

OSRA Thirteenth Annual Research Conference
Training for Technology and Performance
The Westin Crown Center, Kansas City, Missouri
March 27-29, 1994

**INFORMATION TECHNOLOGY AND ITS CORPORATE IMPACT:
A LOOK AT THE COMMERCIAL PRINTING INDUSTRY**

Gregory S. D'Amico
Clinical Assistant Professor
New York University
School of Education
Graphics Communications Management and Technology
239 Greene Street, Rm. 737
New York, NY 10003
(212) 998-5128
Fax (212) 995-4046

Session: Information Systems: Its Impact on Decision Making and Communications
Category: Refereed Research Paper

Information Technology and Its Corporate Impact: A Look at the Commercial Printing Industry

Introduction

Words that even ten years ago were not part of the every day vocabulary of business, such as downsizing (or its more positive corollary, rightsizing), outsourcing, re-engineering, empowerment and quality assurance are on the lips of everyone in large organizations today. Such words have crept into common use as organizations attempt to become meaner and leaner— as they attempt to do more with less. Technologies were not the cause for the crises that spawned such measures; however, technology may definitely play a new role to facilitate the flat organizational structure that is increasingly the norm in business.

In his *Harvard Business Review* article, "The Coming of the New Organization," Drucker (1988) predicted that by the year 2008 large businesses will have fewer than half the levels of management of its counterpart today, and no more than half the levels of management of its counterpart today, and no more than a third the managers. Drucker explained that such a structure will be possible because organizations will become information-based. This flat organization will be "composed largely of specialists who direct and discipline their own performance through organized feedback from colleagues, customers, and headquarters." This new organization is based on information sharing which mandates problem solving and group communications.

The commercial printing industry is one of many industries that has recently undergone an information systems transformation. According to Thaler (1993), the printing plant without a computer is becoming a rarity as more and more daily tasks are automated in production, administration, finance and sales. The purpose of this article is to describe recent research that documents the impact of information technologies on the commercial printing industry with regard to information technology's effect on: (1) locus of decision making; (2) management control; (3) organizational structure; and (4) job content of managers.

Related Literature

An extensive body of literature exists on the subject of computer information systems (CIS) and their impact on the organization. In relation to decision making, Rief (1968), and Whisler (1970), found that CIS implementation tended to *facilitate* a centralization of decision making. Klatzky (1970), Blau

and Schoenherr (1971), and Pfeffer and Lablebici (1977), on the other hand, found that the capability of CIS to collect and rapidly process information led to a decentralization of decision making. Carter (1984) suggested that if these two sets of outcomes are viewed historically, their discrepancies may be partially explained. Carter predicted that with an increased sophistication of technology and software, greater familiarity with its capabilities, and an increase in subunit CIS applications, decision making becomes more decentralized in the organizational structure.

With respect to the effect of CIS on control, it is widely accepted, Rief (1968), Whisler (1970), Carter (1984), that there is a general shift from human to computer control in the organization. Findings have also indicated that control becomes more centralized in the organization as a result of CIS. Whisler (1970), and Carter (1984), demonstrated changes in the vertical distribution of control toward centralization. Drucker (1988) has predicted, however, that coordination and control in the evolving information based organization will become decentralized to specialized task force groups, working toward the accomplishment of clearly defined goals.

While there are varying opinions as to the effect of CIS on organizational structure, Drucker's (1988) view with regards to the flattening of organization structure as a result of CIS has been supported in several studies, Jasinski (1963), Whisler (1970). And while Levitt and Whisler (1960) predicted early on that managerial job content would become more routinized as a result of CIS, later studies, I-less (1974), and Carter (1984) have shown that as CIS usage expands to each level of management, managerial job content becomes broadened and further enhanced.

The Study

Senior managers in the 63 largest U.S. commercial printing companies were surveyed by mail; 66.7% of the questionnaires were returned and 60.3% were usable. Part I of the questionnaire gathered information on each company: its applications of information systems technologies and the number of microcomputers and terminals throughout the organization. Part II of the questionnaire was based on an instrument developed by Whisler (1970), and solicited senior managers' perceptions on the effect of technology throughout the organization. In line with the Whisler study, four central research questions concerning the effect of CIS on organizational structure were addressed_ Below is a list of each central research question followed by its corresponding set of secondary questions.

1. Does senior management perceive the locus of decision making as being more decentralized in the organization when end-user computing is employed?

Does senior management perceive:

- a. an increase in the number of decisions made by supervisory management?
- b. an increase in the number of decisions made by middle management?

c. a decrease in the number of decisions made by senior management?

2. Does senior management perceive organizational control as being more centralized in the organization *when end-user computing* is employed?

Does senior management perceive:

a. *an increase in centralization of control?*

b. an increase in control by computer?

c. an increase in control over individual behavior?

3. Does senior management perceive a flattened hierarchical structure when end-user computing is employed?

Does senior management perceive:

a. a decline in the number of levels in the organization?

b. *an increase in the span of control?*

c. an increase in formally defined horizontal communication channels?

4. Does senior management perceive managerial job content as being broadened when end-user computing is employed?

Does senior management perceive:

a. broadened job content at the supervisory level?

b. broadened job content at the middle management level?

c. broadened job content at the senior management level?

d. an increase in the amount of inter-personal *communication?*

e, an increase in skill requirements at the supervisory level?

f. an increase in skill requirements at the middle management level?

g. *an increase in skill requirements at the senior management level?*

Findings

All respondents indicated that information technology was used for transaction processing — general ledger, accounts receivable, accounts payable and payroll. In addition, as Table 1 shows, technology was used for managerial functions such as meeting corporate financial objectives, production scheduling, word processing, electronic mail, and production process control by over two-thirds of the

respondents. Table 1 breaks these applications down by management level. End-user computer applications were clearly integrated throughout each management level in participating organizations.

Table 1
End-User Computer Applications
By Management Level(s)
(38 Valid Responses)

Application	%Senior	%Middle	%Superv.
Corporate Financial Objectives	89.5	65.8	31.6
Mergers and Acquisitions	60.5	7.9	0.0
New Plant Authorizations	52.6	28.9	2.6
Major Product Development	26.3	23.7	2.6
Cash Flow Analysis	65.8	73.7	18.4
Production Planning	44.7	76.3	42.1
Marketing Objectives/Sales	60.5	71.1	13.3
Labor Power Resources	31.6	63.2	52.6
General Ledger	50.0	78.9	50.0
Accounts Receivable	42.1	78.9	57.9
Accounts Payable	39.5	73.7	63.2
Payroll	36.8	73.7	71.1
Inventory	36.8	86.8	78.9
Cost Accounting	39.5	86.8	68.4
Estimating	36.8	78.9	57.9
Order Entry	21.1	63.2	76.3
Production Scheduling	18.4	73.7	71.1
Automatic Data Collection	23.7	57.9	52.6
Word Processing	34.2	50.0	73.7
Mailing	13.2	42.1	52.6
Database Management	21.1	57.9	36.8
Production Process Control	21.1	63.2	55.3

The Effect of Technology on the Locus of Decision Making

As indicated in Table 2, an increase in the number of supervisory decisions was reported by 57.9% of the respondents.

Similarly, an increase in the number of middle management decisions was also demonstrated. There was a perceived increase of middle management decisions in 65.8% of the companies sampled.

The data also indicated, however, that 39.5% of the respondents reported an increase in the number of decisions made by senior management. An equal percentage reported that the number of decisions made by senior management had remained the same. Only 21.1% reported a decrease in the number of *management decisions*.

Table 2
The Effect of end-User Computing
on the Locus of Decision Making
(38 Valid Responses)

Management Level	Increased	% Remained the same	gc, Decreased
Supervisory	57.9	36.8	5.3
Middle	65.8	34.2	0.0
Senior	39.5	39.5	21.1

The number of management decisions was reported to have increased at both the supervisory and middle management levels. Despite the fact that a majority of senior managers reported either an increase or no change in their level of decision making, these findings do support a decentralization of decision making since the increase found at the supervisory and middle management levels outweighed *that reported for the senior level*.

Increased decision making at the senior management level may suggest that more decisions are being made at all levels of management in commercial printing. Other explanations could be that: (1) end-user computing has resulted in a breakdown of decisions into component parts, each directed to the appropriate management level for resolution; (2) end-user computing has increased access to information and enhanced productivity; and (3) since respondents to the questionnaire were members of senior management, they may have been reluctant to admit making fewer decisions.

The Effect of Technology on Control

In the questionnaire, control was defined as a process of influence over individuals and activities of an organization in such a way that the achievement of goals within the organization is accomplished. As indicated in Table 3, end-user computing resulted in a reported decentralization of control. It was found that 39.5% cited a decreased centralization of control, while 34.2% reported no change and 26.3% reported an increase.

Table 3
The Effect of End-User Computing on Control
(38 Valid Responses)

Category	Increased	% Remained the same	Decreased
Centralization of Control	26.3	34.2	39.5
Control by Computer	81.6	18.4	0.0
Control Individual Behavior	26.3	55.3	18.4

An increase in the degree of computer **control in line with the application of end user processing** was strongly supported by the data. A very large proportion of the respondents, 81.6%, reported increased computer control in their organization.

Thirdly, the findings with respect to control over individual behavior as a result of application of end-user computing were neutral. A total of 55.3% of the respondents indicated no change in control over individual behavior. Of those reporting change, 26.3% reported increased control over employee behavior, although the remaining 18.4% felt that control over behavior had decreased.

The data would imply that senior managers have ensured the necessary controls were incorporated into end-user computing systems. This could have been obtained through software design, for applications throughout the organization. Using these packages, the application of end-user computing may have released senior managers from any future concern with respect to the centralization of control, thereby allowing them to focus their time and energy on senior management level decisions. The reported increase in computer control implies an underlying faith in the application of computer technology.

The Effect of End-User Computing on Hierarchical Structure

Regarding the effect of end-user computing on hierarchical structure and the number of actual organizational levels, **Table 4 shows that the majority (60.5%)** of the respondents reported no change as a result of end-user computing. Those respondents indicating a change, however, did tend toward a decrease in the **number of organizational** levels (28.9%), as opposed to only 10.5% who cited an increase.

With respect to the *effect of CIS on span of control*, the response was neutral, with 52.6% of the respondents reporting that the span of control had remained the same with the application of end-user computing. Of those respondents stating change, a strong 42.1% did indicate that span of control had increased, while only 5.3% claimed a decrease.

Table 4
The Effect of End-User Computing
on Hierarchical Structure
 (38 Valid Responses)

Category	Increased	% Remained the Same	Decreased
No. of Organizational Levels	10.5	60.5	28.9
Span of Control	42.1	52.6	5.3
Formal Communications	31.6	65.8	2.6

The respondents stated that end-user computing had no effect on formal communication channels between managers on the same level in the organization in 65.8% of the companies. Those that did report change tended toward an increase in the horizontal flow of information within the organization: 31.6% reported an increase in formally defined horizontal channels; while only 2.6% reported a decrease.

The findings pertaining to this central research question proved to be neutral. Despite the increase in inter-personal communication, no reported flattening of the hierarchical structure resulted.

The Effect of End-User Computing on Job Content

As indicated in Table 5, 73.7% of the respondents reported that job content at the supervisory level was broadened as a result of end-user computing. Broadened job content for middle management was also reported by 63.2%, and 52.6% reported a broadening of senior management's role.

A greater amount of inter-personal communications among individuals in the organization as a result of end-user computing was also supported. A majority (68.4%) of the respondents reported an increase.

Table 5
The Effect of End-User Computing
on Job Content
(38 Valid Responses)

Category	Increased	% Remained the Same	Decreased
Supervisory Job Content	73.7	21.1	5.3
Middle Management Job Content	63.2	34.2	2.6
Senior Management Job Content	52.6	44.7	2.6
Inter-personal Communications	68.4	23.7	7.9
Supervisory Skill	76.3	21.1	2.6
Middle Management Skill	73.7	26.3	0.0
Senior Management Skill	76.3	23.7	0.0

A substantial 76.3% of the respondents reported that end-user computing resulted in an increase in supervisory management skill requirements. Skill requirements were also reported to have increased for middle management in 73.3% of the companies, and 76.3% of the respondents reported increased senior management skill requirements.

In line with the literature, the data highly supported the view that the application of end-user computing would result in the broadening of managerial job content. Respondents reported that the managerial role at all levels — supervisory, middle and senior — was enriched. This was greatest at the supervisory level with 73.7%, followed by the middle management level with 63.2%, and senior management with 52.6%. In other words, the higher the management level, the less the perceived effect end-user computing had on job enrichment.

Implications

It would seem that the expansion of managerial responsibilities and capabilities is a logical outcome of the increase in decision making found at all three managerial levels in this study. This trend toward the enhancement of managerial performance is not so surprising if one thinks of the computer as a technological innovation that extends human capability. As Carter (1984) suggested, the older centralized computer systems extended this capability of only a few individuals, typically those in senior management positions with access to these computers. End-user computing extends these benefits to all management levels.

An interesting analogy may be made here with respect to the evolution of print technology. Before

the invention of the printing press, information was limited to an elite few. Consequently, the structure of society was highly centralized. As Eisenstein (1983) discussed, after print evolved as a medium of communication, those lower in the hierarchy were able to gain access to information to which they previously had not been privileged. End-user computing is accomplishing a similar function by distributing information and information processing capabilities to those lower in the organizational hierarchy with a resultant decrease in centralization of decision making. Similarly, software has evolved in such a manner as to broaden each individual's job function.

However, the results of this study should not be generalized as automatically applying to all manufacturing industries. This is particularly true when considering the perceived increase in broadened job content for middle management. The commercial printing industry is not simply a manufacturing industry. As a service industry, every job is custom-tailored to detailed client specifications before being mass produced. It is in this service capacity that middle management's role is critical.

The data clearly indicate that management information systems allow the decentralization of decision making, the decentralization of control, and the broadening of job content for each level of management throughout the organization. Yet, only a small percentage of respondents (28.9%) reported a decrease in number of organizational levels in the hierarchical structure of their organization. Intuitively, the most efficient organization has the minimum number of layers of management between its executive and supervisory level needed to meet corporate objectives. It is indicated from the data that there is a resistance among organizations to alter their traditional hierarchical structure as computer information systems are implemented throughout all levels of management and enhance performance. Drucker (1988) predicted that information based companies will be moving toward a leaner, work group approach. Executive management needs to explore the potential of computer information systems to allow new and more efficient approaches to organizational structure.

As end-user computing becomes a larger part of organizational structure, the need for continued research on the subject increases. The results of this research indicate that much more needs to be done before a full understanding of the effects of end-user computing is to be achieved. This understanding is critical if management is to realize fully the potential of this evolving technology.

Selected References

- Blau, P.M. & Schoenherr, R.A. (1971). The structure of organizations. New York: Basic Books.
- Caner, N.M. (1984). Computerization as a predominate technology: Its influence on the structure of newspaper organizations. Academy of Management Journal, 22, 247-69.
- Drucker, P.F. (1988). The coming of the new organization. Havard Business Review, L€ (1), 45-53.
- Eisenstein, E. (1983). The printing revolution in early modern Europe. Cambridge University Press.
- Hess, G.L. (1974). The influence of the computer on medium-size manufacturing organizations. Dissertation Abstracts International, 35, 3979A. (University Microfilms No. DDJ75-00002)
- Jasinki, F.J. (1963). Adapting organizations to new technology. In M.D. Richards & W.A. Nielander (Eds.), Readings in Management (2nd ed.). Cincinnati, OH: South Western.
- Levitt H.J. & Whisler T.J. (1960). Management in the 1980's. Havard Business Review, 38 (4).
- Pfeffer, J. & Lablebici, H. (1977). Information technology and organizational structure. Pacific Sociological Review, Q.
- Rief, W.E. (1968). Computer technology and management organization. Iowa City: Bureau of Business and Economic Research, University of Iowa.
- Thaler, M. (1993). Computerize to survive. Printing Impressions, 21 (8), 24-26.
- Whisler, T.J. (1970). The impact of computers on organizations. New York: Praeger Publishers.