing of equipment. These production areas were paste-up and copy preparation, letterpress platemaking, gravure platemaking, offset presswork (web), flexographic presswork, and bindery and finishing.

**QUESTION 2**

*PLACE CHECK MARK(S) IN SPACES AS APPROPRIATE FOR BOTH COLUMNS A AND B BELOW.*

- A. THE NUMBER OF OPERATIONAL PERSONNEL REQUIRED FOR YOUR NEW EQUIPMENT MARKETED SINCE JANUARY, 1968, WILL:
- B. THE NUMBER OF MAINTENANCE PERSONNEL REQUIRED FOR YOUR NEW EQUIPMENT MARKETED SINCE JANUARY, 1968, WILL:

## LAYOUT AND DESIGN

Six responding manufacturers indicated that the number of operational personnel required for their new equipment would not change significantly. One reported a decrease. Only two manufacturers responded to the maintenance part of this question. One manufacturer reported that the number of maintenance personnel would increase, and one reported that the number of personnel would not change.

## QUESTION 2 - Continued

Question 2A

Production Areas	Number of Manufacturers Who Said That <u>Operational</u> Personnel Will:			
	Increase	Decrease	Not Change	Total Response
Layout and Design	0	1	6	7
Paste-up and Copy Preparation	2	0	4	6
Camerawork	11	0	5	16
Stripping	3	2	7	12
Photo and Strike-on Composition	3	0	5	8
Hot Metal Composition	0	2	0	2
Imposition and Lock-up	0	1	1	2
Offset Platemaking	8	2	6	16
Offset Presswork (Sheet)	8	5	6	19
Offset Presswork (Web)	4	4	7	15
Letterpress Platemaking	2	2	2	6
Letterpress Presswork	0	1	3	4
Flexographic Platemaking	0	0	2	2
Flexographic Presswork	1	0	3	4
Gravure Platemaking	1	1	1	3
Gravure Presswork	1	0	5	6
Screen Process Platemaking	1	0	3	4
Screen Process Presswork	0	0	2	2
Bindery and Finishing	2	5	3	10
Other	1	0	2	3

## QUESTION 2 - Continued

## PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION

Manufacturers indicated that a similarity existed with reference to projected increases in the number of operational personnel required for paste-up and copy preparation, stripping, and photo and strike-on composition. The greatest increase in operational personnel was expected for camerawork equipment. Eleven manufacturers indicated that newly marketed camera equipment would require an increase in operational personnel. The only production area in which manufacturers expected a decrease in the required number of operational personnel was in the stripping area, where two respondents indicated an expected decrease.

More than half of the respondents in each production area reported that the number of personnel required to operate new equipment would not change. The one exception to this was camera equipment manufacturers who, as mentioned previously, expected an increase in the number of required operational personnel.

An increase in the number of maintenance personnel required for newly marketed equipment was expected in the areas of paste-up and copy preparation, photo and strike-on composition, and camerawork. Again, the greatest number of manufacturers who expected an increase (six) was in the camerawork production area. Stability was indicated in all areas, but especially in the stripping area, where all four manufacturers responding indicated that the number of maintenance personnel required for newly marketed equipment would remain relatively unchanged.

## QUESTION 2 - Continued

Question 2B

Production Areas	Number of Manufacturers Who Said That <u>Maintenance</u> Personnel Will:			
	Increase	Decrease	Not Change	Total Response
Layout and Design	1	0	1	2
Paste-up and Copy Preparation	1	0	2	3
Camerawork	6	0	5	11
Stripping	0	0	4	4
Photo and Strike-on Composition	2	0	3	5
Hot Metal Composition	0	1	0	1
Imposition and Lock-up	0	0	0	0
Offset Platemaking	4	0	7	11
Offset Presswork (Sheet)	6	1	7	14
Offset Presswork (Web)	2	2	8	12
Letterpress Platemaking	0	1	3	4
Letterpress Presswork	0	0	3	3
Flexographic Platemaking	0	0	1	1
Flexographic Presswork	0	0	3	3
Gravure Platemaking	0	1	1	2
Gravure Presswork	1	0	4	5
Screen Process Platemaking	0	0	2	2
Screen Process Presswork	1	0	0	1
Bindery and Finishing	1	1	6	8
Other	1	0	2	3

## QUESTION 2 - Continued

## HOT METAL COMPOSITION, IMPOSITION AND LOCK-UP

Only two survey respondents indicated that they marketed new equipment for hot metal composition. Both indicated that the number of operational personnel required for the new equipment would decrease. One of the respondents reported that maintenance personnel needed for new equipment would decrease also.

Of two manufacturers who reported marketing new equipment for imposition and lock-up, one indicated that fewer operational personnel would be required. Neither manufacturer gave an indication of the effect of new equipment on the required number of maintenance personnel.

## OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)

In general, an increase in the number of personnel required to operate new plate and press equipment was reported by the responding manufacturers. No change in the number of required operating personnel was expected by seven of the offset web press equipment manufacturers; four manufacturers indicated an increase, and four indicated a decrease, in the number of required personnel. Five manufacturers of offset sheet-fed presses reported an expected decrease in the number of personnel required to operate their newly marketed equipment. However, eight manufacturers expected operating personnel to increase, and six expected no change.

In the maintenance personnel category, relative stability was indicated by the number of manufacturers who reported that no changes in personnel requirements were expected in each of the three production areas. All



## QUESTION 2 - Continued

these production areas were expected to have increases in the number of required personnel. The lowest number of respondents reporting an increase in personnel requirements was in the web press equipment area. Only two of the web press manufacturers indicated that they expected increases in the number of maintenance personnel required for newly marketed equipment. Both web and sheet press manufacturers reported a minimal decrease in the number of maintenance personnel required.

## LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK

There was some variation in the number of respondents for operational and maintenance personnel in the platemaking area. Three manufacturers indicated that the number of required operational personnel would increase, but that the number of maintenance personnel would not change. One manufacturer indicated that both types of personnel would decrease. Two manufacturers indicated that operational-personnel requirements would not change.

In the letterpress presswork area, a stable personnel situation was projected by equipment manufacturers. All three manufacturers responding expected that the number of required maintenance personnel would not change.

## FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK

When the data describing operational and maintenance personnel needs for platemaking equipment were examined, it was found that only two manufacturers responded. Both indicated that the required number of operational personnel would not change.

## QUESTION 2 - Continued

Of four manufacturers of press equipment who responded, three expected no change in the required number of maintenance and operational personnel. One manufacturer, however, indicated that his new equipment would require an increase in operational personnel.

## GRAVURE PLATEMAKING AND GRAVURE PRESSWORK

Two of the responding manufacturers of gravure platemaking equipment indicated that the operational personnel requirements would not change. One manufacturer reported that his new equipment required fewer maintenance personnel, and another reported that maintenance personnel requirements would not change.

Five of six manufacturers of presswork equipment indicated that there would be no change in operational personnel requirements, while one manufacturer reported that personnel requirements would increase. Basically, the manufacturers' responses for maintenance were similar to the responses for maintenance personnel in the platemaking area; however, one less manufacturer responded.

## SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK

Manufacturers of screen process platemaking equipment indicated that generally no change in the number of operating personnel would be required. One manufacturer, however, reported that an increase in personnel would be required. Two respondents indicated that no change in the number of maintenance personnel would be necessary.

## QUESTION 2 - Continued

In the presswork equipment area, no change in the number of operating personnel was projected; however, one manufacturer reported that an increase in the number of maintenance personnel would be required.

## BINDERY AND FINISHING

Unlike the majority of equipment manufacturers, bindery equipment manufacturers indicated that a decrease was expected in the required number of operating personnel. A decrease in required personnel was reported by five manufacturers, an increase was projected by two manufacturers, and three expected no change.

The number of maintenance personnel required for bindery equipment was expected to remain relatively stable, with two of the three responding manufacturers indicating that no change in the number of personnel would be required.

**QUESTION 3**

*FIVE AREAS OF TECHNICAL KNOWLEDGE ARE LISTED AND NUMBERED BELOW:*

1. *PHOTOGRAPHY*
2. *MATHEMATICS*
3. *ELECTRONICS*
4. *CHEMISTRY*
5. *MECHANICS*

*WRITE IN ONE OR MORE OF THE NUMBERS LISTED ABOVE, IN THE SPACES BELOW, TO BEST DESCRIBE WHETHER THE TECHNICAL KNOWLEDGE REQUIRED OF BOTH OPERATIONAL AND MAINTENANCE PERSONNEL FOR NEW EQUIPMENT MARKETED BY YOUR COMPANY SINCE JANUARY, 1968, HAS INCREASED, DECREASED, OR NOT CHANGED.*

**PHOTOGRAPHY****LAYOUT AND DESIGN**

All three of the manufacturers who indicated that a technical knowledge of photography was required of operation and maintenance personnel for new layout and design equipment reported that the requirements had not changed.

**PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION**

Requirements for a technical knowledge of photography in the pre-press areas generally had not changed. The exception was in the camerawork area, where nine manufacturers reported that requirements for a knowledge of photography had increased for personnel operating new equipment.

INCREASES IN TECHNICAL KNOWLEDGE REQUIREMENTS REPORTED BY MANUFACTURERS

Production Areas	Number of Manufacturers Who Said That Technical Knowledge Required of Operational Personnel Has Increased In These Fields:					Number of Manufacturers Who Said that Technical Knowledge Required of Maintenance Personnel Has Increased in These Fields:				
	Photography	Mathematics	Electronics	Chemistry	Mechanics	Photography	Mathematics	Electronics	Chemistry	Mechanics
Layout and Design	0	0	0	0	0	0	0	0	0	0
Paste-up and Copy Preparation	2	0	1	2	0	2	0	3	1	1
Camera work	9	6	4	5	3	4	1	6	2	2
Stripping	2	0	1	1	1	2	0	1	1	2
Photo and Strike-on Composition	2	3	4	0	0	1	1	5	2	1
Hot Metal Composition	0	0	2	1	2	0	0	2	0	2
Imposition and Lock-Up	0	0	0	0	0	0	0	0	0	0
Offset Platemaking	4	3	5	5	5	5	1	7	5	8
Offset Presswork (Sheet)	4	0	2	6	4	0	2	8	3	7
Offset Presswork (Web)	3	2	3	3	3	0	1	5	2	4
Letterpress Platemaking	2	0	0	0	1	2	0	1	0	1
Letterpress Presswork	0	0	0	0	0	0	0	0	0	0
Flexographic Platemaking	1	0	0	0	0	2	0	1	0	0
Flexographic Presswork	0	0	0	0	0	0	0	0	0	0
Gravure Platemaking	1	0	1	1	1	2	0	1	0	0
Gravure Presswork	0	0	0	1	2	0	0	0	0	1
Screen Process Platemaking	1	0	0	0	0	1	0	0	0	0
Screen Process Presswork	0	0	0	0	0	0	0	0	0	0
Bindery and Finishing	0	1	1	0	2	0	1	1	0	0
Other	0	0	1	1	1	0	0	1	1	1

## QUESTION 3 -- PHOTOGRAPHY - continued

## HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP

In the hot metal area, for both operational and maintenance personnel, one manufacturer reported that requirements had decreased and one reported that they had not changed. There were no responses for either operational or maintenance personnel in the imposition and lock-up area. This seemed to indicate that a knowledge of photography was not considered necessary for new equipment in this area.

## OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)

Requirements for a technical knowledge of photography for personnel working with new equipment in the offset area appeared to be relatively stable. Two increases in technical knowledge requirements should be noted, however. One increase was in the platemaking area for maintenance personnel, where five of the respondents indicated that requirements for a knowledge of photography had increased. The second increase was reported for operational personnel in the area of offset sheet presswork; four manufacturers of this equipment reported that requirements had increased.

## LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK

In the letterpress platemaking area, it is interesting to note that only two manufacturers answered Question 3. Both said that photography requirements had increased for operational personnel and for maintenance personnel handling new equipment. There were no responses in the presswork area.

DECREASES IN TECHNICAL KNOWLEDGE REQUIREMENTS REPORTED BY MANUFACTURERS

Production Areas	Number of Manufacturers Who Said that Technical Knowledge Required of Operational Personnel Has Decreased in these Fields:					Number of Manufacturers Who Said that Technical Knowledge Required of Maintenance Personnel Has Decreased in These Fields:				
	Photography	Mathematics	Electronics	Chemistry	Mechanics	Photography	Mathematics	Electronics	Chemistry	Mechanics
Layout and Design	0	0	0	0	0	0	0	0	0	0
Paste-up and Copy Preparation	0	1	1	0	1	1	1	0	1	1
Camerawork	1	2	2	0	0	1	1	0	1	0
Stripping	0	0	0	0	2	0	0	0	0	1
Photo and Strike-on Composition	1	2	0	0	1	0	1	0	0	1
Hot Metal Composition	1	0	0	0	0	1	0	0	1	0
Imposition and Lock-up	0	0	0	0	0	0	0	0	0	0
Offset Platemaking	3	1	1	3	3	1	1	0	2	1
Offset Presswork (Sheet)	0	0	0	0	3	0	0	0	0	1
Offset Presswork (Web)	0	0	0	0	2	0	0	1	0	2
Letterpress Platemaking	0	0	0	1	0	0	0	0	1	0
Letterpress Presswork	0	0	0	0	1	0	0	0	0	0
Flexographic Platemaking	0	0	0	0	0	0	0	0	0	0
Flexographic Presswork	0	0	0	0	0	0	0	0	0	0
Gravure Platemaking	0	0	0	0	0	0	0	0	0	0
Gravure Presswork	0	0	0	0	0	0	0	0	0	0
Screen Process Platemaking	0	0	0	0	0	0	0	0	0	0
Screen Process Presswork	1	0	0	1	0	0	0	0	0	0
Bindery and Finishing	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0

## QUESTION 3 -- PHOTOGRAPHY - continued

## FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK

Of the two manufacturers who reported marketing new equipment for flexographic platemaking, one did not respond to Question 3 and one reported that requirements had increased for both operational and maintenance personnel. There were no responses in the presswork area.

## GRAVURE PLATEMAKING AND GRAVURE PRESSWORK

One manufacturer of new equipment for this area said that requirements for a technical knowledge of photography in the platemaking area had increased for operational personnel; three manufacturers said requirements had increased for maintenance personnel. No responses were given for gravure presswork.

## SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK

One manufacturer of new equipment for screen process platemaking reported that the technical knowledge of photography required to handle this equipment had increased for both operational and maintenance personnel. One manufacturer of equipment for screen process presswork indicated that technical knowledge of photography for operational personnel had decreased.

## BINDERY AND FINISHING

A knowledge of photography for bindery and finishing operations did not appear to be important. The two manufacturers who responded indicated that requirements would not change.



REPORT BY MANUFACTURERS ON TECHNICAL KNOWLEDGE REQUIREMENTS THAT HAVE REMAINED UNCHANGED

Production Areas	Number Of Manufacturers Who Said that Technical Knowledge Required of Operational Personnel Has Not Changed In These Fields:				Number of Manufacturers Who Said that Technical Knowledge Required of Maintenance Personnel Has Not Changed In These Fields:					
	Photography	Mathematics	Electronics	Chemistry	Me- chanics	Photography	Mathematics	Electronics	Chemistry	Me- chanics
Layout and Design	3	2	1	2	2	2	1	1	2	1
Paste-up and Copy Preparation	3	1	1	3	2	2	2	3	3	1
Camera-work	4	2	2	5	4	4	3	5	5	5
Stripping	3	3	3	3	2	3	3	3	3	2
Photo and Strike-on Composition	5	1	1	4	3	3	1	3	3	2
Hot Metal Composition	1	2	0	1	0	1	0	1	1	0
Imposition and Lock-up	0	1	0	0	1	0	0	0	0	0
Offset Platemaking	3	5	3	4	2	3	2	3	3	2
Offset Presswork (Sheet)	3	6	6	4	5	6	1	6	6	3
Offset Presswork (Web)	3	5	5	4	4	4	2	4	4	3
Letterpress Platemaking	0	1	0	1	1	0	0	1	1	0
Letterpress Presswork	0	0	0	0	0	0	0	0	0	0
Flexographic Platemaking	0	0	0	0	0	0	0	0	0	0
Flexographic Presswork	0	0	1	0	1	0	1	0	0	1
Gravure Platemaking	0	0	0	0	0	0	0	0	0	0
Gravure Presswork	0	0	1	0	1	0	1	0	0	1
Screen Process Platemaking	0	0	0	0	0	0	0	0	0	0
Screen Process Presswork	0	0	0	0	0	0	0	0	0	0
Bindery and Finishing	2	1	2	2	5	2	2	2	2	0
Other	0	0	1	0	1	0	1	0	0	1

## MATHEMATICS

### LAYOUT AND DESIGN

Although responses were few, manufacturers who considered a knowledge of mathematics necessary for personnel in the layout and design area indicated that there had been no change in the requirements for either operational or maintenance personnel.

### PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION

In the prepress areas, mathematics requirements for operational personnel appeared to fluctuate. For example, in the paste-up and copy preparation area, no increase in requirements for a technical knowledge of mathematics was reported. However, in the camerawork area, an increase in requirements was reported by six manufacturers of new equipment; in the photo and strike-on composition area, by three. Requirements in the stripping area had not changed at all, according to the three responding manufacturers.

### HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP

Requirements for a technical knowledge of mathematics for personnel in the hot metal and imposition and lock-up areas had not changed, according to manufacturers of new equipment.

### OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), OFFSET PRESSWORK (WEB)

Requirements for a technical knowledge of mathematics for both operational personnel and maintenance personnel in all areas of offset printing had not changed significantly, according to the respondents.

**QUESTION 3 -- MATHEMATICS - continued****LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK**

Only one manufacturer responded; he indicated that requirements for a knowledge of mathematics had not changed for operational personnel in the platemaking area. There were no other responses in the letterpress area.

**FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK**

There were no responses for flexography.

**GRAVURE PLATEMAKING AND GRAVURE PRESSWORK**

There were no responses for gravure printing.

**SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK**

There were no responses for screen process printing.

**BINDERY AND FINISHING**

Of the two manufacturers in the bindery and finishing area who considered a knowledge of mathematics necessary for personnel handling new equipment, one reported that requirements had increased, while one indicated that they had not changed.

**ELECTRONICS****LAYOUT AND DESIGN**

In the area of layout and design, one manufacturer reported that the required knowledge of electronics for both operational and maintenance personnel had not changed.

## QUESTION 3 -- ELECTRONICS - continued

PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING AND PHOTO AND  
STRIKE-ON COMPOSITION

In the pre-press area, requirements for a technical knowledge of electronics for operational personnel appeared to fluctuate from production area to production area. Four manufacturers who considered a technical knowledge of electronics necessary for personnel operating new equipment in photo and strike-on composition reported that requirements had increased. Four camera manufacturers also indicated that required knowledge of electronics had increased for operational personnel. Three manufacturers of stripping equipment reported no change in requirements for a knowledge of electronics. In the paste-up and copy preparation area, however, three manufacturers were equally divided in their opinions that requirements had increased, decreased, or not changed for operational personnel.

Most manufacturers indicated a definite increase in requirements for a technical knowledge of electronics for maintenance personnel. The exception, however, was in stripping, where only one manufacturer reported an increase.

## HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP

For hot metal composition, both of the manufacturers of new equipment indicated that the technical knowledge of electronics required had increased for operational and maintenance personnel. There was no response for either operational or maintenance personnel in the imposition and lock-up production area.

## QUESTION 3 -- ELECTRONICS - continued

## OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)

Of the nine manufacturers who considered a knowledge of electronics necessary for operational personnel in the platemaking area, five said that requirements had increased. For operational personnel in both presswork areas, most manufacturers reported that requirements had not changed.

Definite increases in requirements for technical knowledge of electronics were reported for maintenance personnel in all three areas of offset equipment production.

## LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK

There was only one manufacturer who responded in the letterpress area. That manufacturer reported that required knowledge of electronics for maintenance personnel in the platemaking area had increased.

## FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK

One manufacturer reported that requirements for knowledge of electronics had not changed for operational personnel in presswork. Another reported that the requirements for maintenance personnel in platemaking had increased, while a third said that there had been no change in requirements for maintenance personnel in the presswork area.

**QUESTION 3 - ELECTRONICS - continued****GRAVURE PLATEMAKING AND GRAVURE PRESSWORK**

One manufacturer indicated that the technical knowledge required for operational personnel in platemaking had increased. Another said that requirements had not changed in the gravure presswork area for operational personnel.

For maintenance personnel, one manufacturer reported that requirements in the platemaking area had increased, and one said that they had not changed for presswork.

**SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK**

There were no responses for screen process printing.

**BINDERY AND FINISHING**

Most manufacturers of bindery and finishing equipment indicated that the required technical knowledge of electronics had not changed for either operational or maintenance personnel.

**CHEMISTRY****LAYOUT AND DESIGN**

Two manufacturers of new layout and design equipment indicated that there had been no change in requirements for a knowledge of chemistry for either operational or maintenance personnel.

## QUESTION 3 -- CHEMISTRY - continued

## PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION

In the pre-press area, manufacturers reported that, on the whole, there had been no significant change in the requirements for a knowledge of chemistry for either operational or maintenance personnel.

## HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP

Of the two manufacturers who responded in the hot metal composition area, one reported that requirements for a technical knowledge of chemistry had increased, while others reported that requirements had not changed. There were no responses for imposition and lock-up.

## OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)

Responses in the offset area were varied. Six manufacturers indicated that requirements for a technical knowledge of chemistry had increased for maintenance personnel. Of the twelve manufacturers who considered a knowledge of chemistry necessary for operational personnel in the platemaking area, three said that requirements had decreased, four reported that they had not changed, and five said that they had increased.

## LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK

No manufacturers responded for either operational or maintenance personnel in the letterpress presswork area. In the platemaking area, one manufacturer said that the required knowledge of chemistry had decreased for both types of personnel, and one said that requirements had not changed.

## FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK

There were no responses for flexography.

**QUESTION 3 -- CHEMISTRY - continued****GRAVURE PLATEMAKING AND GRAVURE PRESSWORK**

The two responses in the gravure area were both for operational personnel. One manufacturer said that requirements for a knowledge of chemistry had increased in the platemaking area, and the other reported that requirements had increased in the presswork area. There were no responses for maintenance personnel.

**SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK**

There was only one response in the screen process area. The manufacturer reported that requirements for a knowledge of chemistry had decreased for operational personnel in the presswork area.

**BINDERY AND FINISHING**

In the bindery and finishing area, two manufacturers reported no change in chemistry requirements for both operational and maintenance personnel.

**MECHANICS****LAYOUT AND DESIGN**

Three manufacturers reported that there had been no change in requirements for a technical knowledge of mechanics in this area.

**PASTE-UP AND COPY PREPARATION, CAMERAWORK, STRIPPING, AND PHOTO AND STRIKE-ON COMPOSITION**

For operational personnel, some manufacturers of new equipment reported decreases in the required knowledge of mechanics in past-up and copy preparation, stripping, and photo and strike-on composition. However, on the whole, the required knowledge of mechanics had remained relatively stable.



**QUESTION 3 -- MECHANICS - continued**

For maintenance personnel, two camera manufacturers said that required knowledge of mechanics had increased, while five said that it had not changed.

**HOT METAL COMPOSITION AND IMPOSITION AND LOCK-UP**

Requirements for a knowledge of mechanics had increased for both operational and maintenance personnel working in hot metal composition, according to the two responding manufacturers. One manufacturer reported that requirements had not changed for operational personnel in the area of imposition and lock-up.

**OFFSET PLATEMAKING, OFFSET PRESSWORK (SHEET), AND OFFSET PRESSWORK (WEB)**

There appeared to be no decisive pattern for operational personnel in the offset area. The mechanical knowledge required of maintenance personnel in platemaking and sheet presswork had definitely increased, however.

**LETTERPRESS PLATEMAKING AND LETTERPRESS PRESSWORK**

In the letterpress platemaking area, one manufacturer thought that requirements had increased for operational personnel, and one thought that they had not changed. For presswork, the one manufacturer who responded indicated that the knowledge of mechanics required of operational personnel had decreased.

**FLEXOGRAPHIC PLATEMAKING AND FLEXOGRAPHIC PRESSWORK**

Two manufacturers responded for flexography. One said that in the presswork area, there had been no change in requirements for operational personnel. The other reported that in the same area, there had been no change in requirements for maintenance personnel.

## QUESTION 3 -- MECHANICS - continued

## GRAVURE PLATEMAKING AND GRAVURE PRESSWORK

In the gravure platemaking area, one manufacturer responded. He said that the requirements for a technical knowledge of mechanics had increased for operational personnel. For operational personnel in the presswork area, requirements had increased, according to two manufacturers. One manufacturer said requirements had not changed.

## SCREEN PROCESS PLATEMAKING AND SCREEN PROCESS PRESSWORK

There was no response for screen process printing.

## BINDERY AND FINISHING

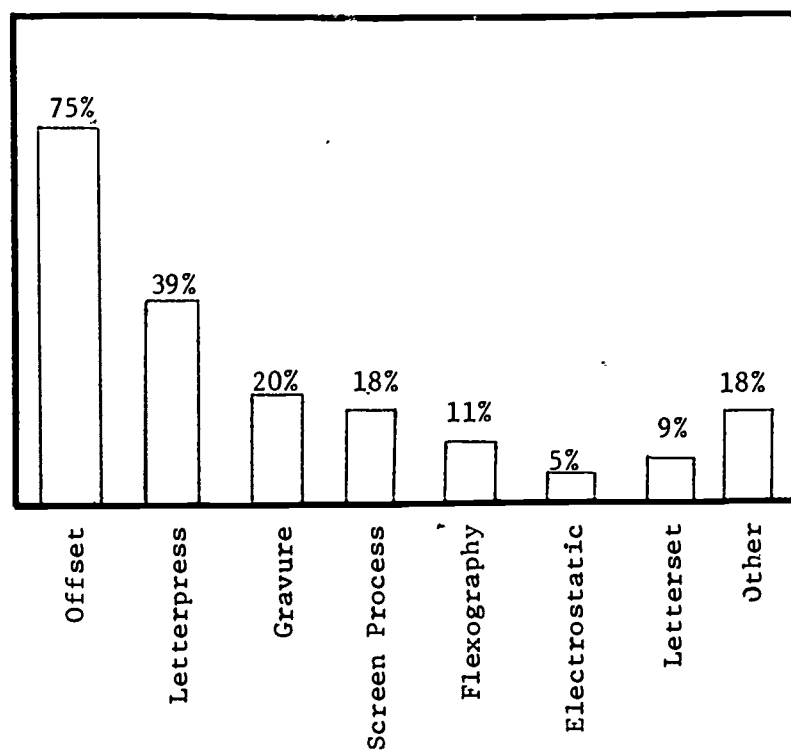
Of the seven manufacturers of new bindery and finishing equipment who responded, five said that requirements had not changed for operational personnel.

#### QUESTION 4

WRITE IN THE PERCENT OF YOUR COMPANY'S EQUIPMENT PRODUCTION FOR EACH PROCESS IN 1971, AND CHECK WHETHER PRESENT PRODUCTION HAS INCREASED, DECREASED, OR NOT CHANGED SINCE JANUARY, 1968.

#### Percent of Manufacturers Responding to Survey Who Produced Equipment for Each Printing Process

(Some manufacturers produced equipment for more than one Process.)



#### OFFSET LITHOGRAPHY

Of the total number of 44 manufacturers who responded to the survey, 75 percent, or 33, made equipment for offset lithography. Sixteen of these manufacturers reported that offset equipment represented 80 percent or more of their total production. Present production, according to 27 of these manufacturers of offset equipment, had increased. Four indicated that production had not changed, and only two reported a decrease in production.

## QUESTION 4 - continued

## LETTERPRESS

Manufacturers of letterpress equipment represented 39 percent of the total survey respondents, or 17 manufacturers. Of these manufacturers, 16 reported that letterpress equipment represented less than 40 percent of their total production. Nine of the manufacturers of letterpress equipment reported that production had decreased in this area. Four of the manufacturers indicated that their production of letterpress equipment had increased, while four reported that production had not changed.

## GRAVURE

Twenty percent, or nine, of the total survey respondents manufactured gravure equipment. Of these nine manufacturers, seven reported that gravure equipment represented less than 20 percent of their total production. Two of these manufacturers indicated that 41 to 60 percent of their production involved the manufacture of gravure equipment. Of the nine responding manufacturers of gravure equipment, five said that equipment production had increased, while three said that it had not changed and one reported a decrease in production.

## SCREEN PROCESS

Manufacturers of equipment for screen process printing represented 18 percent of the total survey respondents, or eight manufacturers. These manufacturers indicated that the manufacture of this equipment represented less than 40 percent of their total production. The production of screen process equipment, according to five of the manufacturers, had increased; according to two, the production of this equipment had not changed. One reported a decrease in production.

## QUESTION 4 - continued

## SCREEN PROCESS

Manufacturers of equipment for screen process printing represented 18 percent of the total survey respondents or eight manufacturers.

These manufacturers indicated that the manufacture of this equipment represented less than 40 percent of their total production. The production of screen process equipment, according to five of the manufacturers, had increased; according to two, the production of this equipment had not changed.

## FLEXOGRAPHY

Only 11 percent, or five, of the survey respondents produced equipment for flexography. All of them reported that the production of this equipment represented 20 percent or less of their total production. The manufacturers indicated that production in this area was stable, since four reported that it had not changed.

## ELECTROSTATIC

Electrostatic equipment was manufactured by only 4 percent of the manufacturers responding to the survey; that is, by 2 manufacturers. Both indicated that the manufacture of this equipment represented less than 20 percent of their total production. They did not indicate whether production had increased, decreased, or not changed.

## LETTERSET

Nine percent, or four, of the survey respondents manufactured letterset equipment. All four reported that the manufacture of this equipment represented less than 20 percent of their total production. Two of these

## QUESTION 4 - continued

manufacturers of letterset equipment indicated that production had increased, and two indicated that it had not changed.

## OTHER

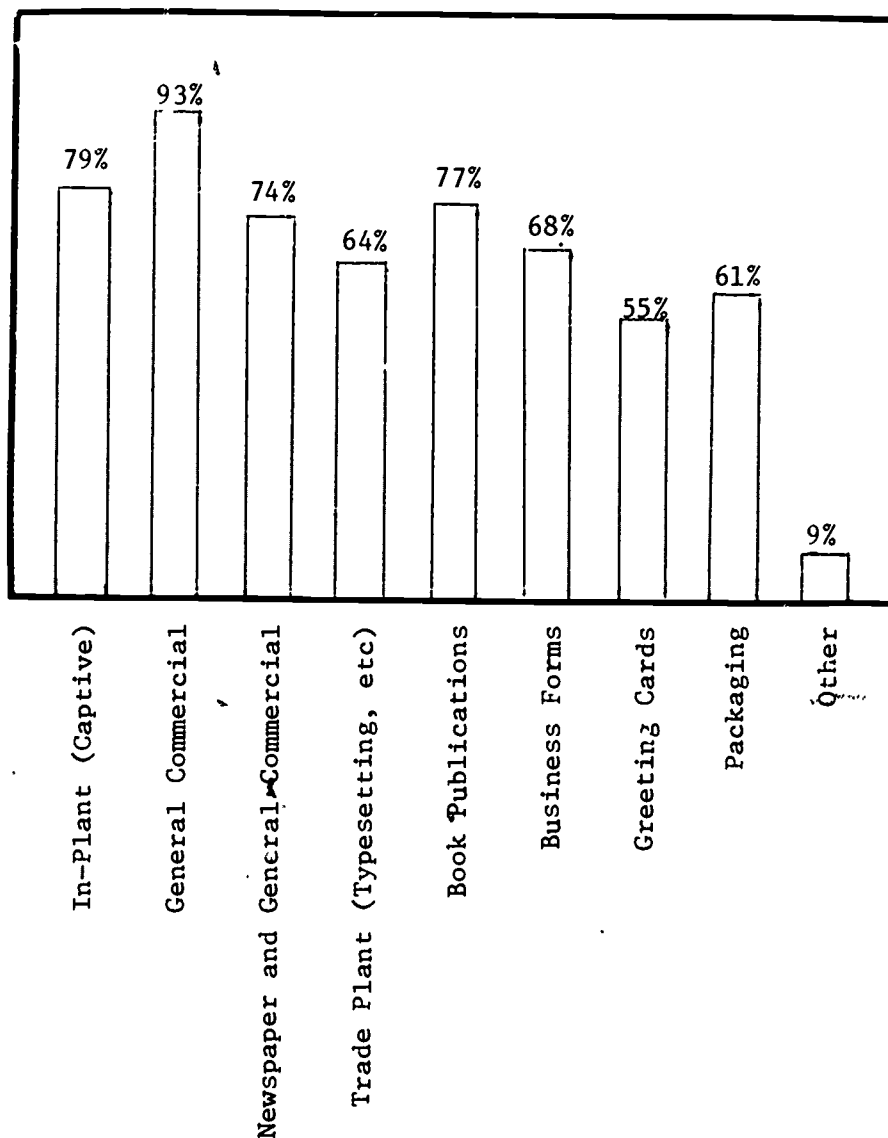
Of the responding manufacturers, 18 percent, or eight, produced equipment that fell into the classification "other." They did not indicate, however, to which kinds of equipment they referred. The manufacture of "other" kinds of equipment represented 40 percent or less of the total production of six of these equipment manufacturers. According to three manufacturers, production of this equipment had decreased, three reported an increase in equipment production and two indicated that production had not changed.

**QUESTION 5**

RANK EACH MAJOR INDUSTRY CLASSIFICATION IN NUMERICAL ORDER IN RELATION TO THE AMOUNT OF YOUR COMPANY'S EQUIPMENT MARKETED TO EACH CLASSIFICATION. THE LARGEST MARKET WILL BE No. 1. ALSO, CHECK WHETHER EACH CLASSIFICATION'S USE HAS INCREASED, DECREASED, OR NOT CHANGED SINCE JANUARY, 1968.

Percent of Manufacturers Responding to Survey Who Marketed Equipment to Each Major Industry Classification

(Some manufacturers marketed equipment to more than one classification.)



## QUESTION 5 - continued

## IN-PLANT (CAPTIVE)

Equipment was marketed to in-plant printers by 79 percent of the manufacturers responding to the survey or 35 manufacturers. Only three of these manufacturers, however, ranked sales to this group first. The market was ranked second by eight manufacturers, and third by nine. Twenty-three manufacturers of in-plant equipment indicated that the use of equipment among in-plant printers had increased. One reported that equipment usage had decreased in this area.

## GENERAL COMMERCIAL

The greatest percentage of manufacturers (93 percent) marketed equipment to printers in the general commercial area. Of these 41 manufacturers, 29 ranked sales to this group first, and nine ranked them second. Twenty-eight of these manufacturers reported that the use of equipment by general commercial printers had increased, and 11 indicated that equipment usage had not changed.

## NEWSPAPER AND GENERAL COMMERCIAL

Of the total number of survey respondents, 74 percent, or 33, marketed new equipment to printers in the newspaper-general commercial classification. The greatest number (10) ranked sales to this group third, although six ranked these sales first and seven second. Fifteen of the manufacturers reported that the use of equipment by printers in the newspaper-general commercial area had increased, and 14 said that equipment usage had not changed.



## QUESTION 5 - continued

## TRADE PLANT (TYPESETTING, PLATEMAKING)

Equipment was marketed to trade plant printers by 64 percent of the survey respondents, or 28 manufacturers. Of these, only one ranked sales to this classification first, while six ranked them second and four ranked them third. Equal numbers of manufacturers (12) reported that equipment usage had increased in this area or had not changed. A decrease in usage was reported by four manufacturers.

## BOOK PUBLICATIONS

Equipment for printers of book publications was marketed by 77 percent, or 34, of the responding manufacturers. Seven of the manufacturers ranked sales to these printers third, and another seven ranked them fifth. Only two manufacturers ranked these sales first, and six ranked them second. Manufacturers were almost equally divided in their options as to whether equipment usage among these printers had increased, decreased, or not changed. The fact that 11 of the manufacturers reported that usage had decreased, however, was the most significant indication of a decrease among all the major industry classifications. Eleven manufacturers reported an increase in sales, and 12 reported no change.

## BUSINESS FORMS

Equipment for printing business forms was marketed by 68 percent of the survey respondents, or 30 manufacturers. Only one of these manufacturers ranked sales to firms printing business forms first, six ranked them second, and five ranked them third. The greatest number of manufacturers

## QUESTION 5 - continued

(eight) ranked sales to this category fourth. Eighteen of the responding manufacturers indicated that use of equipment in this area had increased; eight reported that equipment usage had not changed; four reported a decrease.

## GREETING CARDS

Printing equipment for greeting cards was manufactured by 55 percent, or 24, of the manufacturers who responded to the survey. None of these manufacturers ranked sales to this category first or second. One of the manufacturers ranked them third. However, seven manufacturers ranked sales to this category fourth, five ranked them fifth, and seven ranked them sixth. According to 11 of the manufacturers, equipment usage in this area had not changed. An increase in usage was reported by eight manufacturers, while five reported a decrease.

## PACKAGING

Packaging equipment was marketed by 61 percent, or 27, of the manufacturers who responded to the survey. Only two of these manufacturers ranked sales to this classification first, none ranked them second, and three ranked them third. The greatest number of manufacturers (seven) ranked sales to this category fourth. Equal numbers of manufacturers (11) said that packaging equipment usage had increased or had not changed; five reported that equipment usage had decreased.

## OTHER

Equipment that fell into the "other" category was manufactured by only 9

## QUESTION 5 - continued

percent of the survey respondents, or four manufacturers. Only one ranked sales of these unspecified types of equipment first. Two manufacturers reported a decrease in equipment usage, and two reported that equipment usage had not changed.

**APPENDIX V**

**"SUMMARY SURVEY OF GRAPHIC ARTS TECHNOLOGY 1971"**

**SUMMARY SURVEY OF GRAPHIC ARTS TECHNOLOGY 1971**

**PREPARED FOR**  
**GRAPHIC ARTS INDUSTRY MANPOWER STUDY**  
**EASTMAN KODAK COMPANY**

Prepared by

Graphic Arts Research Center  
Rochester Institute of Technology  
Rochester, N. Y.

November 1971

SUMMARY SURVEY  
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THE STATE OF THE ART  
AND RANDOM PREDICTIONS

...In order to keep up with the demands for printing in the next five years, every single printing plant in the country must increase its volume by 40 percent.

...The estimated expenditures for education for the 1970/1971 school year are \$70 billion.

...There are about 30,000 new books and new editions each year.

...The printing industry is the seventh largest industry in the United States.

...By 1978 cable TV will have 50 million subscribers.

...In 1975 printers and publishers will spend over a billion dollars for process printing plates.

...By 1978, 970 letterpress dailies out of 1,155 will have converted to offset.

...By 1975, 100,000 computers will be working for a wide range of businesses.

## INTRODUCTION

### SCOPE OF THE REPORT

This report is a summary of the state of the art in graphic arts technology through May 1971 as selected from a search of current graphic arts literature. It is designed and prepared as part of a manpower study conducted by the Eastman Kodak Company.

The report is intended to show the current status of all areas of graphic arts technology that have recently changed or are presently changing. As an overview of technology, it does not dwell upon details except when they are significant to a larger perspective of change. And for the most part, it is assumed that long-established processes and procedures continue to exist as active constituents of the industry. This assumption is necessary, since the source material for this report does not consist of tutorial subject matter. Although the intent of this report is to restrict the information to the technology of graphic arts, it becomes realistic in many cases to explain its applications and manpower implications.

The reader will find that certain categories have been manipulated from "normal" sequential positions. In some instances, little, if any, significant information concerning new technology appeared in the trade publications. And in some cases, information on new technology concerned only one or two processes. Lack of significant information on other processes or procedures indicated no change.

## TERMINOLOGY

Graphic arts terminology is a confusing but maturing language. This is to be expected of a dynamically changing industry. Words that adequately described an earlier function may be carried over into a new process for which they become non-descriptive. Functions may be modified and un-similar. An "old" term may be applied to a new function because it follows an old sequence of production. Furthermore, terms are coined to describe an area having an opposite connotation: for several years, hot metal was "opposed", by cold type. At one point, the word "photocomposition" was used, and now there is the more descriptive term of "flat type".

Not only is graphic arts struggling with the terminology of its own internal innovations in engineering and chemistry, it has been merging with the concepts of other industries. This introduces another world of terminology, e.g., mag tape, visual display, laser, facsimile, infrared drying, microimaging, and more recently, scroll and cursor.

Add to this confusion the art of shortening language to acronyms and we have OCR, CRT CO, CATV, ET .

Finally, in a much larger sense, graphic arts is realizing with some reluctance that it is a major element in the broader field of communication.

Thus, the vocabulary of graphic arts is a living language, confusing, at times, but struggling successfully to better terminology. In any written presentation in graphic arts, the reader should be aware of this aspect of the state of the art.

#### VALIDITY OF INFORMATION

Although the information in this report has been reviewed by knowledgeable personnel in the field of graphic arts, the coverage is so broad that there is always a risk of minor inaccuracies. The reader should be aware that those who prepare this report are sensitive to the validity of information and have spent considerable effort to present only information that can be supported by reports of "factual experience."

In spite of this effort, the source of the information in this report is a survey of current literature. The reader must bear in mind that the nature of trade literature includes 1) a desire to sell products, 2) a desire to promote an individual person or company, 3) information before it is validated experimentally, 4) an introduction of products with an unannounced cost or operating expense that are not profitable for the user, 5) introduction of equipment and processes prematurely, 6) inconclusive surveys, and 7) meaningless generalities.

Knowing this to be a way of life in the commercial world of business, the preparation of this report has involved a severe scrutiny and filtering of written material.

#### STATE OF THE ART VS FORECASTING

If changes were abrupt and clean, it would be a simple matter to divide the state-of-the-art report from the forecast. Unfortunately, there are all degrees of overlapping and false starts, as well as static or pausing situations in developments. Engineering models may work, but for one reason or another, commercial models have problems. Change is always a

fluid condition. For this reason, the reader may find a subject only in forecasting although it is rather common information. Or similar information may be in both categories.

## DESIGN

### INTRODUCTION

Although design is typically treated as part of the layout and design steps, it is defined here as a "pure" function. The reason is that there is a new role emerging for the designer. While pure design may not be a technology in a narrow definition, it is significant to a state-of-the-art report in printing technology.

The concept of layout is relegated to that area of copy preparation where parts of a page are positioned for esthetic as well as communicative and space considerations. In this report, it is placed under "Copy Preparation."

### BOOK DESIGNERS

An example of the extent of change in graphic arts is the new role of book designers, particularly in the field of education. Both the aspects of marketing books to a mass audience and the changing technology of production now makes the designer of the book a key factor in its success. The decisions of the designer now become highly significant.

Today's designer selects more illustrations and illustrations of a higher quality. The use of color continues to increase and add new dimensions

to the printed communication. And as the designer calls for more color, more book publishers are installing color presses. An extension of the designer's interest in color shows in his concern with the production so he can make decisions that will fall within the capability of the reproduction process.

Today's designer should realize that there are limitations to the reproduction process, and it makes no sense to create and lay out designs that cannot be accurately reproduced. This means that the designer must have some appreciation of the printing characteristics of the paper, ink, and press.

At the merchandising end of book publishing, the impact of the design may greatly affect the quantity of sales. The designer not only needs to know the book and the reproduction capabilities, but he must be aware of its proposed audience in order to consider the kind of stock, cover material, point of sale, and method of distribution. These factors should be reflected in cost analyses so that the subject matter of the book, along with the design, will be compatible with the needs and economies of its buyer. It is reported that when all the factors are put together in a logical manner, the book will design itself.

The role of the designer should be one which might be described as a super-specialist in conjunction with broad fields of education, training, and experience. And it has been suggested that some of these requirements can be fulfilled by a liberal arts education.

## TYPOGRAPHY

Few items in a changing graphic arts industry have changed more than type, its availability, and methods of being set. Its range of style reaches from the huge (and sometimes rare) wood styles to the styles in phototypesetting, including all the infinite variations of slanted and irregular shaped letters that can be produced on photolettering devices.

Part of the problem in type design is the past and anticipated introduction of new media. One has only to observe old movies on television (and even some current commercials) to be aware that type should be designed specifically for its media. And while present designs for the printed page may continue to serve as legible copy, it is not known when or where new media or methods of handling characters may evolve. For example, part of the eye strain of editing material on a CRT may be due to the system's incompatible type design. The future use of laser beams for generating characters may present another problem in design. And we are now also aware of the problems of reading equipment in OCR systems.

All of these factors present a challenge for future type designers and typographers.

## COMPOSITION

### INTRODUCTION

Composition consists of the methods of preparing type matter for a mechanical. A small section on hot metal has been included.

Methods of producing flat type (formerly cold type, more recently called non-metal or flat type) include paper type, templates, scribes, photolettering, direct impression, and phototypesetting.

#### FLAT TYPE

Paper Type. For the inplant operation, there are several ways to produce the copy, headlines, and display type that are needed for bulletins, reports, covers, and other inplant communications. The equipment and methods are designed for low-volume production. Inexperienced personnel can produce items that look quite professional.

Paper type comes in three different forms: composition, adhesive, and transfer. All are assembled manually using line guides.

Composition type (the least expensive) consists of letters printed on paper which can be assembled one at a time and are used primarily for straight headlines or display copy.

Adhesive type is peeled from its transparent acetate sheet and assembled on a layout sheet. Lines are used for alignment.

Transfer letters are also supplied on transparent sheets. In this case, the pigmented letter itself is transferred to the desired position by burnishing the top of the transfer sheet. Once transferred, these letters cannot be removed. Thus, they are a little more exacting to handle.



Templates and Scribers. For the most part, templates and scribers are used as drafting aids for callouts and title blocks on engineering drawings. However, they are useful for display letters for the inplant printer. Frequently, they are used as an intermediate device. When production needs are increased, these devices are set aside in favor of photolettering equipment.

Lettering templates and scribers provide more versatility than paper type, but also require a little more care and skill in producing the letters. Some have adjustable settings to make enlargements, reductions, italics, and various special effects from a single font. Scribers can be used with any kind of paper which accepts the image material. Also, by using an appropriate ink-receptive lettering medium, the scriber can be used on direct-image offset plates.

Photolettering. Like lettering templates and scribers, photolettering equipment is used for display type. Here the "template" is in the form of a master disc, strip film, or even a glass plate. In normal room lighting, images on these masters can be selected one at a time, positioned on the copy film or paper, exposed, and processed ready for paste-up.

There is a wide selection of fonts, and the flexibility of some photolettering machines makes it possible to extend, condense, slant, overlap, stagger, screen, curve, and otherwise manipulate each image. In addition to regular letters and numbers, some equipment provides masters of ornaments, borders, and symbols. Some have automatic spacing, some leave spacing entirely to the discretion of the manual operator.

Sophisticated photolettering equipment provides sufficient flexibility and production capability to satisfy the requirements of commercial printers.

Direct impression. For straight composition of text matter, direct impression equipment (IBM Selectric Composer, Varityper, Justowriter) produces camera-ready copy. This equipment is frequently thought of in terms of inplant and/or low-volume production. It is used to produce a large variety of communications, including bulletins, routing slips, telephone directories, product letters, manuals, revisions, and promotional material.

Keyboards are similar to regular typewriters. Without re-keyboarding, the hard copy can be used for paste-up. If a tape is generated simultaneously with the hard copy, as in the IBM system, it can be used in the companion piece of equipment for producing justified copy (at the rate of 14 characters per second) for paste-up.

The MT/SC is automatic except for hyphenation which requires the decision of an operator. From the standpoint of general inplant material, its proportional letter spacing can save as much as 25 percent in paper costs. Operators can be trained within two weeks.

Phototypesetting. Gutenberg's accomplishment of movable type in 1450 appears again and again in graphic arts literature as one of man's great achievements. In today's language, it broke a bottleneck. As in most areas of technological progress, graphic arts has grown by breaking the

constraints of bottlenecks in production. In each case, another bottleneck is formed which is the obvious result of the lack of a systems approach. Movable type, the cylinder press, the line-casting machine, and the more recent (1950) use of phototypesetting machines are examples of "breaks." And again, with the application of electronics to typesetting, the industry is already scrambling to prevent bottlenecks from forming at the input and platemaking stages of reproduction. There is active research in OCR, CKT, photo-platemaking, ink-jet systems, in addition to several stop-gap efforts. Eventually the bottleneck will be focused on the man/machine interface at the beginning and at the end of information transfer.

Meanwhile, in the technology of phototypesetting, system concept designs must be kept simple enough to hold down costs and minimize failure rates. At the same time, machines must be sufficiently useful to justify their design and cost of operation.

Phototypesetting entered graphic arts as an application of computer capability to justify and hyphenate in the 1960's. Success in these areas permitted applications to spill over into other graphic arts areas (by using CRT, it was unexcelled in handling listings such as directories, catalogs, parts lists) until quite suddenly, it was realized that much of the computer equipment in graphic arts was monstrous, incompatible, and too costly to be feasible. This is not to say that electronic computers have had their day in graphic arts. Quite the reverse is true. Computers have gained wide acceptance (over 1,000 in graphic arts use at the end of 1970) and are being applied to systems such as CRT editing

where one person can initiate, proofread, correct, and lay out pages from one position.

The "overkill" of attempted computer applications did, however, help the field of electronics and the field of graphic arts to realize that applications of electronics need to be compatible with graphic arts production. The result has been a situation in which each has compromised for the common goal of collecting, storing, retrieving, and disseminating information, which is a part of the role of education and communication.

At the same time, it was obvious that computers could be used in the administration of the graphic arts industry as in other industries.

Suddenly, as in any wise and cost-conscious industry, it was necessary to pause and evaluate all this application. There is still confusion, and present progress is being studied cautiously.

The attitude toward computer application in graphic arts as a marvel has passed. It has been de-glamorized. Today, it is viewed as a tool, and if it does not fit the job to be done, industry is not buying it. As with other equipment, the computer must justify its initial cost and its operating cost. This includes software costs. Furthermore, buyers and users should consider syntactically organized languages for typesetting systems such as TEXT 360, PAGE 1, ULTRA X, or APSOLVTE.

One of the uneasy aspects of deciding to invest in electronic equipment is the fact that electronic performance is not visible. Hot metal

ment has mechanical parts and functions that can be viewed, timed, and controlled. Its volume and cost have been known for years. It has independent units that can be added to or subtracted from the production line without much thought of a system.

The operation of electronic equipment is quite different. Most of the time, its capabilities are greater than its workload (thus, time-sharing). Its usefulness is appreciated only when considered as part of a system. Even its terminology is so different that graphic arts personnel must learn a new vocabulary. And finally, its "secret" performance keeps most uninitiated printers in a state of awe, confusion, and distrust - all of which can, and is, being overcome.

In some respects, the phototypesetter can be divorced from computers. If viewed as an electronic-optical-mechanical device for the photographic projection of images from a matrix, it is a piece of equipment constructed around a flash or discharge device through a matrix of the typeface - on a disc or drum - and rotated rapidly between the flash tube and the imaging lens. Stepping motors are used for width and line feeds and the internal control is almost wholly by solid state devices. Size variations are controlled by the lens used, and a turret is provided to swing the proper lens into position by tape control. It is only when we deal with the selection and format of the printed matter that the system draws on the storage and direction of the computer program. Yet the two functions join in a natural union. It has been reported that the actual computer processing of copy takes longer than the phototypesetting operation.

The nature of a phototypesetting machine is such that each time a character is exposed, it is necessary to advance the paper to receive the next character. The width of the character must be determined. This same calculating circuitry which establishes the character width and calibrates interword spacing can, with a little modification, be used to operate the machine for a justified output. All of this seems to be a feasibly related function. Today, almost any keyboard can be coupled with appropriate computer hardware and used for phototypesetting. Furthermore, the presence of a computer facility for storage and information processing allows the inclusion of outside terminal facilities. A distant typewriter terminal, for example, will allow a computer input that can later be edited as needed.

Phototypesetting is the first major advancement in composition since hot metal in 1890. Its growth has been spurred by offset printing which, again, is a natural component of a total reproduction system.

Comparisons commonly made between hot metal and phototypesetting emanate from experience which may or may not be typical. Nevertheless, comparisons are useful to evaluate progress.

1. Phototypesetting is less expensive for a given capability than equivalent hot metal.
2. Phototypesetting machines are faster, e.g., 20 lines per minute. One phototypesetting machine can replace several linecasters.
3. Phototypesetting machines have a greater range of type size. From 10 to 32 type styles can be intermixed in 5- to 72-point sizes.

4. Phototypesetting can accommodate a greater range of input tapes and code combinations.

The one big disadvantage of phototypesetting is that it is more difficult to make corrections in such a system. This problem is tolerated and partially solved by careful scrutiny of pasted-up copy. Furthermore, some editing programs allow phototypesetting to produce error-free tape. There is no doubt that the speed capability of phototypesetting equipment is great. However, the claims of the volume being processed can be misleading if it is assumed that phototypesetting is "overwhelming" hot metal. Volume figures may represent other factors. For example, a great deal of material which was not previously typeset is run through phototypesetting equipment. Secondly, while standing galleys of the hot metal system were corrected by removing or adding necessary pieces, in phototypesetting an entire directory is reset. In fact, because of the capability of the computer equipment, the overall cost of resetting an entire book is considerably less than that required to update standing type, to say nothing of improved accuracy and convenience.

The phototypesetting question frequently arises when a newspaper goes from letterpress to offset. Because of the daily changes in the classified ad section, it is believed that hot metal should be retained for this section. Hot metal has inherent advantages in the mechanical lock-up of so many bits of information. It has been shown, however, that the phototypesetting system can handle this section, providing the entire classified section is generated by computer (after corrections, additions, and deletion) phototypeset, and pasted down on a grid layout. This was the approach taken by the Sacramento (California) Union when it converted 100% to phototypesetting for offset reproduction in 1968.

The value of speed in any system is to reduce total production time and improve the opportunity for more jobs and more profit. Comparisons of phototypesetting and hot metal can be made here also.

1. A book requiring six months to produce by hot metal can be produced in three weeks by phototypesetting.
2. For a book such as a phone directory, the phototypesetting system eliminates the need for storing tons of standing type.
3. A computer-set phone directory of 750,000 entries took 16 hours by phototypesetting. Allowing for an average of 40 characters per entry, the same job would have required 1,250 hours on a tape-operated linecaster working at an average of 18,000 characters per hour.

Among the more advanced processes in phototype etting is the Harris-Intertype CRT technique of providing almost instant print-out of publication-quality typography. When used in conjunction with appropriate hardware, this equipment can compose whole pages photographically. The computer program directs changes in format such as manipulating data, recalling programs for updating, and sizing and spacing of characters. The output is a full-page composition on either photo paper or film ready for platemaking in approximately four seconds.

#### HOT METAL

There appears to be no major change in the area of hot metal composition. Although still a strong and major production process in graphic arts, any new designs in equipment tend to be improvements in versatility, increased speed, or better compatibility with photocomposition systems.



Metalset by Composition Systems, Inc., is a new computer program which includes such features as pi mat facility and automatic ellipsis insertion. Reportedly the first hot metal computer program to offer full tabular capabilities, it also offers French and regular spacing, ligature function, small caps, quad left, quad right, upper and lower rail, word delete, keyboard shorthand break, one-line justification, font definition, measure, runaround, ragged copy, interword space changes, one line bold or caps, dropped initial, and end of take. It also incorporates functions for wire service text rejustification; rejustification of stock market and box score tapes; and Justape compatibility.

Linotype Model 794 is reported as the new 12-line-a-minute composing machine. This redesigned equipment is faster, has more magazines than previous models, and incorporates many features to make composing easier for the operator.

## **COPY PREPARATION**

### INTRODUCTION

Copy preparation is defined as those activities and procedures needed to prepare a mechanical for a process camera. The mechanical, of course, consists of the copy (text matter) that has been prepared in composition and the line art that has been prepared by an art department.

### PASTE-UP

Unfortunately, many people in other areas of the reproduction process do not understand or appreciate the care with which a mechanical must be

made. A mechanical is a kind of "point of no return." While copy and positions can be changed at this point with relatively low cost, changes that are made after this page is photographed become relatively expensive. And since proofs can be made of the mechanical, there is really no need to make changes (except possibly in halftones, which are stripped in later). Therefore, the mechanical deserves careful attention.

The person making up the mechanical must understand the tools and methods that can produce clean photographic copy. He must also have the sense of proportion and balance so necessary for eye-appeal. For this reason, it is recommended that the person have art training or background. In actual situations, however, the person usually has had training in some other area of graphic arts, and preparing mechanicals is done by trial-and-error methods.

At the present, paste-up remains a manual function. The procedure is as follows: A rough sketch is usually the first step in assembling the units of copy and art. Exact space must be left for halftones to be stripped in later on the flat, and this requires careful planning. In simple cases, sketches can be eliminated if the individual units are placed in their approximate positions before they are finally pasted down. The paste-up personnel may also be using a previous reproduction for comparison, since a visual of some kind is frequently more meaningful and more effectively understood than written figures of measurement and instructions.

For the actual paste-up there are several methods such as waxing, rubber cement, gum, and adhesive tape. The "artist" will select and use the methods that best fit his needs. Some are more economical. Some are faster, cleaner, and allow quick changes to be made. These seemingly insignificant tools are important, since poor quality in the mechanical will mean even worse quality in the final reproduction. And any camera enlargements will accentuate flaws such as broken type, holes in the type, stains, smudges, and weak image areas.

This is the point where all the material (except halftone and color separations) are assembled:

- Letterpress proofs
- Positive photoprints from photocomposition
- Paste-up type, presstype
- Shading sheets
- Instructions for tonal effects to be produced photographically by the copy camera (process camera)
- Negative photostats for white copy on black background
- Register marks
- Prepared "modular art" for illustration

It should be noted that halftones are stripped in the flat (a negative film sheet of the page) that is made from the mechanical. If there are no photographs to be included in this page, no stripping operation is necessary. Likewise, a screened halftone print that could be pasted up on the mechanical would also eliminate the stripping operations. Kodak's photomechanical transfer process using a gray contact screen was

designed for this purpose. KODAK PMT Negative Paper is simply exposed in a process camera holding the desired photo. Then this is placed in contact with a sheet of PMT Receiver Paper, and both sheets are inserted into a diffusion-transfer processor. In 30 seconds, the sheets can be peeled apart, and the receiver sheet has a screened image which can be pasted up immediately. In addition to saving in intermediates and stripping, one of the errors it eliminates is the mistaken identity or position of halftones. Of course, the photomechanical transfer process can be used for proofs of the completed layout.

Along with other tools and aids that are being used in making the mechanical and the prints, one of the time-saving pieces of equipment is the stabilization processor. This one-step print processor is convenient in the paste-up function.

#### PHOTOGRAPHY

General Status. Prepress operations can involve a great deal of photographic processing. Hot metal, as well as flat type, can be directed toward lithography. Photosensitive materials are used in prepress gravure and screen printing. And whenever continuous-tone photographs are converted to halftones or separations, photography becomes one of the currently basic methods.

The process camera is similar to other cameras, yet it must perform a special task. First of all, it photographs subjects that have only two dimensions: height and width. This requires a lens with a "flat field" characteristic. Focusing, enlarging, and reducing are accomplished by

moving the lens and the copyboard. The three basic types of work for the process camera are line, halftone, and color photography.

Galley cameras, darkroom cameras, and the vertical camera-enlarger (1954) have had their sequential and overlapping usefulness in making photography a part of graphic arts.

Typical aids include halftone calculators, dot gain scales, data sheets, and color control devices. Most cameras today have vacuum frames. In the camera department, routine, repetitive, and easily controllable operations are rare except for mass production of a single photo. Most frequently, each camera job requires careful evaluation of the work to be done and skill in adjusting the tools to be used. A cameraman's skill must include accurate evaluation of the original copy.

It is difficult to make a neat division between common accessories usually found in the camera department and those specially designed devices which tend to make the job into a system. As in other areas of graphic arts, there are pieces which may or may not fit, depending upon existing equipment, the nature of the printer's work, and cost structures.

Photography seems to be a core function in the prepress area of graphic arts reproduction. While there are ways to by-pass the silver halide photographic process in the reproduction system (ink-jet, electrostatic reproduction), the photographic process seems to be the best route to arrive at the product when large volumes and mass-production are considered.

Since film is going to be used, it must be processed. Automatic processors necessarily become a building block in a system. And of course, various automatic features have been developed in camerawork. A system is desirable for high-production products such as cartons and labels. Although a system can be feasible and profitable whenever high volume is concerned, a simple combination of camera and automatic film processor can also be profitable. Such a system might incorporate automatic exposures, a conveyor from camera to film processor, accurate pin registration on the copyboard, accurately punched copy from the layout department, automatic processing, the use of roll film, dimensionally stable film. While some of these factors are not ordinarily considered automation, they do contribute to the concept of speed, accuracy, and the least amount of man/process interface.

The need for control of factors making the halftone negative (and separations) is apparent. Exposure values of the original must be translated by some means to get the best available sequence of time and illumination. These controls can be made by using computer or slide rule or some variation of control device and/or system such as Gammatrol, the Welch Densichron, Robertson Photo-Mechanix's Imagic, Type 229 Densiprobe, EPOI marketed by Johnsons of England, Carlson Magnacolor by Master Sales and Service Corporation, C-14 Enlarger by Consolidated International, Durst G-184 Process Color Enlarger, and Cosmocolor by Web Press Engineering Inc.

For many inplant publications, the Polaroid MP-3 system for making "instant halftones" is useful. An original continuous-tone print is placed on the MP-3 baseboard. Photoflood lamps provide the illumination for

exposure. A holder in the camera head accommodates the Polaroid screen of 65, 85, 100, or 120 lines per inch. Model 500 or 545 can be used for  $4 \times 5$  film. Polaroid's system, using type 51 Land film (ultra high contrast) produces screened prints for paste-up. Cost is reportedly less than a dollar, and the time involved can be as little as 15 seconds.

Screens. Probably the most important item for camera work for reproduction is the halftone screen.

In 1852, Fox Talbot obtained the English patent, number 565, for a screening method of breaking continuous tone images into printable dots. His screen consisted simply of a dark fabric, and he was applying the idea to the gravure process. In 1855, A. J. Berthod obtained a permit for a lined screen. The industry worked exclusively with glass screens for many years. Kodak, in 1941, introduced contact screens. Eventually these ideas developed into our present technology of halftone photography.

Glass screens are made of two glass plates, each having parallel opaque lines with a ratio of 1:1, mounted together so that the lines of each plate cross each other at right angles. All glass screens are equal in tone reproduction performance. Good quality halftone depends upon the skill of the operator, basically selecting the appropriate screen distance.

The contact screen, of course, is a single sheet of film having a pattern of vignette dots with a uniform density gradient. Vignette dots are superior in resolution and light transmission.

All screens come in a variety of lines to the inch. Screens can be either negative or positive (positives give a fairly straight line negative but do not print back straight) and are marketed in several tone levels such as hard, medium, and soft. They also come in different patterns: regular square dots, chain-dot, spiral dots, and special screens with grain. Policrom of Italy markets a screen known as "double dot" or "large and small dot" which describes the actual physical pattern. Furthermore, the vignette dots may be silver or dye images. Silver images are the same as ordinary photographic images and are known as gray screens. They are used in the direct screen process as well as for black-and-white screening.

Screens having a dye image are known as magenta screens because this is their developed color. And because such a screen is colored, it cannot be used in the direct screen process. However, in black-and-white screening, the magenta screen makes it possible to vary the reproduction density range with the use of color-compensating filters.

There are many ways a skilled cameraman can use his selection of screens (fine or coarse), exposure times, filters, light sources, and exposure methods (main, bump, flash) to obtain the best available halftone for the reproduction. However, he must also understand the characteristics of the reproduction process and the nature of photo subject in order to get what is wanted.

The many advantages of the contact screen over the glass screen make it the commercial favorite among cameramen. This seems to hold true even



though the contact screen must be regularly replaced because it is subject to damage by scratches, fingerprints, moisture, and chemical contaminations in its daily routine use. Also, in replacing the contact screen, it should be remembered that screens vary quite a bit from each other. Screens from different manufacturers may not even be compatible. They will vary in contrast range and needed exposure time. Furthermore, contact screens are generally made from glass screens and will inherit all of the glass screen's deficiencies.

In black-and-white reproduction, the single most critical problem has been the sudden jump in density around the 50 percent halftone dot. At this point in the square dot contact screen, the square corners begin to join, making a non-uniform gradation. The condition is aggravated in the reproduction process by ink spreading on the press sheet. Moreover, the jump occurs in the sensitive middletone areas of photos such as facial skin tones.

The problem is complicated in four-color work, since the color break may occur at different levels. This may soften the break, but it may also cause "red banding" in flesh tones. Such a band runs between the highlight and lower middletone areas.

Kodak, along with other designers, has attempted to solve this problem by the use of elliptical dot screens. These screens are just as easy to use as "conventional" screens, and they help to eliminate the 50 percent jump.

Direct Screening. By the mid 1960's, several firms were using direct screening to make color separations. Certain advantages are offered in the short cuts of direct screening. Although the technique depends somewhat on the selection of equipment, a common feature in all direct screening is the exposure of panchromatic lith film to the projected image of the transparency, using a color correcting mask and a gray contact screen. Separation filters are inserted in the light path and the screen is angled according to standard procedures. The result is a four-color set of halftone negatives.

Automatic Film Processors. Automatic film processors (perhaps better called mechanized processors) cannot perform magic, but they are a useful tool and, for many shops, an indispensable piece of equipment. As in all automation, the concept is to maintain constant control according to selected settings. Control strips from film manufacturers should be used to get the best results from the processor. They should be read with a densitometer and records should be kept as part of the tool. Processors have been blamed for a poor performance when the operator should have been better trained. It is most important that the operator thoroughly understand the capability as well as the limitations of the processor. Speed, temperature, and chemistry can be critical factors. A knowledge of the characteristics of film is necessary.

This form of automation is not necessarily restricted to large plants, since less costly, smaller processors make automation available to the medium-sized plant. Users should know that some processors are designed for processing lith-type film (line and halftone) while others process continuous-tone film.

Manufacturers point out that a processor should at first be used to process the film only with the chemistry for which it was designed. In this way there is some assurance that the processor is operating correctly.

Users of automatic processors point out that while similar personnel are needed, the kind of training is different. An operator must have a "caution disposition" and be somewhat of a perfectionist. But he must be trained in the ways of automated equipment. He must realize that equipment can generate its own brand of faulty product and in considerable quantity. But the length of training for automation is considerably shorter than, for example, tray processing in a darkroom.

Some shops are so confident in the concept of automation and its equipment that, upon building new plants, they have made no provision for "back-up" systems. They have no processing sinks. When and if equipment breaks down, they are out of business until it is repaired. Obviously, routine maintenance is a vital part of such shop procedures.

Color Scanners. Although the use of color strongly depends upon budgets, there continues to be an interest in the technology of color reproduction. Good color reproduction has impact in communication. It is wanted by advertisers and editors alike, but the user must always consider the total cost of any job in which color is reproduced.

It is interesting to note that the beginning popularity of reproduction color came to the public in 1890 when it was used in comic strips to increase the circulation of newspapers. It wasn't until the 1930's that

process color began to appear in newspapers. In the 1970's everyone seems to believe that color reproduction has an exciting future, although there are a number of problems beginning with costs and ending with a vague area of not really knowing the perception desires or capabilities of the reading public. The inherent limiting aspects of the reproduction process have never been explained to the public, and the average person still believes that the quality of reproduced color can be as good as what he sees in the real world with his own eyes. The public believes that any quality less than this is due to the indifferent attitudes of people in reproduction. If the reader knew the effort that is put into the reproduction of color, he would possibly appreciate the quality of color that is printed. At least he would appreciate the effort being made.

Separations can be made either by photographic methods or by scanners. It is still not clear which process produces the better product. Quality depends upon the evaluation of the original, the experience of personnel, quantity of work involved, and the end media.

The basic problem is the need to make certain color correction adjustments. In photography, this is accomplished by masking. Correction by scanner uses electronic circuits to control the exposure of corrected negatives or positives. Some scanners (Ciba Limited and Hell) have developed procedures in which correction signals can be derived from the original copy by modulation.

Reportedly, the scanner permits better quality control. Undercolor removal is no problem. Handwork is eliminated. By being a combination scanner, computer, and kind of scribe, the electronic scanner can produce completely color-corrected separations. The scanning function picks up the characteristics of the original scene. The computer makes the calculations needed for each corrected separation. And the output signals sent to the scribe make the correct exposure on separation film.

Today's scanners enlarge, reduce, screen, and merge copy. Pictures can be merged with linework or artificial background. Negative and positive color text can be dropped in.

Although the scanner can handle the separation step, the exposed film must still be processed. The best results are obtained by the use of a nitrogen-burst processing tank or a mechanized film processor.

It should be noted that various manufacturers are experimenting with laser beams in an effort to scan directly onto a plate while it is mounted on the press.

Some feel that scanners are a threat to the photographic method. Photographic systems are being improved in a number of ways. KODAK Tri-Mask Film and GEVAERT Multimask Film, for example, reduce the time needed to make proper color correction. Cameras and light sources have been calibrated to standards. Constant color-temperature pulsed xenon lamps, stabilized light counters, preset filters, better optical systems with fine adjust-

ments, plus automatic processors have shown a degree of automation and better control.

Prepress Color Proofing. The color proof is a tool for controlling color relative to both the original and to the product that will come off the production press. The last few years have seen a flourishing of such systems corresponding to the growth of color printing in general. Today, at least 16 firms are manufacturing over 22 prepress proofing systems for printers of color.

There are two basic types of proofing systems. The overlay system, in which four transparent sheets, overlaid in register, bear each of the four process colors, is a rapid method; its primary advantage is that it can serve as a progressive proof by combining any two or three colors in register. The other method is the superimposure method. This method produces a proof which is closer to the press sheet. By building up layers of color on a single base sheet, this method more closely resembles the actual printing process and thus eliminates the color distortion which is inherent in the overlay system.

New products exist in both of these categories, and some of the older products have been improved to give the printer better control of his printing operation. The individual systems offer a variety of advantages: some offer speed and economy; some emphasize accuracy of color rendition. Costs to operate the systems range from a few pennies to many dollars.

The existing prepress proofing systems cannot, for the most part, duplicate what will appear on the press sheet. The photographic techniques used for most of these systems simply cannot account for such on-the-press occurrences as dot gain or trapping. Nevertheless, the most recent systems promise to eliminate the color distortion common in many of the earlier systems without exceeding the boundaries of economy. And for a world which is demanding increasingly more and better color from the printing industry, prepress proofing systems are becoming an indispensable tool for preplate operations.

Systems Design for Copy Preparation. There is already in use a number of systems which can quite effectively transcend the conventional steps of layout. These systems tend to compress so much of the task that the responsibility of a final layout shifts back to the editor.

This recent (1970) approach to layout consists basically of a CRT display as the axle of a wheel of peripheral equipment. The commander of this display will be recognized as the editor, but he must play a different game.

In this electronic system, the CRT is used as a composing and layout facility. Classified ads can be received by phone and immediately composed on a CRT. As the ad is typed on the keyboard, the characters appear on the screen. Length of the ad, proofreading, and corrections can be accomplished while both parties are on the phone. When the ad is ready, it is transferred to computer storage along with other new ads as well as repeat ads. When the deadline arrives, a tape is produced,

and the classified ad section is quickly set in type. Meanwhile, billing data has been computer processed and is ready for mailing.

In another area of layout, display ads can be maneuvered and positioned by using the CRT. This CRT display of layout provides a facility for quickly and easily evaluating the page aesthetics before it is given to the newsroom. Beginning with the parameters of the individual newspaper, the display ad skeletons can be moved by computer and arranged on one page or transferred to other pages. The final layout is then used as a guide for the dummy.

In this particular system, there is presently no working facility for entering editorial copy in the dummy. However, CRT editing of copy is becoming a feasible approach for moving copy from the editor directly to paste-up type for the composing room. There is even speculation that color CRT will emerge at this position.

In simple terms, an editor puts his copy on the CRT display terminal, adds to it or deletes copy, makes corrections after proofreading, and transfers his story to a computer which generates a tape which, in turn, operates a typesetter -- either hot metal or a phototypesetter. And suddenly, the editor is being saddled with direct and complete responsibility for editorial copy, layout, and composition.

Some editors are not completely in favor of this new responsibility. The man/machine interface position is not to their liking. It conflicts with their personality. Besides, it is reported that the eye-strain is debilitating.



Not only must the editor evaluate all copy, including the stories that he must pull from a computerized news storage facility, he must read and correct copy by editing with a cursor and be certain that all of the copy is in order before he transfers it to a computer. Once he clears the screen, the copy is "in the works" and may not be seen again until it appears as justified copy ready for paste-up.

Once again, the facilities and the hardware seem to be available and awaiting man's capability to match its demands and become compatible. Not only does this require training, it calls for acclimation which may be psychologically delegated to younger, incoming persons.

In 1966 the management at Life magazine felt that production time could be reduced by changing its traditional method of layout. Too much time was spent in manipulating copy and art to satisfy all the people who were responsible for these functions.

They engaged a firm in optical engineering to design an electro-optical, mechanical system that would provide a wide selection of parameters for each piece and page making up the magazine. The Editorial Layout Display System (ELDS) consists of sixteen 35mm slide projectors, the means for transferring slides between the various magazines and projectors, another projector for displaying the layout grid on the operator's display screen, a complete photographic system to produce full-sized prints of the finished layout, and the electronics to control the system. The main magazine holds 99 color or black and white transparencies in 35mm format. Two other magazines hold 142 transparencies of bogus type.

These slides can be called up for display so that the art director can make a selection. The system, however, does not provide an automatic layout. It just puts a wide variety of possible art work and designs within each display.

As each transparency is selected, it is moved into the main page area where the art director can change the magnification, crop as desired, superimpose grids, and add some basic type styles. This complete layout can be produced in a few minutes.

When the layout is complete, several full-sized positive prints are made for final evaluation. All of the slides of the ELDS are returned to their original position in the system, and it is ready to begin the next layout.

The system costs over \$1 million, but simpler models might cost less. The suggestion has been made that although the ELDS is costly, models might be made available on a time-sharing basis.

There is something gargantuan about such all-encompassing systems. Their value may not be sustaining. This is particularly worthy of thought in view of the fact that many publications with large distributions have recently discovered that "bigness" is not always a criterion for "profit."

### IMPOSITION AND STRIPPING

There is no neat definition for this function of preparing a final form for making the plate. Pages as well as such components as register

marks and halftones, whether locked up for letterpress or stripped in for lithography, must be positioned so that they will appear in proper sequence when bound.

At present this step of the reproduction process seems free from automation or automatic devices. Placing pages in their final position and preparing the flat for platemaking is still a manual operation. New supplies and equipment to make the job easier are on the market, but none seem to alter the basic step: Each shop develops its own way of doing the job, and minor innovations are made by the more progressive people.

## PLATEMAKING

### INTRODUCTION

In the 1960's, photocomposing equipment created a revolution in the field of composition. Hot metal composition is being displaced, and lithography's rapid advance may also be traced in large part to the advent of photocomposition. If this revolution was largely limited to the area of composition in the 1960's, the 1970's should see an extension of this revolution into the realm of platemaking. The effects of photocomposition on platemaking are certainly already being felt, as one writer has defined platemaking as "the step between photocomposition and the press." As a result, photographic plates of some kind are going to be more heavily in demand than traditional plates in every process.

The second major trend which is going to affect platemaking is simplification of the platemaking process. The day of the skilled craftsman

platemaker is gradually disappearing, and it is unlikely that future generations will need to be taught his skills. The need for the craftsman platemaker is being eliminated on one hand by a change in plates and platemaking procedures, but perhaps more extensively by automatic processing, labeled "the biggest thing in platemaking today." As Modern Lithography explained, "This is the age of 'systems,' and...plate manufacturers now supply automatic processing equipment for their plates." Regardless of the printing process, automatic processing of some kind will change the nature of the platemaking department, with craftsmen and manual tools being replaced by "lab technicians," men familiar with machine systems and control panels.

#### PLATES AND PLATEMAKING FOR LITHOGRAPHY

Lithography, by virtue of its youth and inherent characteristics, has been the most adaptable to new trends in platemaking as a result of photo-composition. Unhampered by traditional concepts and large investments in platemaking and composing equipment, the offset printer has been more willing to try a variety of new plates and techniques, and offset platemakers have accordingly been more creative in developing new plates which always seem to find a market. Lithographic platemaking can thus be characterized as the most revolutionary of all processes with an abundance of developments which depart from traditional concepts and promise to bring radical change to platemaking as well as printing techniques. A necessary by-product of this innovativeness is a short life-span for many of the products and the possibility of a future not related in almost any aspect to the present. As one writer has claimed, "the life span of any new plate is unlikely to exceed 10 years in the changing

world of web offset." For the offset printer, this means that his avant-garde platemaking department may be obsolete in ten years. His problem will be one of gearing his platemaking procedures to today's production problems without restricting his ability to adapt at a future date.

The new types of plates which have simplified the platemaking process have, of course, been largely responsible for lithography's advance to the position of dominance it now enjoys in graphic arts. Plates and platemaking are therefore of special importance for the offset printer. Among the factors which will influence his choice of plates are the time to prepare (exposure and development times plus subsequent treatments to make the plate press ready), the developing procedure, whether manual or machine processed, cost of plate, and plate life. Plate life requirements obviously depend on the application, but with offset's increasing penetration of the newspaper field, long-running plates for offset become a must.

Until 1950, there were only two lithographic plates in general use in the United States. These were the albumin-coated and deep-etch plates. Zinc was the primary plate material. Today most plates are aluminum which is a better metal for surface treatments and for coating with photosensitive materials. The copperized aluminum plate, introduced in 1955, has been responsible for completely converting deep-etch platemaking to aluminum. Furthermore, wipe-on plates, presensitized plates, and photopolymer plates have since appeared on the plate market, which now represents a sales volume estimated at between \$40 and \$200 million a year. These plates can be classified in three basic groups: surface plates,

deep-etch plates, and multimetal plates.

Surface plates. Surface plates usually have an aluminum base coated with a photosensitive layer, either of which may be the printing surface. In the case of wipe-on plates, the platemaker coats the surface himself, using a diazo resin which changes solubility when exposed to light. Presensitized plates, on the other hand, come already coated from the manufacturer and may use either the diazo coatings or a photopolymer coating.

Processing of both wipe-on and presensitized plates has been greatly simplified. Exposure time is around one minute. Development times depend on whether an automatic plate processor or hand development is employed. An automatic processor is naturally faster, but even hand development requires only 1 1/2 to 2 minutes using one, or at most, two developing solutions.

It is not surprising that the wipe-on plate is the least expensive of lithographic plates, since the manufacturer does not have the labor and materials cost involved in coating the plate. The price of presensitized plates climbs in direct proportion to the durability of the plate, with the photopolymers (Du Pont Lydel Plate and KODAK POLYMATIC Litho Plate LN-L, for example) at the top of the price scale. Nevertheless, these more expensive photopolymers are more resistant to abrasion than diazo coatings and accordingly provide longer runs, with Du Pont's plate offering top performance at over 100,000 impressions. Plate life for most wipe-on plates varies from 15,000 to 45,000.

Deep-Etch plates. Deep-etch plates have played an important role in lithography in the past. They are still in widespread use today for long runs -- up to 1/2 million -- on large sheet-fed and web-fed presses. They are, however, restricted by the fact that they are positive-working only, and that they require manual processing which takes two to three hours.

The deep-etch plate begins with a sheet of aluminum. A photosensitive stencil, adhered to the surface and exposed to the film positive provides a resist for the etching which produces a recessed image area on the plate. Although this plate, like most other lithographic plates, is not truly planographic, the degree of recession is slight, and the distinction between printing and nonprinting areas still corresponds to the ink- and water-receptive areas of the plate. The image areas are generally coated with copper after etching, since copper has a high natural affinity for ink. The nonprinting areas are made water-receptive by removing the stencil while a nonbinding lacquer insures ink receptivity of the printing areas.

Multimetal plates. Multimetal plates are best characterized as long-run plates. The most rugged of lithographic plates, they are capable of runs from 1/2 million to 3 million as a rule. The multimetal plates may consist of two or three layers of metal, with aluminum or stainless steel serving most frequently as the base metal. The surface metal of a bimetal plate is copper, while a trimetal plate has both copper and chromium layers which serve as the image and nonimage areas respectively. More recently, a brass and chrome plate has produced runs of up to 5 million impressions with excellent ink receptivity. Presensitized multimetal plates are also available, but the photosensitive layer, unlike

that of presensitized surface plates, serves only as a resist and is removed before printing.

A longer processing time and higher expense are two of the limitations of this plate. A processing time of less than 30 minutes cannot be expected whether the plate is processed manually or in an automatic processor. Nevertheless, good quality, ease of running, and consistency on the press compensate for these disadvantages. And recently Itek has announced a low-priced, long-run metal plate which the firm claims can economically produce runs of 250,000 to 750,000. The processing of the plate deposits a modified form of silver on the plate during a metal developing bath subsequent to exposure in which a special coating on the plate becomes excited to make it receive the metal deposits. The plate is fast, requiring a 30-second exposure, followed by a development time of 1 1/2 to 2 minutes. Furthermore, the plate will cost as little as 1/3 the cost of conventional metal plates when it is marketed.

Beyond this variety of plates, which fall into the traditional classifications of lithographic plates (if such a tradition can be said to exist), are two new developments in lithographic platemaking which most likely will have far-reaching results: the "driographic" plate and the "process-less" plate.

In 1970, the 3M Company announced its new Dry Plate and with it a new printing process which it calls driography. Driography is a planographic printing method which does not require the dampening system that is part of conventional lithography. Nevertheless, the plate can be run on



conventional lithographic presses by simply disengaging the dampening system.

The plate itself has a special coating which is ink-resistant. After exposure through a negative, the presensitized plate is developed and the coating removed from the image areas. Exposure is not critical, and after development, no further treatments (lacquer, etch, or gumming) are necessary. Cost is only slightly higher than conventional lithographic plates.

Since water-ink balance is one of the biggest problems on a lithographic press, the Dry Plate is a welcome technological breakthrough. However, there are still a number of problems even though small driographic plates are commercially available in some areas. One of the main drawbacks is the small number of usable paper grades, since paper must have good internal bond in order to resist the high tack of the specially formulated driographic inks. In addition, there is the possibility of serious build-up of lint and ink on the blanket as well as offsetting problems. In spite of these drawbacks, however, the concept of a dry plate has great promise for the future and could revolutionize press designs.

The second innovation which is being heralded in lithographic platemaking departments is the concept of a plate which does not require processing after exposure. Two companies have developed such a plate. The Teeg Research plate has not yet been released, while the Rogers 2000 plate, developed by Union Carbide and marketed by Rogers Corporation, is pre-

sently being field tested.

The unique feature of the Rogers 2000 plate is the fact that the image and nonimage areas of the plate both have the same coating. Exposure to ultraviolet light changes the image areas of the coating (which is normally water-receptive) to make them ink-receptive. It is therefore a truly planographic plate. After exposure, the plate should be washed in water to desensitize it, but this may also be accomplished by the press dampening system if the plates are to be used reasonably soon. The plate is capable of runs of over 100,000 impressions.

The Teeg plate was announced two years ago but has not yet been made commercially available. The coating of this plate consists of metallic layers deposited on aluminum. Like the Rogers 2000 plate, it is basically water-receptive, becoming ink-receptive on exposure. However, the company reports that the chemistry of the plate can be reversed to produce the reverse situation. This would provide a positive-working plate. The plate is completely inorganic.

The innovations in lithographic plates have generally been generated from within the platemaking industry to reduce processing time, simplify development procedures, and produce better quality plates. However, external changes already foreseeable may command plate developments in the future. It is, for example, probable that within the next ten years, press speeds could double. Higher printing speed will require tougher printing surfaces. This requirement could lead to the use of new materials, such as new metal alloys or plastics as the basic substrate.

Automatic processors will become a rule for two important reasons. They will reduce the level of skill needed to produce a plate and they could also be the solution to restrictions imposed by water pollution laws. Automatic plate processors reduce the volume of chemicals used to process a plate and therefore reduce the amount of chemicals poured down the drain. Water pollution laws will also favor water-based processing systems (already in widespread use in Europe) as well as developments like the processless plate. Beyond these requirements, the trend in offset plates will continue to be toward mistake-proof, fast-processing, easily corrected plates.

#### PLATES AND PLATEMAKING FOR LETTERPRESS

Trends in letterpress platemaking reflect a problem which exists within the letterpress industry. The hot metal type forms and copper etchings which have served as masters for duplicate plates are losing a popularity contest with computer-operated photocomposition. The problem which results is equipment-related. Even if the letterpress printer decides to change from hot metal to photocomposition, he is still using letterpress presses which require type-high printing plates. While smaller printers with minimal investments in equipment might easily switch to offset printing, the large newspaper with numerous presses running much of the time is tied to the letterpress process. As one newspaper printer pointed out, the statistics which claim that 87 percent of all newspapers will be printed lithographically in 1978 do not reveal the fact that the remaining 13 percent of letterpress printers will still be producing 95 percent of the circulation. It is for this group of printers -- the large newspaper printer with a high investment in equipment and the need for competitive

platemaking procedures -- that new plates are vital. The requirements for such plates are better print quality, less preparation time, and the ability to use photographic masters.

The traditional newspaper press plate is the stereotype plate. And there are newspaper printers who still claim that the stereo is the most economical and efficient plate for newspaper printing. The stereotype is a duplicate plate molded in a mat which has been molded from a metal master. Proponents of the stereotype plate point to the introduction of packless mats which produce improved reproduction and faster platemaking. They remind new plate manufacturers that the time to produce stereos is short, "measured in plates per minute, not minutes per plate." Low cost of platemaking is another benefit of the stereo: the lead plate is reclaimable, which means that successive plates cost next to nothing. The problems, of course, are prior to the actual platemaking stages. The computer and photocomposition are not readily linked to the stereo production. In addition, the platemaking department is restricted by the need for skilled craftsmen. For this reason, some letterpress printers have begun looking at the alternatives.

The alternatives come mostly from the world of plastics, although lead and magnesium are far from eliminated. New letterpress platemaking systems include direct and duplicate plates as well as photographic and molded plates. Photographic plate systems are usually one of two kinds: photopolymer or photoengraved.

There are a number of photopolymer plates. Of these, perhaps the Letterflex plate has received the greatest attention. The Letterflex system is a lightweight, flexible, direct photopolymer plate system for use primarily in letterpress newspapers although applications in commercial printing (especially in flexography) have been suggested. The first plate requires approximately 10 minutes to produce and costs about one cent per square inch. Used in conjunction with photocomposition, the system reportedly generates a considerable savings over the system which calls for a master plate with subsequent molding of matrix and duplicate plates. The original Letterflex polymer, which was soft, has recently been replaced by a harder polymer denoted Letterflex C. Ink transfer is excellent as with most plastic printing plates.

This improved ink transfer from plate to paper has also been responsible for the development of several duplicate plates. The Hylox plate, for example, has been very successful with a low cost per plate (plate material is also reusable). As a system, the Hylox plate could become a strong competitor of the stereotype if its matrix could be made photosensitive, thereby eliminating the first molding process. Hylox developments planned for the future include a photoresponsive plastic to be developed primarily as a pattern plate.

The other direction the direct printing plate can take is photoengraving. Direct zinc plates, for example, can be etched very rapidly with four or six plates being etched at one time. Automatic processors for both zinc and magnesium etching are available. The introduction of powderless etching for letterpress some years ago has made the photoengraving of

zinc flats for direct printing of newspapers a reality. This method eliminates the time-consuming alternation between etchant and protective powder which characterizes conventional etching for photoengraving.

The future of the letterpress plate naturally depends on the future of letterpress printing in general. For the most part, however, letterpress printers are going to be looking for the most efficient, economical, and competitive way to use traditional equipment. Not seeking revolutionary ideas, the letterpress printer is more likely to be concerned with standard plate thicknesses (a reduction in plate thickness would bring materials savings), a standard lockup system, and standard processing methods than with a plate which will revolutionize letterpress design. Again, however, the general trend will necessarily be away from a dependence on human skills and more dependence on "systems."

#### GRAVURE CYLINDERS

The gravure process, in general, has become highly automated. On gravure presses, length register, ink viscosity, and web tension are electronically controlled. Electronic color scanners are in widespread use as are automatic film processors. Only in the area of cylinder preparation is gravure still largely dependent on skilled hands. Hand etching is a difficult job. It requires artists. And it is practically impossible to identically etch two cylinders even when all of the procedures are alike. It is not surprising that the engraving department has been called the Achilles heel of the gravure process. For these reasons, automatic processing of cylinders has become increasingly important to keep gravure competitive with other processes, particularly with offset

printing which has quick, noncritical platemaking processes.

Gravure cylinder preparation generally begins photographically. The halftones or other film images are transferred to a resist which then is applied to the cylinder to be etched by the etchant, generally ferric chloride. Cylinders can be iron, steel, copper, or aluminum. Traditionally, gravure platemakers have used carbon tissue for a diffusion resist. This gelatinous material hardens to varying degrees when exposed to a halftone, depending on the amount of light to which it is exposed. The variably hardened areas of the carbon tissue, in turn, create varying cell depths to provide a wide tonal range. More recently, two new resist materials have been introduced under the names Rotofilm and Autofilm.

Another trend has been developing in recent years as the direct engraving of gravure cylinders has created interest in the industry. Direct engraving employs a photoresist (KODAK Photo Resist) which is spray-coated on the cylinder (mechanical coating is available) and subsequently exposed. The immediate problem which arose with direct engraving was the limited tonal range available due to the fact that the resist produces a constant cell depth throughout the range of dot sizes. This problem has been alleviated by adaptation of letterpress' powderless etch process to direct engraving. The ferric chloride bath is treated with other agents which protect the side walls of the cells, enabling the etching of deeper cells. As a result, the gravure printer can get the cell depth gradation, and consequently, the tonal variation that he desires. This problem having been solved, direct engraving offers

shorter preparation time, lower production costs, ease of corrections, greater tolerance to temperature and humidity variations, and excellent image reproducibility.

The actual etching of the cylinder is, as already mentioned, a highly critical process. The introduction of a number of automated engraving machines has brought speed and uniformity to engraving. Automated equipment represents the most important advance in gravure cylinder preparation and is the logical direction for future development. Such equipment can be divided into two categories: equipment for chemical etching and that for electromechanical engraving.

Chemical etching machines. Chemical etching machines do automatically what the etcher does manually. The numerous manufacturers have developed a variety of ways to do this. Some machines use spray nozzles and rotate the cylinder to etch the printing surface. Others use rubber rollers or a bubbling action in the etchant caused by air pressure. Each machine has its advantages. The speed for etching a cylinder in one machine is six minutes. Another firm points out that the cylinder is visible during the entire operation and that the operator can compensate for small variables in the resist. Most machines can be used with carbon tissue and Autofilm or Rotofilm as well as direct engraving.

Electromechanical engraving. Electromechanical engraving, introduced to gravure by the Helio Klischograph, has been hailed as a cylinder production method which would make gravure cylinder preparatory cost competitive with offset platemaking. In the Helio Klischograph system, a half-



tone is electronically scanned, and the information is used to drive a diamond stylus which engraves the cylinder. The triangular cross-section of the stylus produces a cell shaped like an inverted pyramid. While actual engraving time may be longer than for chemical etching, a considerable amount of time is saved by eliminating the steps necessary to prepare the resist. With the Helio Klischograph, the engraving is done directly from the halftone film from the camera department.

The preparation of gravure cylinders has always been a costly and time-consuming process. Any developments which could bring speed and uniformity as well as lower costs to the cylinder preparation could break down the barrier that has prevented gravure from invading offset and letterpress territories.

#### FLEXOGRAPHY AND SCREEN PRINTING

In sharp contrast to offset printing plates are the image carriers for screen printing and flexography. These processes are defined by definite restrictions on their image carriers: flexography by its molded rubber plates and screen printing by its screen. For this reason the plate-making area for these processes has been rather stable with changes primarily in the materials, and these not generally of a revolutionary nature.

Nevertheless, it should be mentioned that screen printing has expanded far beyond its original silk screen to make use of nylon, dacron, and metal screens. Metal screens are the newest, sturdiest, but most expensive screens. E.T.S., Inc., of Dallas, Texas, has developed a metal fabric

for screens which is coated with a photosensitive resist and then exposed through a composite photographic positive of an aperture pattern and the artwork. The foil is then developed and etched electrolytically to produce a screen which will give over 9,000 prints. And the cost of this fabric is about the same as that of silk.

Another development which could, in fact, bring radical change to screen printing is the web-fed cylinder press with a cylindrical printing screen. The development of a distortion-resistant screen cylinder was the key to success of the press. The cylinder is a fine-wire stainless steel, coated to insure rigidity and to prevent it from becoming distorted under the tension of high press speeds. A photosensitive emulsion covers the cylinder mesh and the screen is processed like any photographic film. During printing, a squeegee-like blade inside the cylinder works in combination with a fountain pan to deposit ink on the web.

In flexography, the rubber plates are both the distinctive feature of the process and the limiting factor in its application. The flexographer, for example, is most likely using hot metal composing and metal engraving for making his master plates instead of the rapid photographic plate-making procedures which have made offset so competitive in recent years. Nevertheless, much of flexography's success has been based on the economy of its plates. The original plate, including engraving and molds, costs between \$17 and \$25, duplicates are only a fraction of that cost, and flexographic plates have a life of several million impressions.

The biggest step toward modernizing flexographic platemaking would be a photographic press plate. The introduction of photopolymers has been applied to flexography, but only with limited success. At the present, wear and high cost of photopolymer plates are prohibitive for many applications. Furthermore, the photopolymer plate limits the number of solvents which can be used. The future development of a photographic plate for flexography without these drawbacks will play a vital role in the success of the process in expanding its markets.

## PRESSWORK

### INTRODUCTION

It would be almost impossible to describe the developments in printing presses without first surveying the competition which exists among the various processes. Letterpress is the oldest of the printing processes. It is basically a simple printing process without the production problems associated with the necessity of ink-water balance in lithography. And it is still responsible for a very large share of all printed product. Nevertheless, its growth has been much slower than that of the leading competitors in recent years. In the three-year period up to 1969, dollar volume for letterpress grew only 8.1 percent while offset grew 27.3 percent and gravure had an increase of 29.5 percent.

### PRESSES

Offset Lithography. The rate of installation of new offset presses across the country is constantly increasing. These new presses offer higher speeds and greater color capabilities with multiple printing units.

They incorporate automated techniques into offset production. Still, this degree of automation is, according to some, only "a drop in the bucket" compared to the needs of tomorrow's printer. These people point to too much waste (in spite of a decrease of about 25 to 30 percent due to automated tension control infeeds), to a net production which is too low, and to the problems of variations in performance. The need for solutions to better dampening and inking systems still exists. In general, they claim, there is still plenty of room for improvement and simplification in offset printing.

The printer who is in business today, however, is setting the pace in his choice of the equipment which is presently available. There is the choice between web-fed and sheet-fed presses, between small multicolor presses and larger four-color presses. And greater speed of operation is going to be the decisive factor in almost every purchase.

The decision to convert to web-fed presses seems to be an increasingly common one. In 1969, sheet-fed offset press shipments were just under \$100,000,000; web-fed offset shipments were over \$100,000,000 with predictions for a substantial increase. Web offset was, of course, originally designed for newspaper and catalog work for which high quality was not the major requirement. However, web offset has now invaded the commercial printing plants with quality which, in some cases, exceeds that of sheet-fed presses.

The biggest limiting factor to web offset success in the commercial printing field is the length of runs. Web offset presses offer speed as their best asset, but reaching speeds of 1500 on a web press produces

a large amount of waste and makeready costs. On contract encyclopedia work, long-run magazine work, and text books, this waste can be justified by very long runs. But for shorter runs, the ratio of setup time to actual running time becomes critical in determining the economics of a press-run. Many lithographers believe that runs of 15,000 to 20,000 books, for example, are the shortest economical runs for web presses, while sheet-fed presses are a necessity for shorter runs. Nevertheless, new developments in web presses are aimed at making web offset applicable to smaller runs.

Users of sheet-fed presses claim greater flexibility of their printing machines. Because web cutoff lengths are fixed, they do not offer the flexibility of printed format available with sheet-fed presses. The web offset printer can print a smaller format than his fixed cutoff length, but only with considerable waste. However, the introduction in the future of web-fed presses with interchangeable cylinders that can be switched with only a slight time loss will enable the web-fed printer to vary his cutoff length. In general, then, the facts point to a future in which offset printing will be dominated by the web-fed presses. It is this kind of outlook that has led one writer to say that "unless the commercial printer with a 25 x 38-inch, four-unit, sheet-fed press is in labels, cartons, display advertising, or some other specialty, his next press is much more apt to be a web offset press than a larger four-color sheet-fed press."

Parallel to the trend to web-fed presses is a trend toward--surprisingly enough--smaller formats for presses. A few years ago, most press

manufacturers predicted that, in the future, the heatset commercial web offset printer would be demanding presses no smaller than 35 x 50 inches. These presses, believed the prophets, would soon render the 22 3/4 x 38-inch presses noncompetitive except in the shortrun markets. They were wrong. Sales of large standard-size presses have been small while sales of presses 22 3/4 x 38 inches and 23 9/16 x 38 inches have mushroomed. And while the larger presses have demonstrated some problems in performance and flexibility, it is the improvements in the smaller presses more than the failing of the large ones which have produced this unexpected trend.

Speed is one of the critical factors. The smaller press has enjoyed improvements which have greatly increased its speed capabilities. The introduction of the double blanket circumference design enables the 22 3/4-inch or 23 9/16-inch press to print "reliably high-quality work" at speeds of 1000 fpm or 30,000-32,000 impressions per hour. Compare this to the larger 35-inch press. At peak production, this press is designed to operate at speeds of 1200 to 1500 fpm. Running a press at 1200 fpm has, however, proved difficult except for highly standardized runs. Thus, the greater flexibility which smaller presses claim at only slightly slower speeds has proved a bonus for the commercial printer.

The second, and perhaps more important, development in small press manufacturing is the multi-unit press. The first six-color machines were introduced in packaging just a few years ago. Today, eight-unit presses are turning up in increasing numbers in commercial printing plants. And even the 12-unit press is a reality today at Colorgraphics in Oklahoma

City. Colorgraphic's 12-unit Hantscho Mark II press is reportedly the longest press in the world: its 12 blanket-to-blanket printing units stretch 150 feet. These presses, with their smaller formats but increased number of printing units offer optimum flexibility for the commercial printer.

Consider Colorgraphics' press, for example, It has the capacity to print four colors on both sides of three webs in one operation. Or it can print two colors on both sides of three webs (6 units), plus one color on both sides of two webs (+2 units), plus four colors on both sides of a sixth web (+4 units = 12 units) all at the same time. And a wide variety of other possibilities exist, even for the eight- or nine-unit presses which are more common. In addition to printing several webs simultaneously, these presses can imprint, perforate, glue, fold, and slit. Furthermore, the multi-unit press makes the speeds of the smaller format press competitive with those of a larger press. An eight-unit, 22 3/4 x 38-inch press, running at 1000 fpm, can deliver 32 pages, 8 1/2 x 11 inches, at a rate of 32,000 iph. By comparison, a four-unit 35 x 50 inch press would have to print at 1580 fpm in order to deliver signatures at the same rate.

One exception to the trend toward smaller, but multi-unit presses must be noted. In the area of packaging, larger machines with higher speeds and increased diecutting capabilities are the direction for the future.

A preview of the automated litho press is offered by one large press manufacturer who sells the first sheet-fed lithographic press to use an

electronic logic system. According to reports, the digital logic system of this press "substitutes the speed of electronics for slower human reaction time." The system controls printing pressures, the ink flow in each printing unit, and the travel of paper through press with automatic changing of paper in the feeder and delivery -- all by instant remote control. The electronic system also records data about press performance on a tape which shows running speeds for the entire day, indicates the time and cause of delays, and provides a time report of makeready, wash-up, and running time on every job. The result? Production increases by 25 to 40 percent.

Letterpress machines. As one would expect from a process which is over 400 years old, letterpress equipment manufacturers have produced a wide variety of press configurations. Newspaper presses, magazine presses, and a variety of commercial and specialty presses all have their own peculiar characteristics. However, in response to the rigorous competition with lithography, equipment manufacturers have added to the many existing press designs one which is foreign to conventional letterpress design with the exception of periodical presses. This is the rotary press for letterpress.

Since very early in its commercial development (1904) offset has been based on the rotary principle. Letterpress printers, by contrast, have almost exclusively used flatbed cylinder presses. With the exception of the newspaper and periodical presses which use stereotype or electrotype curved plates (these are economical only for very long runs), the letterpress printer could not expect to reach the printing speeds of



offset primarily because of the weight of the reciprocating bed.

The breakthrough came in 1959 when Dawson, Payne, and Elliott made the first machine designed specifically for wraparound printing. Within less than 10 years, by 1968, eleven letterpress equipment manufacturers were offering a total of 48 models. Today, there are 231 letterpress machines in operation in many applications but primarily in book printing, commercial color work, and magazine printing. This development has made letterpress printing the fastest and most productive process in terms of the actual printing operation.

However, rotary letterpress is still a relatively young development in letterpress' long history. Accordingly, refinements are still being made, and rotary letterpress printers are rather vocal in their expectations for future presses. While press manufacturers are beginning to offer web-fed rotary presses in hopes of keeping commercial letterpress printing competitive with offset, printers are making it clear that one of their primary requirements is consistency of net output. The higher speeds of web-fed rotary presses, they claim, will not be desirable if net output is still restricted at or near present levels by web breaks and other production problems. Rotary letterpress printers are also seeking greater uniformity of quality. And a reduction in labor requirement without an increase in maintenance requirements which might cancel any gains is high on the list of objectives for rotary letterpress development.

Gravure Presses. It has been claimed that rotogravure is the printing process with the greatest tonal effect and excellent color reproduction. It is certainly one of the simplest printing processes with no rollers needed to apply the ink, no offset roller required to put the printed image on paper, and with minimal wear on the printing surface. Perhaps it is this simplicity which has enabled the gravure press manufacturers to concentrate on small details of press design, effecting minor advantages which certainly are not revolutionary but which have contributed greatly to gravure's steady growth.

Register, tension control, doctor blades, and ink transfer have been of primary concern. In order to capture the packaging market, rotogravure has had to demonstrate that it can print extensible films without carrier webs. The computer has been applied to many areas of press control systems, including tension control, which has helped solve the problems of printing films and foils. Computer-controlled register systems have also produced the quality color necessary for the gravure-printed tabloid. It should be pointed out that this kind of application of the computer is not the exception in gravure; automated gravure presses are almost universal.

The doctor blade is a critical part of the gravure press. Its purpose is to wipe the excess ink from the cylinder surface so that only the ink of the cells is transferred to the paper. A lot of work is being done on the doctor blade. Manufacturers now offer reversed angle doctor blades, plastic doctor blades, and long-life doctor blades. But what many gravure printers are hoping for is the eventual elimination of doctor blades altogether.

One of the few advances which could eventually bring a real change to gravure printing is the electrostatic assist developed by the Gravure Research Institute. Electrostatic assist has been called "a shortcut to improved quality in gravure printing." It was developed out of the knowledge that gravure's highly fluid inks are very susceptible to electrostatic fields. An electrostatic field, created within the paper, attracts the ink in the cylinder cells which have the opposite charge. The result of this strong upward pull is the solid contact between paper and ink, eliminating white specks known in gravure as snowflaking, skipping, or speckling.

The principle of electrostatic assist has been commercially developed by Crossfield Electronics Ltd. of the United Kingdom. The Heliostat 260, as their product is called, is a "sealed electronic package containing generator and control circuit connected to a conductive, rubber-covered generator roller." Driven by the impression roller, the generator roller creates the required voltage to give quality printing in spite of ink and paper variations.

Electrostatic assist is not without problems. Accordingly, its use has been limited primarily to packaging applications, and it has had little influence on gravure printing of publications. It does, however, offer distinct advantages, including the opportunity to use finer screens and rougher paper as well as lighter-weight papers. It reduces press-wear due to overheating and friction by reducing the pressure required to print. And it means higher printing speeds and better printability. The principle of electrostatic assist, suggests one writer, could be developed

into a total electrostatic transfer system which would actually revolutionize the gravure press.

As mentioned before, there is a marked difference in the attitude of American and European gravure printers toward their process. In America, gravure is a long-run process. Most work is being done on wide-web presses with wide cylinders. These cylinders have high preparatory costs. In Europe, the movement has been toward narrower webs and cylinders. Cylinders 31, 40, 49, and 50 inches wide are in common use. And these narrower cylinder widths offer a decreased cost of preparation. This reduced cost perhaps explains the ability of European printers to compete for short-run jobs. The European example indicates what the future might hold in store for the American rotogravure industry.

Flexographic Presses. Flexographic presses include a wide range of designs, sizes, and prices. While almost all flexographic presses are high-speed, four- to six-color web-fed presses, the web widths range in size from 4 inches to as wide as 99 inches. The 30 different manufacturers offer presses beginning at \$3000 up to a few hundred thousand dollars. There are three basic press designs: inline or flow press, stack press, and common impression press. The six-color, common impression press capable of speeds of 1000 feet per minute has been described as the "best all-around flexographic press" to own. This design has a single common impression drum which supports the web as it travels through the printing units which are arranged around the drum like satellites. It has been developed into the popular flexographic machine it is today in response to the needs of stretchy, nonabsorbent substrates like plastic films.

Flexography, like some of the other processes, is well on its way to becoming a fully automated process with automatic unwind and rewind tension controls. But flexographic printers recognize that an automated future will require higher speeds, as high as 2000 feet per minute, a tension braking system, and fully automatic splicers. And as with most other processes, flexographers are looking to the computer to provide a totally automated system which would set up the job, scan the printing and control all of the related press operations, and shut the press down when the job is finished.

Screen Printing Equipment. The screen printing process has been the slowest of the processes to experience the benefits of automation. Jobs involving a variety of odd-shaped objects or those requiring only a few copies do not easily fit into the world of automation. But screen printing has recently been entering into competition with other processes in the printing of paper, boards, and other flexible materials. In these areas, production speeds become significant. Accordingly, modern screen printing equipment has been improved to increase production speeds from 200 to 6000 impressions per hour.

From the hand tables requiring manual feed and squeegee operations to the newest web-fed cylinder presses, there is a wide range of equipment available for screen printing. Within this range, the printer can find semi-automatic equipment in which the motion of the squeegee is mechanized while manual feed and takeoff still limit the speed of production and the length of the run, as well as full automatics, reciprocating presses with automatic feed and takeoff at speeds which frequently require mechanical drying.

The web-fed cylinder press, which contributed so much to the production speed of the other printing processes, is now a reality for screen printing. By developing a cylindrical printing screen which resists distortion under the pressures of web printing, Roto-Screen Press, Inc., Skokie, Illinois, has overcome one obstacle in the automation of screen printing. The development of this four-color web-fed press enables the screen printing firm of Morlin, Inc., where the press is in operation, to obtain printing 100 percent of the time compared to the less competitive 30 percent offered by existing reciprocating machines.

Hybrid Presses. The introduction of the hybrid press -- a press with units using two different printing processes for a single product in a single pass through the press -- reflects the growing willingness of printers to modify their processes to obtain greater versatility. Furthermore, if carried a step further than the definition implies -- if a printing unit from one process is used alone on the press of another process, the hybridization contributes to another trend, the breakdown in the distinct divisions between processes.

The most highly publicized hybrid press has been the newspaper letterpress machine with lithographic units. This press has appeal to a number of printers for a number of reasons. One of the biggest advantages of the hybrid press is its ability to "offer the best of two worlds." The rapid letterpress stereotype platemaking is a necessity for the daily newspaper printer, but the quality of these plates is frequently unacceptable for process color work. Add lithographic units in tandem on the same press, however, and it is possible to obtain a newspaper page with

quality process color along with economical and rapid production.

Getting the best of two worlds is not the sole consideration in choosing a hybrid press. For the letterpress printer who does not want to make a sudden change to lithography or who would suffer considerable loss if he replaced all of his letterpress equipment, the hybrid press represents a compromise. It becomes part of a conservative transition, allowing the printer to evaluate lithography for its profitability in his printing operation.

Another combination of processes has produced the indirect gravure process. A method which offers the advantages of both flexography's common impression design and gravure's distortion-free metal printing cylinder, indirect gravure employs a gravure cylinder on a flexographic press. The advantage is better halftone printing on stretchy plastic substrates. In addition, rubber slugs attached to the rubber transfer cylinder and carrying dates, prices, or other elements which require frequent updating can be changed conveniently, eliminating the need to engrave a new gravure cylinder. This kind of press represents the most complete blending of two processes when used only as indirect gravure. But the six-unit flexographic press, with two units designed for indirect gravure and printing halftones while the remaining four units print solids flexographically, becomes a most versatile press for packaging operations.

As with any process which represents change or transition, the hybrid press creates people problems. Because the hybrid press is between two processes, pressmen will have to know how to gain the best production

from both processes. But so will the people earlier in the production process, from the editorial department to the composing, camera, and platemaking departments. The hybrid concept does, however, represent an improvement over complete and sudden changeovers in this respect. It gives the people involved more time to learn and absorb new skills without severe interruptions in production.

#### MAKEREADY

It has become apparent that web-fed presses, whether they be offset, letterpress, or rotogravure, offer several advantages for the future. However, their success in commercial printing fields, where runs are traditionally shorter than in publishing, depends on the ability of the printer to reduce the time to prepare the press to an acceptable ratio to the actual printing time.

Makeready has been defined as all the nonproductive work of preparing the press for starting a job. This includes setting tension controls, register controls, pressures, and folders, as well as the actual threading of the press. Manufacturers of equipment see computerization as the answer to the problems of reducing makeready time. Thread-up time, they claim, can be greatly reduced by feeding punched cards into a computer and then allowing the computer to calculate the variables and instruct control devices to make adjustments electronically, all in a matter of seconds.

While electronic control of many of these areas is already a reality, the numerous automated devices would have to be combined into a total system



to function as the kind of system these manufacturers envision.

#### INFEEED

The feeding of the press is a critical factor in the speed, quality, and economics of press production. Equipment manufacturers have contributed significantly to reducing downtime in this area with the introduction of continuous nonstop feeders for sheet-fed presses and with automatic or flying pasters for web-fed presses.

Continuous nonstop feeders offer increased production on sheet-fed presses, particularly for long runs, by eliminating press stops for reloading.

The most efficient continuous feeders are the roll-feed sheeters, which are being installed on more and more presses. These feeders feed paper from a roll, sheet the paper to the desired dimension, and "stream feed" the paper into printing units. The result is monetary savings -- two to three cents per pound of paper and three to six dollars per thousand impressions on a 78-inch press, thanks to a greater production. The greater production is achieved by reducing problems of curling, waviness, and static, among others. Several manufacturers supply roll-feed sheeters for 10 x 15-inch presses, and at least two produce them for large presses.

On all web presses, color register, backup register, and cutoff or folding register must be adjusted each time the press starts up. Offset printing has the additional problem of ink-water balance. The result is expensive downtime each time a roll is changed. The solution is the flying paster.

Modern flying pasters cost relatively little and operate with a high degree of reliability. One such paster is the Butler Automatic Flying Splicer, in which a "festoon" system builds up a reserve supply of web, enabling the splice to be made with the roll stationary. The festoon is created by weaving the web through a series of rollers. As the web is exhausted, the roll stops for splicing while the festoon system continues to supply paper to the press. Without stopping production, the new web is fed into the press in precise register with the old.

Another possibility for achieving nonstop roll changes is being considered by two manufacturers of flying pasters. They propose to apply a computer to the operation. Accordingly, the computer would determine the amount of paper left on the roll, and when the roll is nearly depleted, the computer would signal the paster for a roll change.

The flying paster is a valuable piece of equipment for all web printers, but particularly for those using the 8- to 12-unit web offset presses which are becoming increasingly popular. It would be difficult to imagine a printer running a 12-unit press with six separate webs, some with four-colors, some with two-colors on coated paper, and one with newsprint, without the aid of automatic flying pasters.

For the future, flying pasters will have to increase their roll capacity. It has been predicted that 50-inch-diameter paper rolls will become commonplace, while many existing pasters accept rolls only up to 42 inches. Also, as press speeds increase, flying pasters will have to keep pace. One paster already available will operate at 3000 feet per minute.

## TENSION SYSTEMS

Tension controls have advanced significantly in the past ten years. Today's sophisticated electronic web tension controls have eliminated many of the problems associated with feeding and controlling of the web so that the pressman is free to concentrate on other aspects of printing. Electric eyes, air pressure, and mechanical drive are just a few of the methods used to accomplish tension control.

Pneumatic Applications Company, for example, has an automatic tension system which operates on a pneumatic feedback principle. An automatically controlled air-flow operates a pneumatic clutch or brake, maintaining tension at the correct level. The manufacturers point out that the pneumatic device offers an advantage over mechanical devices, since there are no linkage parts to wear out or be constantly adjusted.

Another system, the Model 400 Infeed/Tension System from Web Press Engineering, Inc., is a dual-purpose system: it controls infeed speed, with speed drift reduced to .000625 percent; or with the turn of a switch, it can control tension, providing up to 14 pounds of tension per linear inch on a 38-inch web.

The trend in tension control is the same as most other areas of presswork. The pressman wants to be able to set a dial at the beginning of the run and let the equipment do the rest.

## REGISTER SYSTEMS

The control of register begins long before the press is started up. In

offset, for example, all new presses are equipped with a pin register system. The holes in the plate cylinder coincide with holes in the film flat, in camera film, and on the copyboard, so that the entire system is in register from original copy to the press. The same kind of prepress register control is also available for letterpress. One manufacturer provides an offpress positioning and proofing unit. Plate lockup, makeready, and registering are accomplished on this unit. The entire sheet can then be transferred to the press, thus reducing downtime and makeready on the production press. This preregistering of plates is a trend which has found a large following in Europe where preregistering with only minor registering on the press is so well developed that it reduces makeready time to "next to nothing."

For controlling register during the press-run, a number of developments have been important. Magnetic cylinders, for example, are available for all kinds of plates. While manufacturers of magnetic cylinders describe many advantages, including a reduction in plate cracking and damage, magnetic cylinders are also reported to increase print sharpness and register. Electrostatic emitter bars are another way to control register on some sheet-fed presses. An electrostatic charge is directed to the sheet at the printing nip to draw it tight to the impression cylinder. This electrostatic control means better control of the sheets up to 7,200 impressions per hour, and therefore, increased production.

The need to reduce press stops has been answered by register systems which allow the pressman to correct register around and across the cylinder without stopping the press. This can be accomplished either manu-

ally or automatically, but the automatic systems naturally hold the greatest potential for the future. At least three manufacturers presently offer fully automatic color register control devices for offset presses. Scanners electronically inspect color register marks, detecting register errors as small as .001 inch. Electronic motors then correct register errors by retarding or advancing the web. Manufacturers predict that in the future, the electronic scanners will be linked with a computer which will calculate the amount of misregister in each color according to its program and automatically activate an electronic device to bring the image back into perfect register. The Hurtletron Model 631 Automatic Register Control already employs a completely digital computer to hold register after initial manual registering. Or it can select a specific mark and register to it, eliminating any phasing-in operation. The computer has a large numeric readout display which can be read from approximately 50 feet.

#### INKING SYSTEMS

Inking systems, in general, require simplification. Particularly with letterpress and lithography, the series of inking rollers represent an increasingly complex system which does not really offer substantial benefits over its simpler predecessors. An entirely new approach to inking systems has been recommended, and one suggestion for offset is an inking system consisting of a single, porous roll. Pressurized ink would be fed into the roll at a rate which would produce the correct film thickness when the roll contacted the plate. Electrostatic deposition of a mist of ink directly onto the plate is another possibility which has been suggested. It has already been mentioned that even in

gravure, which uses a relatively simple inking procedure, elimination of the doctor blade is a desirable goal. In all inking systems, simplification is the direction, with automated control of any variables such as the addition of solvents.

In conjunction with inking systems, it should be mentioned that ink manufacturers are continually working with new ink formulations for better performance and less wear and tear on the environment. Solventless inks and water-base inks are examples of what ink manufacturers may be producing in the future in the face of increasingly stringent antipollution laws. In addition, water-base inks for gravure would be a major breakthrough, since gravure has traditionally been restricted to highly volatile inks with a great potential for explosions.

#### DAMPENING SYSTEMS FOR OFFSET

Offset lithography's dampening systems still represent what is perhaps the greatest drawback of offset printing. The ink and water reaching the printing plate must be kept in balance throughout the run, in spite of press stops and starts. The conventional systems have used water as the dampening solution. Mollleton coverings on the dampening rollers absorb the water and transfer it to the plate. This system is less than perfect, since the cotton covers provide unequal dampening and react very slowly to adjustments in water feed. They also dry out during press stops.

Some manufacturers have responded by providing covers of a different fabric. The Hyton dampener cover, for example, is made of rayon. Rayon,

claims the manufacturer, has high absorbency and better moisture-dispersing characteristics than cotton. In addition, rayon covers last longer and do not shed lint.

In an attempt to achieve better and faster control of the ink-water balance, some printers have turned to alcohol systems. The specially designed systems add alcohol to the dampening water, allowing the pressman to print without dampener covers. (Some printers use alcohol in their conventional dampening systems, claiming good results.) The alcohol dampening systems react more quickly to adjustments than do water systems, and the dampening reportedly remains more constant during the run. The three most widely used alcohol dampening systems are the Dahlgren system, the Miehle-Matic, and the Roland Autodamp system. The last system uses a single rubber roller instead of the two cloth-covered dampening rollers of the conventional system. Large printing presses in the United States are almost all equipped with these alcohol systems.

It might be worthwhile to bear in mind that the successful application of the driographic plate to offset could eliminate the need for dampening systems altogether.

#### BLANKETS AND ROLLERS

The quality of the printed image in offset lithography and indirect relief printing (usually with DYCRIL and KODAK Relief Plates) depends a great deal on the quality of the rollers and blankets. New rollers are being made of polyurethane, polyvinylchloride (PVC), and other plastics. The conventional offset blanket consists of three to four layers of

rubber and woven cotton. This blanket is not compressible. A recently developed blanket is the air-cushion blanket which is constructed so that the air in the microcells is compressed during passage through the printing areas. The result is a reduction of dot deformation, and consequently, sharper print. Another new blanket is Dayco Corporation's sticky-back blanket. Unlike many blankets, the sticky-back blanket will not creep during printing. Furthermore, it peels clean from the blanket. The company claims that it is a balancing of cohesive and adhesive forces in the product's backing which makes this a superior blanket.

Automatic blanket washers have received considerable attention from printers. Available for both sheet- and web-fed equipment, these washers make it possible to remove piling on blankets without stopping the press or even slowing it down. One system uses a chemical detergent and a series of spray bars, while a second system dispenses solvent onto the moving web instead of directly onto the blankets. While offset printers view automatic blanket washers as valuable and time-saving devices, their development may also affect the future of gravure printing. Offset gravure could give gravure printers greater versatility and flexibility for substrates, and automatic blanket washers could make offset gravure a viable printing process.

#### DRYING SYSTEMS

Most drying systems on the market today operate on a principle of either a combination of flame and medium-velocity hot air or simply high-velocity hot air. Conventional systems, however, are not entirely satisfactory. Gravure presses, for example, are giant space-consumers, and the main



problem is the bulky driers which are arranged after each printing unit. Offset printers report that drying problems are "the most universal reason" for the failure of web offset presses to operate at at least 75% of the speed guaranteed by the manufacturer. And antipollution laws are forcing manufacturers of driers to redesign existing equipment and to look for better drying systems for the future.

Three systems hold particular promise for the future: infrared, radiation, and microwave drying. Infrared drying is perhaps the easiest technique, but it perpetuates one of the major problems of current driers, the generation of external heat. Radiation drying, on the other hand, does not use or generate heat, and at the same time, it eliminates the need for solvents in the ink. The process does require special inks which are not presently available. According to speculation, however, radiation driers and compatible inks will both be available by 1973.

The most publicized of the new drying methods is microwave drying. Although microwave drying is not a new concept, the equipment for use on a press has been lacking until recently. Today, microwave drying is being tested in a number of research plants and is also in commercial use in at least one plant, a newspaper printing installation in Coventry, England. In microwave drying, radio waves excite molecules evenly throughout whatever is to be dried. This excitation of molecules is actually heating, but unlike conventional drying systems, the heating action is limited to the print itself, and no heat is wasted.

A microwave drier consists of a powerpack, a magnetron which converts dc power to electromagnetic waves, and a wave guide which focuses the microwaves on the paper. It is a compact unit with low maintenance requirements. Microwave driers do not require any warm-up or cool-down period, and shut off automatically if a web breaks. This method of drying appears to hold particular promise for gravure and flexography (in combination with the use of water-base inks) and for letterpress with glycol-base inks. It does not, however, appear to be applicable to offset lithography at the present. Microwave drying requires a highly polar material such as water or alcohol, and an ink based on one of these would obviously be incompatible with the principle of lithographic printing.

Another approach to solving the drying problem has been taken by the ink industry. All major inkmakers are working with solventless or high-solids inks in which drying is accomplished by polymerization. The development of such inks will eliminate the pressures on drier manufacturers to design driers with air pollution controls, since solventless inks greatly reduce emission of pollutants.

#### DELIVERY

The development of faster speeds on all kinds of presses has put a strain on the delivery units of presses, rendering many units obsolete. On sheet-fed presses, this unit carries the sheets from the impression cylinder to deliver them, face-up and properly jogged, on a pile. Continuous deliveries for sheet-fed presses are now a must, and some manufacturers are selling presses with double deliveries, particularly for folding-box printers.

The ever-increasing popularity of web-fed presses for all processes has produced a number of innovations in the delivery unit, borrowed primarily from newspaper operations, but adapted and improved for many other applications. Stacker-counter equipment, for example, stacks, jogs, collects, counts, and soft-folds signatures from the web press. Increased-capacity delivery units such as cutoff folders have reduced production handicaps by enabling the eight-unit press to operate at full speeds. Add a signature paster to an eight-unit press, and it is possible to produce completed catalogs with up to 64 pages, 8 1/2 x 11 inches, which are ready to be trimmed and shipped to the customer.

A variety of new folder designs are available, and it is interesting to note that Europe is leading the way in this area. In fact, one writer has suggested that it would be worthwhile for any owner of a web-fed letterpress machine to go to Europe and watch some of these concepts in operation. From one European manufacturer comes a variable cutoff folder for use on most webfed presses. This folder will handle up to 82 1/2 inches with a variable cylinder range of 33 to 44 inches. Combined with a variable printing cylinder web press it could give a single press a wide range of cutoff and trim sizes.

Speed and accuracy of folders are also improved. Some manufacturers have achieved this accuracy by using the same kind of electronic devices as are used in registering systems. An electric eye scans a printed mark and advances or retards the web for accurate folding and cutoff. The end result is a reduction in spoilage after start-up and during the run.

## PRINTING WITHOUT A PRESS

While press manufacturers are striving to make presses faster and more automated, other graphic arts equipment suppliers are developing alternative methods for producing print, methods which do not require presses in the conventional sense. Included are electrostatic printing, ink-jet printing, and laser beam printing.

Electrostatic printing is the most familiar of the non-press printing methods. It has found its most successful application in the copying and duplicating fields, and therefore, has not really been a competitor to traditional printing methods. The first electrostatic copier was the Xerox copier, introduced in 1950. Since that time, numerous and improved copiers have appeared on the market. Today, some xerographic copiers can print at speeds up to 3600 copies per hour. The Xerox 7000 copier is a reduction duplicator capable of reducing documents at ratios of 85, 75, 70.7 and 61.5 percent of the original size. Some copiers have color capabilities. The 3M Company has already introduced the first color photocopier, while another firm, Savin Business Machines, is presently developing a color copying device which will electrostatically produce enlarged color prints from 35mm slides. And a copy machine by Electro-Print is expected to make full-color reproductions using an electrostatic screen stenciling method and will thus print on corrugated and curved materials.

There has been some speculation that some kind of electrostatic printing method might actually replace the major printing processes. Rumors report that someday an electrostatic printing device will print one side

of a whole skid load of paper. The printer would then turn the skid over, repeat the process, and send the sheets to the bindery. This superprocess has, of course, not yet been developed, and the average printer is not holding his breath in anticipation of it. But that same printer might find it worthwhile to look at some characteristics of xerography as it exists today; he might find that it does have competitive potential. For example, xerographic print quality can reportedly "approach average litho quality on currently available small commercial machines." Furthermore, according to predictive reports at Comprint 90, "xerography promises to work with as large a range of papers as any printing process," while costs which are now high may eventually be even lower than corresponding costs for other processes. And even though xerographic machine speed is slower than offset, the total production time is competitive, since editing, text composition, and graphic preparations are easily achieved, and since no preplate operations are required for xerography. Thus, the total production time for xerography can reportedly be as little as one-third of the total production time for offset. Some of xerography's competitive potential is apparent today in inplant printing installations and in instant printing which is already challenging the small commercial printer.

Ink-jet printing has been attracting considerable interest recently, although it is not a new concept (RCA made ink-jet printers in the 1930's). It has become more promising in the light of its compatibility with digital computers. The "Inktronic" by the Teletype Corporation, for example, is a jet printer which produces computer output at a rate of 120 characters per second.

There are at least two methods of ink-jet printing. The first uses one or more nozzles which write an image on paper by scanning across the sheet, much the way electron beams produce a television image. This is the method used by the Videojet R, a product of the A. B. Dick Company. The second method uses a whole series of nozzles, "each spitting out discreet droplets of ink controlled electrostatically to conform to a character matrix." It is this approach which some feel will eventually have the greatest potential, with possible applications in the large-scale production of newspapers, magazines, and books.

Jet printing can reproduce both alphanumeric symbols and photographs. The Videojet, for example, can receive material from a remote terminal via a Dataphone voice-grade telephone line, producing hard copy at 250 characters per second or 2500 words per minute -- as fast as the Dataphone line can transmit it. It should be stressed that at this point in its development ink-jet printing does not produce copy of graphic arts quality. But as one writer has suggested, if ink-jet printing is developed to its potential, "it could make as much difference as the invention of movable type." It would completely eliminate platemaking since the "press" -- an entirely automatic machine -- would be guided by a master copy of the material to be printed or by digitally stored material. Furthermore, copy could be scanned on the East Coast and reproduced in large or small quantities in the West almost instantaneously. If the research for the development of ink-jet printing is well supported, the effects of ink-jet printing could be felt very soon.

Finally, the laser beam is also being studied as an imaging system, although no commercial apparatus is presently available. By using electro-optical principles, such a system would employ a laser beam to write images directly on a drum. A toner would render the images visible. And speeds are expected to be comparable to those of rotary presses.

In all of these systems, the emphasis has been on speed and use of modern computer and electronics technology. The systems are thus, by nature, highly compatible with communication systems of the future. In this respect they hold some advantage over conventional presses. If these systems can be developed to produce high-quality images -- and this has not yet been demonstrated -- they could represent the beginning of a revolution which would eventually send the traditional press to its grave.

## **BINDERY**

The evaluation of new trends in bindery equipment, materials, and methods is complicated by the fact that the firms involved in bindery operations do not represent a homogeneous group. For example, the needs and, therefore, the methods used by inplant reproduction departments certainly differ from those of the trade binder. And different from both of these is the book publisher with mammoth printing and bindery operations all under one roof. It is therefore not surprising that trends also vary from group to group.

For example, in the field of book publishing, combination printing and bindery operations usually represent highly standardized processes. In this area, sewn bindings are still the preferred binding. However, for the trade binder who serves corporations, educational institutions, advertising agencies, and the government in producing everything from instruction manuals to catalogs to annual reports, a wide variety of bindery techniques supplies greater versatility. The wire, saddle-stitched binding, for example, is an old favorite. Trade binders report that this method accounts for 30 percent of the products which go to corporations. The flexibility of saddle-stitch operations has in the past protected this area from the competition of other binding methods.

The other methods include adhesive bindings, looseleaf, plastic bindings, spiral bindings, and as mentioned for book publishing, sewn bindings. Of these, perhaps the adhesive binding is the most important to watch for the future. It is the fastest growing method, and some binders predict even more spectacular growth in the future. Adhesive binding offers several advantages, including speed and a variety of equipment available, with machines ranging in price from \$5000 to \$300,000. Today, almost any book over 80 pages will be adhesive-bound, according to one binder.

While this variety of methods offers greater versatility to the trade binder, the need for greater speed is pressuring many bindery plants to specialize. Increased standardization of sizes and compatibility of products allow ganged runs which, in turn, improve production speeds. Thus, both sizes of materials and binding constructions will most likely follow the trend of standardization.



The bindery operation is actually a complex materials-handling operation in which semi-raw products -- printed pages -- are processed to make them easier to use. In an average book, this operation includes eight stages: 1) cutting of sheets, 2) folding of printed sheets, 3) assembling of folded material for binding, 4) the binding (fastening of material in book form), 5) trimming, 6) preparing of the book for covering, 7) cover-making, and 8) combining of the cover and bound book. In some cases, of course, the binder receives the material to be bound already cut and folded. And in plants with both printing and bindery operations, the flow of material might even be direct from the press with inline folders to the gathering and binding machines.

Although bindery manufacturers have been accused of lagging behind other areas of graphic arts, bindery operations are, in general, becoming increasingly mechanized. Even smaller inplant operations are finding that they can produce better-quality products faster by using mechanical equipment instead of manual labor. The great variety of mechanical equipment includes collators, inserters, gathers, stitchers, trimmers, and on- and off-press folders. Adhesive binding equipment, joggers, punches, drills, perforators, and hardbook binding equipment are also available. Many of these machines perform several operations at once. For example, one saddle-stitch model, the Consolidated-Mueller Jetstream 250, is an inserter-stitcher-trimmer. The manufacturer claims that this machine is the fastest one of its kind, operating at speed of 15,000 booklets per hour. From another manufacturer comes a double-track, high-speed gatherer with running speeds of up to 200 per minute. Two tracks handle the same signatures and merge only after the stitching operation.

The use of two tracks means that the individual tracks can operate at reduced speed for greater accuracy; furthermore, by using two tracks the length of the gatherer is greatly reduced.

Further down the production line, new equipment is being designed to bring automation to the mailroom. Here, complete systems wrap or apply labels to material received from the bindery, sort the material into groups according to zip codes, and stack them for subsequent mechanical tying and shipment.

In almost all of these machines, the emphasis is on speed. The development of highly stable adhesive binders, for example, has made it potentially possible to produce periodicals, books, and catalogs at a rate of 12,000 per hour. But by their very nature, bindery operations inhibit these new machines from reaching their full potential. The bindery is an assembly-line operation. Materials are passed from one machine to another, from one operation to another. The production in one area depends on the input from the preceding area. If the gatherer breaks down, the binding machine will be idle. And if a piece of equipment further down the production line is inefficient, the speed and efficiency of all the earlier operations are without value. For this reason, it has been common practice to separate many of the operations, so that manual transfer of the product from one machine to the next could, in part, prevent a snowballing of production problems. This manual interference, however, contributes to lower production speeds and greater risk of errors, particularly in the larger operations.

The alternative is the fully integrated bindery which is designed to eliminate bottlenecks and slowdowns. The doubletrack gatherer already mentioned is one element which represents this concept of design. In the past, gatherers have failed to keep the binder in operation not because they were too slow, but because at their high speeds, they were unable to handle signatures effectively. Consequently, the feed to the binder would breakdown frequently. With doubletrack gatherers, the actual operating speeds are slower with a greater volume output and, at the same time, greater stability.

Still, even the best machines will break down. But new concepts in bindery design suggest that a storage system may be the key to maintaining a constant flow of material through the bindery operation. According to this plan, conveyor lines between units feed material to be bound into storage devices in the line of flow. These devices maintain a surplus supply of products of the preceding process. Then, if the preceding unit shuts down for any reason, the stored books continue to flow to the following cycle until the storage unit is depleted or the preceding unit is again in operation. In the same way, if a unit following a storage area shuts down, the preceding unit will continue to operate until the storage space is full.

In order for all the units in this single line of flow to operate in harmony, an integrating system is necessary. An electronic monitoring system which uses photocells along the conveyors is such a system. With this system, all machines in the workline can operate independently. At the start-up, for example, only the gatherer would be running until a

sufficient store of gathered material is fed into the storage devices. Photocells in the storage devices would trigger the start of the following unit when the storage is sufficient. If during the operation some storages fall too low, the photocells again react, this time increasing the speed of the feeding unit, or slowing down the following units. The result is a fully automated bindery.

The interest of bindery managers in this kind of system, along with other developments, has led to an increased interest in computerization of the bindery. Some of the other factors which are encouraging this trend are regionalized periodicals and catalogs which call for minor but frequent changes in runs; smaller book reorder quantities; text prepared in computer media; and the ever-present demand for higher productivity.

It has been estimated that computer control could increase the productivity of an existing bindery line by as much as 25 to 45 percent. Most of this increased productivity would come from computer monitoring of the bindery line. The computer would scan the activity of the production line. As an example of its efficiency, the modern computer could easily scan 400 sensors and drive 100 actuators in the 300 millisecond-aperture it has when the bindery is running at a rate of 12,000 books per hour. In this time, it would register operating irregularities and remove improperly processed material before it could create interruptions downstream.

In addition to improving productivity, the computerized bindery room might also contribute to the trend to regionalization in periodical production. Regionalization requires split-run binding in which total circulations are broken down into sub-editions. This kind of production is particularly popular in magazine publishing, in which the sub-editions offer advertisers selective coverage of audiences. But the split-run may also find application in other areas such as text books for groups with related but different interests.

Without a computer, changes in editions require the binding equipment to be shut down while workers manually exchange the pages of one edition for those of another. With a computer, efficiency can be increased by using computer tape or punched cards to direct automatic setup. The computer can also provide programmed selective feeding of individual infeed stations for "simultaneous, hands-off production from one edition to another."

In general, the computerized bindery offers the opportunity for higher productivity and greater flexibility. The biggest problems at the present are money, talent, and the need to know how much control is necessary. It has been estimated that a computerized bindery would, at the present, be profitable only for firms which already have an inhouse business data processing computer and at least two bindery lines with 20 or more hoppers each.

In spite of the equipment and production problems which are critical to the bindery operation, the most frequently mentioned problem in the

binding industry is a shortage of skilled labor. As a result, many binders are looking to technology to compensate for the lack of quality workmanship in the present market. According to bindery managers, automated equipment plus better training programs for equipment operators will be necessary to solve the problem of labor in the bindery.

## FORECAST OF GRAPHIC ARTS TECHNOLOGY

### INTRODUCTION

Any forecast of graphic arts technology can be exciting and challenging as well as risky for the future of one's reputation. The industry is exploding with potential changes, and each forecaster has his own approach. Conservative forecasters consider the past as indicative of the future. Radical and adventuresome forecasters pick up the potential growth of an industry and inject a high degree of imagination for their prognostication. Furthermore, forecasters in related fields cannot resist the challenge of predicting the future of a new graphic communications discipline.

Generally the forecaster does not make predictions about such subjects as new plate developments and new automatic processors. He tends to look at the industry as a growth package, predicts broader changes, and even expands the parameters of the printing industry to include the communication and information industries. Because of this typical approach, most predictions concern systems, processes, procedures, and not individual pieces of equipment.

While some of these predictions will seem quite realistic, others will seem to be so futuristic as to be useless. The reader should remember, however, that man "thinks" down many paths before he travels any. Whatever is thought, has potential. So, even if these predictions do not affect your personal graphic arts business, they may affect your personal life.

Forecasting is a highly personal effort to exploit one's own knowledge and experience for the purpose of predicting future events. Each prognosticator has his own approach and his own ego to satisfy. Short-range conservative predictions are not too exciting, but they are safer. Long-range radical predictions may upset conventional thinking and ostracize the predictor. In either case, the thoughts of these forecasters deserve some attention.

The broad and general predictions tend to eliminate many of the functions of current graphic arts procedures and processes. Although these futuristic predictions may not help a printer make tomorrow's decision for next week's profit, they will provide a framework of thought for the next generation of effort.

Although the year 2000 seems to be further in the future than it really is, in another 30 years the industry will be there. Whether it will be graphic arts, communication, or information is not certain.

One of the realities that printers must face is the fact that they are part of the communication and information businesses. Some forecasters

feel that the graphic arts industry must first admit that it is no longer exclusively a procedure for putting ink on paper. Printing is closely associated with the industries of communication, education, and information. These industries are developing at explosive velocities and may bypass graphic arts, delegating it, as one forecaster has said, to the simple and sole function of being a computer printout. Even if graphic arts decides to integrate, these industries will force such changes in graphic arts that it will not be recognized as a printing industry.

Assuming that graphic arts must become part of the information business, what is its future?

First of all, print is an inefficient form by which to learn. IBM says that as soon as you stop to read or write, you reduce by one third your capacity to produce. In education, print is already in a phasing-out mode. It would be foolish for teachers to rely on print for an exclusive learning medium. The learning process is highly augmented with supplemental tapes, films, recordings, and so-called teaching machines. And consider the mode of acceptance. Students carry tape recorders and cameras for instant and active records. Photography and tape are active media for communication. We are moving rapidly into an affluent film-and-tape society - perhaps at the expense of the written medium.

McPhail, assistant professor of communication arts at Loyola of Montreal, believes that, within 20 years, the door-to-door newspaper will be dead. People in graphic arts may laugh at this prediction, but consider the



trend of changes in the newspaper industry. A three-newspaper city becomes a two-newspaper city becomes a one-newspaper city. In spite of the evidence of this overview, publishers hang on to their advertising revenues (now approximately \$1.2 billion per year) as evidence of usefulness. Yet even as larger publishers fold, the smaller ones unfold with growth. They are printing information. They provide a useful service to their communities.

Some forecasters point out that by 1978 printing will not be done exclusively on big presses. Instead, there will be thousands of smaller machines in offices, schools, and homes. And it should be remembered that CATV is coming on strong as a communication medium. Homes will have information appliances coupled to information networks designed for individual interests and needs.

Such predictions go on to admit that the printing industry's trend toward automation will continue for another 20 years. The phasing-out process will be gradual. There will still be words printed on paper but it will be done only once. Instead of ink images reproduced hundreds, thousands, or millions of times, print will serve some other means of communication such as the computer.

As industry develops new means of communication and information handling, the days of the printing industry as known in 1970 become numbered.

There is no doubt that graphic arts is in the middle of an era of change. Indeed, an article in Penrose Annual reports that photography will

become the master medium during the next decade. The computer will bring about total automation.

If certain breakthroughs should occur in the fields of visual displays, electronic communications, and optical storage and retrieval, there may, indeed, be a new approach to communication with or without the printed media as we know it in 1971. "Electronic learning and teaching systems" which use little or no printed matter could be the first target.

Actually, when we consider change and forecasting, it behooves us to look at the past. What is so radically different today from 500 years ago about putting ink on paper? Most of the answers concern the process or mechanics of printing. And when we use these constraints to measure our forecasts, we see only the innovations, the increased speeds, better quality, introduction of halftones and color, and a constant battle with budgets. Conventional graphic arts has not kept pace with the needs of the culture in which it exists.

Xerography is probably one of the best examples to show how conventional printing has failed to serve a population and how a new approach to a printing function has consequently developed. For years administration and office procedures had to communicate and store information by carbon copies, a messy, cumbersome procedure. The electrostatic process answered the need and was an immediate success.

Another example of graphic arts' failure has been its low capability to handle large quantities of information. With the computer, data pro-

cessing quickly filled this need. In this case, however, the computer industry, along with peripheral CRT equipment, has become increasingly word-oriented and believes it can do a better job of putting marks on paper than conventional processes in the printing industry.

#### MANAGEMENT

Since managers and consultants, for the most part, make forecasts, they include areas that affect a profit structure which, in turn, determines the production and acceptance of new technology.

One major concept that appears in predictions for the 70's is the significance of market analysis. In the next decade, the medium-size plant will be facing difficulties. The reason is that printing will become more specialized. This means that a company must look for markets at considerable distance from its printing operation. Sales may be interstate or international in scope. Furthermore, it will be more difficult for a printing operation to change its product once it becomes "locked" into its production system.

The smaller printer can still expect to have his customers walk in off the street. However, he is faced with the competition of the rapidly growing concept of the instant printer. In fact, the instant and the small printer may become one and the same.

A market analysis will force all printers to be more concerned with the social aspects of population. A declining birthrate affects the publication of periodicals, books, music, and greeting cards. Management will

look at the governmental requirements, educational commitments, changing income levels, and business climate. And it must consider the general shift of population to the West and Southwest. Although half of the printing in the United States is done in New York, Illinois, California, Pennsylvania, and Ohio, this picture may change.

#### EDUCATION

Future graphic arts technology cannot be seriously considered without looking at the manpower needs and educational requirements to make efficient use of that technology. Again and again, it is reported that the industry must develop a source of adequate manpower. Suggestions for inducing people into the industry range from a total change of the graphic arts image to minor updating of educational courses. But in spite of this realization that the industry needs this source, no organization seems to take the responsibility of establishing a program. There is no tangible program, and graphic arts management is beginning to recruit its professional people from other industries. Measured against some of these other industries, graphic arts is still in the dark ages, weighted down by a tangle of craft concepts.

When forecasters deal with manpower, they relate the problem to existing employment practices in graphic arts and how these practices inhibit necessary flexibility in attracting suitable personnel into the industry. Although progressive forecasters point out that the industry is gradually changing its attitude, the existing philosophy in graphic arts regarding its labor is that it is still basically an arts-and-craft industry of small production units. Through an apprenticeship system, it takes up

to seven years for a beginner to become a "printer." Prognosticators outside the graphic arts industry are inclined to blame this system for the backward condition of graphic arts education.

The apprentice system, as we know it today, is not a good training program for the future. It simply cannot cope with constantly occurring changes. The system tends to eliminate those people who have the capability and need to move rapidly in a career. And this eliminates the kind of character that graphic arts needs. While there is a need for a system which will fill positions with experienced production people, there is also a need to open the doors of the industry to people with a more liberal education.

Education is the most important element in the future of graphic arts. Unfortunately, it is also the weakest point. Within the next decade of changes, this fact will become increasingly and, perhaps, injuriously evident. The coming changes will present numerous interface problems with other industries. The people recruited in graphic arts will need to be familiar with these inter-relationships, not only in aspects of psychology, but also in the technology. These people need to be educated in technical skills. They must have a working knowledge of chemistry, engineering, physics, metallurgy, and mathematics. Tomorrow's printer must carry a complete package of communication disciplines.

#### GENERAL TECHNOLOGY

The future of graphic arts technology would be easier to predict if we had already assimilated the developments now at the industry's disposal.

This is not the case. No ideal printing situation exists. We may have advanced typesetting systems working in conjunction with a conventional plant. Or there may be highly developed printing machinery being served by outdated methods of composition. Each job imposes limits as to the economy of introducing new equipment. One forecaster has said that the goal for the next decade should be simply to put together an ideal printing operation. On the other hand, dynamic accomplishments in graphic arts technology can apply only to a few large corporations with financial strength to support them. And most of the graphic arts industry is composed of plants employing 3 to 20 people. These printers look anxiously for the appearance of miracle supplies, e.g., new inks, emulsions, paper, plates, chemicals. And they look for low-cost systems and controls for solutions to their problems.

In spite of predictions and the availability of equipment designed to provide customers and readers with aesthetic print, printers respond most readily to those devices and procedures which show a profit. No predictions will reach fruition if the process behind them does not show a profit. As examples of recent profitable ideas, consider the following:

- Photo-direct platemaking
- Multicolor press attachments
- Phototypesetting
- Revamped scheduling of jobs
- Improved bindery facilities
- Camera controls
- Film wrapper

New and better job tickets .

Better plates

Improved estimating

Perfect binding

New training programs

The more pragmatic prognosticator points out that the basic principles of the three main printing processes have not changed in spite of impressive progress in prepress procedures. And it is unlikely that there will be any fundamental departure from these principles in the future. Progress in the areas of optics, chemistry, plastics, electronics, fluidics, and other similar spheres of technology have contributed to progress in graphic arts, and it is likely that future graphic arts will continue to absorb this kind of changing technology. This is not an impressive view of the future for graphic arts, but it seems to be closer to the real-world view of a profitable graphic arts industry. It would appear that any spectacular breakthrough will occur outside of graphic arts unless graphic arts wants to enlarge its parameters.

Within this narrow concept of graphic arts, predictions are rather mundane. There will be faster presses, more accurate presses. Plates will be in an advanced stage of development. Computers will offer economies in typesetting, storing, and updating material. And if the industry wants to really rationalize its isolated position, it can say that these new communications methods will free printers from having to be involved in anything but the strictly mechanical process of printing.

Most forecasters adhere to their belief that increased speed will solve most of the problems of the industry. Total speed - from manuscript and photo to final delivery - must be increased. Anything that will increase speed (within a profit structure) seems to be acceptable. Automation in the prepress areas is essential: film processors, plate processors, engravers, conveyor devices, and other new procedures will reduce manual effort as well as man's capacity to commit errors.

Reportedly, there seems to be an interest in some areas that have not been extensively presented in trade publications. If interest develops in these areas, it will be due to the increased specialty nature of the industry.

Hectography, or spirit duplicating, is one example. It has a close technical resemblance to dye transfer and is the only known process capable of producing several colors on a single impression.

Another example is the use of thermally sensitive paper. Although presently replaced by electrostatics, this process might show up in letterpress where image areas are heated or in a flat plate where the image areas could be heated.

It has also been suggested that one form of communication might develop by printing sound tracks on accordion-folded books. A playback device costing no more than a cheap phonograph would enable listeners to hear the contents of the book. Printed by lithography or intaglio, it would cost no more than ordinary printing.



## COMPOSITION

In phototypesetting, research and innovative efforts were extensive in 1969. The growth of lithography helped to generate interest in phototypesetting text machines in newspapers and magazines. Books and other printing had not succumbed to the same degree because of the rigidity of the systems offered. The book printer or general commercial printer needs to have a considerable selection of fonts available.

The lack of a standard for tapes continues to be the industry's problem. TTS, the most widely used tape, is not compatible with formats of other industries which use tape. Huge capital assets in graphic arts are tied to the TTS format, and understandably, the industry cannot afford to make an immediate change. However, as interaction between graphic arts and such industries as data processing increases, it would appear that the problem will intensify. Perhaps, in view of the fact that, in future operations, the typesetting will merely be an off-shoot or by-product of the broader data-processing operations, other technologies (cards, OCR, in-line keyboarding) will by-pass the tape format.

Designs for keyboarding, a man/machine interface, and keyboarding systems have multiplied over the past few years. The sameness of the resulting product is disappointing in that it denies the printer any substantial choice of equipment.

In 1969, economic realities overtook the optimistic expectations of phototypesetting. The speed syndrome gave way to the realization that systems were needed. As a result of interlocking interests in the

communication function, companies from electronics and graphic arts merged and formed other working relationships for the purpose of generating products for an expanding market. It was a year of interfaces, terminals, data transmitters, and changing images. It was also a year of law suits. These events have somewhat cleared the air for future development.

The "Little Report of March 1969" predicted that the market for phototypesetters was heading for a total volume of \$101 million in 1973 compared to \$33.6 million in 1968. In 1970, a report by Creative Strategies Inc. put the phototypesetting industry at \$49 million in 1969 and growing to \$146 million in 1975.

A 1970 CIS report states that hot metal line-caster sales should be less than 10 percent annually for the next five years. By comparison, the phototypesetter sales projection should be a growth of 20 percent per year in the next five years. By 1975, markets for phototypesetters will have increased 300 percent.

CRT, used as an editorial device tied to phototypesetting and computer facilities, will, as John Seybold predicts, be "the key to economic application of computerized composition."

One of the spin-off areas in composition is the increasing growth of service centers or service bureaus. These organizations, similar to, and possibly including, the typography services or typesetters, provide typesetting output services and even software. It is reported that the 30

CRT composition centers have the capacity to set all the type required for all the books being printed in the United States. Also, reports suggest that traditional typesetting services have declined while service bureaus have increased in population.

Another system that can be included in the phototypesetting industry is computer output microfilm (COM). A growth here is apparent in the fact that some 20 firms exhibited COM systems at a computer conference in Las Vegas.

Half of CRT systems should be available in 1975.

In spite of the apparent growth of phototypesetting, the demise of hot metal is not as imminent as some would believe. However, the hot metal industry is slowly being eroded. And it is interesting to realize that some of the profits from the hot metal system continue to support some of the research and experimentation for the advanced, but as yet unprofitable, phototypesetting technologies.

#### PLATEMAKING

On the horizon, or just beyond, are a few developments which are of interest to platemakers. The application of the laser to platemaking has received considerable publicity. A reduction in speed and cost would be the main objectives. It has been estimated the laser engraving of gravure cylinders, for example, would reduce the cost by as much as 25%. Theoretically, the laser has a great potential for high-speed engraving, but in practical applications, the laser has been less than

rewarding. Current mechanical engraving produces 4,000 cells per second, while applied laser speeds have been about 100 times slower. Some experiments have achieved only one impulse per minute, which means it would take 200 years to engrave a 39 x 79-inch cylinder. Another consideration, however, is the fact that laser production could condense the many traditional steps from raw copy to plate into a single process. Although laser engraving is not competitive with mechanical engraving today, even the less optimistic writers concede that mechanical engraving could be replaced by laser engraving by the late 1970's.

In the next few years, gravure cylinder production will continue to use copper skin deposits except in the packaging industry. Aluminum has been talked about for years but not developed. It has also been suggested that a cylinder could be made of plastic with the image surface being molded.

Another fascinating proposition for platemaking is microfilm. Microforms have already startled some of the more complacent printing firms with the success of micropublishing. But it has also been suggested that microfilm might change the platemaking industry. From Business Graphics comes the following explanation:

The dictionary defines micro as: small or short. It defines film as a sheet of cellulose acetate or cellulose nitrate coated with light-sensitive emulsion. This material is the common denominator of most printing processes or platemaking processes today.... There are plants in the West that are producing plates from computer generated microfilm.... There is also an organization in the

East that has some basic equipment that can produce press-ready plates from microfilm, computer generated or conventional, at a rate of ten feet per minute. With the use of a faster plate material, this can be operated at fifty feet per minute....40 plates per minute or 2,400 plates per hour....Microfilm has been with us a long while, and there is no reason to feel that it will not someday be the medium from which we make plates.

In conclusion, it is, of course, necessary to bear in mind that new developments may eventually eliminate platemaking altogether. Ink-jet printing, facsimile transmission, and some types of electrostatic printing by-pass the entire platemaking step to go from hard copy or computer-recorded data directly to the printed image. These new directions in graphic arts cannot be ignored in an evaluation of the future of platemaking.

#### PRESSWORK

Forecasts for offset are almost all the same. Industry members point to spectacular growth in the 1960's and predict even better performance in the future. Equipment manufacturers have responded by directing the majority of their attention toward developing better systems for offset, while relatively few continue to look for new ideas in letterpress equipment. The printing industry in general has embraced offset as a versatile and profitable process, and most adventurous printers are attempting to apply offset to new markets daily. These printers seem undiscouraged by claims that offset lithography is, in fact, the most complicated printing process and, in terms of press production, the most unproductive. The compatibility of the offset plate with photocomposition and its rapid preparation, together with the fact that offset is suitable for printing

on such a wide variety of materials, has played the major role in putting offset where it is today; the efforts of equipment manufacturers undoubtedly will insure its continued success.

If offset seems to be the darling of the American printing industry, this is not so in the European markets where gravure printers display the same kind of enthusiasm for gravure as one sees for offset in the United States. And there are those who indicate that gravure could become a much stronger process here as well if Americans stop viewing it as a process limited to only the longest runs. As one man said, "From a purely technical point of view, gravure is the most sensible way of printing." It is a simple, but high-quality process for almost any printing substrate, and it lends itself well to automation. Its most serious deficiency is, of course, the printing cylinder which is costly and time-consuming to prepare. This part of the process, and not press developments, will most likely have the greatest influence on gravure's future.

The competition among these and other less publicized processes will naturally shape developments in press design. And while some firms are inflexible in their support of one process or another, an interesting trend is developing as a result of this competition. It is a trend toward a gradual breakdown in the distinction between processes. This breakdown is particularly obvious in the hybrid presses which some firms are using today. Perhaps less obvious but more trend-setting is the borrowing and adaptation of advantageous features of one process for use in another. If flexography uses photopolymer plates, how far removed is

it from a rotary system of letterpress which also uses photopolymer plates? Or if offset turns to a driographic plate and eliminates its dampening system, how different will the offset press be, in principle, from a letterpress? The differences will still be there, to be sure. But the neat and orderly classification and definition of printing processes may become increasingly difficult as printers and equipment manufacturers modify their presses and production techniques to compete for markets.

Another trend which is already much more obvious is the trend toward automation of the entire printing press. From the feeding of the paper to register and tension control, to delivery and folding of the printed product, electronics is gradually enabling the printer to control the entire press run from a panel of remote control dials. To control colors, computers will likely become common equipment in the pressroom.

All of these trends, of course, affect people. Changes from letterpress to lithography have become almost commonplace, and with each change, pressmen must either be retrained or relocated. Even those who do not change processes but adopt new equipment and techniques in their traditional process face a period of re-education. Add to these problems the fact that skilled pressmen do not exist in abundance for any process, and it is easy to see that automation and a new kind of pressman are part of the industry's future.

It has been suggested that the solution to the manpower shortage and the increasing complexity of presses is the direction taken by Xerox in devel-

oping their copy machines. These are highly complex but, at the same time, highly automated machines. However, while this kind of automation might eliminate the need for skilled pressmen, it would create a new kind of manpower need. Highly skilled maintenance people would be in great demand, and the resident engineer would become an important employee in major printing firms. With this direction of development, the emphasis shifts from craftsmanship to science, and as one writer points out, this shift will require re-education and reindoctrination of our manpower with the emphasis on professionalism.

#### DRIOGRAPHY

The response to the introduction of a dry-running plate for lithography has been enthusiastic. The effects of the 3M Dry Plate are already being felt in all sectors of the graphic arts. Press manufacturers have already produced at least one driographic press although the plate can be run on any offset press with the dampening systems disengaged. The success of driographic plates could, however, inspire new, simpler, and more economical press designs in the future.

Ink and paper manufacturers are also involved in supplying materials suitable for the new process. Conventional litho inks are not suitable for use with the dry plate. Thus, eleven ink manufacturers are already manufacturing driographic inks. Such inks must be made to adhere to certain substances and not others. In general, driographic inks use a higher cohesive force to guarantee that the coated areas do not attract ink, and as a result, they have a higher tack than other lithographic inks.



The higher ink tack has, in turn, placed a demand on paper manufacturers who must supply paper of good internal bond for driographic printing to prevent picking which is particularly severe on rough papers, newsprint, and coated papers.

Any printer who has ever had to tangle with the problem of achieving ink-water balance on a litho press appreciates the significance of a dry-running plate. At the present, however, driography is not the solution to every printer's problems. Small plates, as well as limitations on the length of the run and the types of papers, make driography most suitable for the printing of business forms. Larger plates and suitable but economical papers are needed for future growth. Process color has also been an obstacle for driographic printing. Nevertheless, test runs at Rochester Institute of Technology's Graphic Arts Research Center have shown that larger plates (23 1/4 x 38 1/2 inches) can produce four-color prints of surprisingly good quality. The industry can thus expect that, if research and testing continue, a driographic system of some kind will become an increasingly competitive method of printing for the future.

#### MICROFORMS

In recent months, there has been a growing interest in the application of microfilm to many areas of graphic arts operations. Particularly in the area of micropublishing -- the sale of information in microform -- recent developments have stirred many a printer out of complacency about his operation. As little as five years ago, most printers viewed microfilm strictly as a storage material unrelated to their own printing or publishing operations. Today, however, several forward-looking publishers

are producing their various publications on microfilm. Many of the traditional graphic arts equipment manufacturers are entering the microforms arena with microfilm readers, cameras, and processors. And it has been suggested that the printer who "disregards the use of micro-products in broadening the range of his market commits a strategic error" and will find himself in an "ever dwindling marketplace if he regards himself solely as one who prints on paper."

Microforms are part of the technology of tomorrow. The next ten years should see today's curious interest in microforms develop into the serious application of the ever-growing technology to economical systems of graphic communications. Particularly influential in this trend will be COM -- computer-output microfilm. COM is a system for recording computer-generated data on microfilm. It employs either the CRT technique used in photocomposition, or more recently, a laser recording technique. The laser beam forms the character images in one of two ways: the beam can be directed through the stencil, or it can be manipulated to form characters in strokes or dots, much like CRT image generation.

The application of COM to graphic communications could develop in two directions. Since an increasing number of businesses are installing inhouse computers, micropublishing could become basically an inplant operation, reducing the work sent to outside printing firms in some cases. The other alternative is for the printer to offer this service himself. If he is to keep the business of such companies, he must realize that his customers will no longer want printed material solely on paper. He will also be selling his product in microform.

In reality, it will not be difficult for the printer to offer his product in either or both of these two forms. As already mentioned, some plants are already producing plates from computer-generated microfilm. These firms anticipate a speed of 40 plates per minute in the future. Thus it may be that in a few years, the customer will be able to specify microform or printed paper, and the printer will be able to supply either with a total system aimed at making the best use of computerized composition, micro-sized products, and conventional printing techniques.

#### OPTICAL CHARACTER RECOGNITION

OCR seems to be one of these inescapable developments. In reproduction systems, the machine input becomes a bottleneck. Presently, OCR devices offer some relief in the input of data processing functions. While some equipment may eventually be developed to economically handle multiform inputs for editorial copy, it seems more reasonable that the preparation of editorial copy can bypass OCR and be put directly onto tape.

OCR can be described as an automation of the operator who, in conventional systems, keyboards information. The equipment eliminates the human element at the input stage. However, equipment has limits as to the configurations of characters that it can read. Equipment designed to read a single font of characters (data processing) is the most economical. The more fonts the equipment is designed to read, the more expensive the equipment becomes. And the complexity of the equipment can defeat its purpose.

OCR is one of the fastest growing methods of data input (it will probably replace some punched card inputs) and will be in widespread use in the next decade, in some cases, on a time-sharing, remote-terminal basis.

Some of the daily applications of OCR might be in hospitals. Data, including a patient's name, room number, and identification numbers on diagnostic tests, would be read by hand-held readers and transmitted to a central terminal for records and billing.

Airline credit validation and baggage control are other uses. And a stock clerk could take inventory by passing a terminal OCR in front of a label.

### CONCLUSION

The parameters originally constraining the field of graphic arts to the craft and technique of reproducing images have burst. Pieces of the industry have fallen onto a wide field of potential growth. Other industries, looking for ways to invest their capital and ideas, have entered the field of graphic arts, investigated parts of the reproduction process, and offered new techniques, supplies, and equipment. This commercial integration has caused a scattering of ideas throughout the larger fields of information and communication. And since no new parameters of interest have been established for graphic arts, we have made arbitrary decisions concerning the inclusion and depth of the subject matter. Some subjects have not been included because they fail in the marginal fields of printing. Other subjects have not been included because they seem to

be temporarily stalled in their technological growth. We have noted a few here.

We should consider the growth and impact of cable television (CATV) and video tape. As communication media, both will influence the future growth of publications.

Videograph printing has not developed beyond a limited quality level and does not seem to be a competitive printing process at this time.

To talk of screenless lithography as a new method of printing for the future would seem paradoxical, since continuous-tone printing was widely used in both lithography and gravure before the invention of the half-tone process in the late 1800's. Nevertheless, the truly successful application of screenless lithography to present-day commercial printing has yet to be achieved. It does not seem to be a question of the value of the method. Screenless lithography offers many advantages including higher resolution, increased color fidelity, and a lack of moire. What is a problem is the printing plate. While, in theory, screenless lithography can use any conventional plate, such plates must be manufactured within close tolerances to provide a highly uniform plate. At the present, manufacturers of plates are not marketing plates which meet this requirement, and until such plates are available, screenless lithography will probably remain at a standstill. But even if this method should become widespread, it will have little effect on the structure of printing as a whole, since it uses conventional presses, inks, paper, and processes.

The Cameron Press, a recent design in belt printing for the production of books, was introduced, and improved models have followed.

In order for 3D printing technology to grow, it needs lighter-weight, more portable equipment, and easier, more accurate methods of lamination.

For the photofabrication process, industry reports that graphic arts specialists are the best equipped and qualified people to employ. The work requires skill and accuracy with a process camera. And a printing operation can quickly find itself in the business of photofabrication by adding etching facilities.

This concludes the state-of-the-art summary and the forecast. A bibliography consisting of approximately 350 entries follows. These three items (state-of-the-art, forecast, bibliography) make up the complete report prepared by the Graphic Arts Research Center for the Graphic Arts Industry Manpower Study being conducted by the Eastman Kodak Company.

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PREPARED FOR  
GRAPHIC ARTS INDUSTRY MANPOWER STUDY  
EASTMAN KODAK COMPANY

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