
Disturbing Realities Concerning Data Policies in Organizations

DONALD L. AMOROSO

University of Colorado-Colorado Springs

FRED MCFADDEN

University of Colorado-Colorado Springs

KATHY BRITTAIN WHITE

University of North Carolina-Greensboro

The importance of corporate data management cannot be overstated in today's volatile environment. Several recent studies of IS professionals have found computer-based data utilization to be one of the top five critical IS issues of the 1980s. A study was conducted with 394 end users in 21 Fortune 500 organizations. The results are alarming. Data pollution existed in every one of the firms we explored. Rekeying of corporate data was evident in half of the end users surveyed creating redundancy problems. Data management policies were not found to be widespread presenting a very real concern to practicing managers. Backup and security procedures were found to be loosely enforced on the average. Based on the findings, the authors recommend a contingency approach to managing corporate data. Recommendations are presented to IS managers which encourage a shift from computer management to data management.

The expansion of end-user computing has complicated the task of data management in organizations. Both end-user computing (EUC) and data management have been perceived as issues of paramount importance, rated in the top five according to widely cited surveys of the past six years (Brancheau, 1986). Yet, how well are end users actually protecting their data and managing their data resources? In a survey conducted by Benson (1983), concerns for data security and integrity, and corporate access for microcomputers were seen as two critical issues requiring organization-wide planning. Quil-

lard, et al (1983) also found companies expressing concern over data-related issues, yet few of them had adopted any formal policies with respect to data. The specific data issues they examined involved the types of data required for applications, data integrity and data availability.

Rivard (1982) in describing data administration sees it as a corporate function whose responsibility is to provide management with computer-based data, with data being the most recently recognized corporate resource. Henderson and Treacy (1986) further expanded the definition of data management as the need "to

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make data accessible, reliable, consistent, and secure.” According to John Diebold (1979) of more than a decade ago, the organizations which will excel in the 1980s will be those that recognize information as a major resource and manage it as efficiently as they do other assets. We plan to revisit this concept of information resource management, as the basis for researching the topic and formulating relevant investigative questions. Kwan and Curley (1989) found new roles and responsibilities emerging as organizations grappled with the management of group-oriented, end-user applications.

The organization’s data resource continues to grow in size and complexity. The importance of data administration has continued to grow throughout the decade. In 1982, Benjamin predicted that by the end of the decade, end-user developed applications will absorb as much as 90 percent of the total computing budget. IBM researchers (1986) recently stated that three out of five business professionals are using the computer to develop applications to support their work. Nolan (1974) suggested that in Stage 3 (control), an important shift in emphasis should occur from managing the computer to managing the company’s data resources. He suggested that a company should develop applications to share data and new planning and control systems should be data-oriented. The current organizational computing environment seems ripe for the emphasis shift from computer management to data management and for an emphasis on data as a corporate resource. A key objective in the management of such a corporate resource should be insuring that data are available to the right person in a timely manner.

This paper reports the results of a survey to determine the current status of data management in organizations and to specifically examine formal procedures with regard to data access, data security, training for data extraction and data policies. Background information concerning previously identified data issues and

data management problems will be presented. Surveyed results based on 373 questionnaires are analyzed. The paper concludes with a discussion of the current status of data management in the organizations represented with recommendations to IS managers and professionals.

Background Research

Quillard, et al. (1983) and Eve (1984) classified data used in the organization into three primary groups which include (1) user owned, (2) external, and (3) corporate. Rockart and Flannery (1983) in an examination of the primary sources of application data found the third group of data (corporate) is required by a substantial number of user applications. The findings showed 34% of users in the first study and 53% in the second one keyed in data from reports, rather than using existing data. Re-keyed data was stated to be the most significant source of application data available. These findings indicate the tremendous amount of duplicate effort that was occurring in 1983-84 in accessing corporate data. As recently as 1986, Pyburn (1986) found that 53 percent of the data needed by end users are user keyed. Further, Carr (1984) found that the first two groups of data, user- owned and external, although of low volume are normally also keyed in manually, suggesting the majority of data available for end user applications requires rekeying by users.

Rivard (1982) and Martin (1982) addressed the data problems that can occur in such a data management environment. The first problem involves data redundancy which, in turn, produces unreliable and inconsistent data. Rekeying data introduces the possibility of data entry errors, creates duplicate and perhaps outdated data, and wastes time and effort. The second problem, lack of flexibility, occurs when needed data items are located in different files, with different data structures. Rockart and Flannery (1983), found that “a major complaint of many end users interviewed was their inability

to either locate where data is stored or once located having the data extracted and forwarded to them.” Martin (1982) stated that with an unmanaged data environment, “it might be difficult to fulfill the user’s need for data.” The final problem occurs when changes have to be made to the structure of a file which is used by more than one program. A seemingly minor change to one user may be considered complex to the data administrator who must consider the data needs of an integrated group of users.

To date, only a few empirically based studies have examined data management issues specifically relating to data administration. Four such studies were identified by Gillenson (1982), Kahn (1983), Sumner (1984), and Goodhue (1988). Each of these studies will be discussed below.

Gillenson (1982) examined the state of practice of data administration in firms who took an active role in the management of data. First, he found that a firm had to treat data as a manageable resource, a critical corporate commodity. He defined data administration as the custodianship, management, planning, and documentation of an organization’s data. This research suggest that a majority of data management activities involve liaison to technical personnel rather than end users. Further, only 58% and 50% of the total number of firms were involved in the crucial activities of education and long range planning respectively.

Kahn (1983) conducted a survey of data administrators of predominantly large enterprises to determine the extent of the existence of data administration and to assess its effectiveness as it is implemented. Seventeen information resource management related activities were identified. Of these 17 activities, only two were identified as being accomplished effectively by a majority of the respondents. The two were procedures for data restoration and maintaining data integrity. This left such functions as (1) data sharing, (2) controlling redundancy (3) maintaining data accuracy and (4) providing training to users as ineffective. These results

further substantiate the data administration crisis in a number of organizations.

Sumner (1984) queried 22 firms of various sizes and industries in the St. Louis area. In cases where automated recovery was required, respondents selected traditional development rather than end-user or microcomputer development. When data was required by only one section or stayed with the department, the size of the data base was relatively small and the data could be extracted from a permanent corporate file, end-user development was chosen. Finally, when less than five users were concurrently updating the application data, end-user development was preferred.

In a recent study, Goodhue, Quillard, and Rockart (1988) reported multiple approaches to managing the “data resource” in corporations. Interviews were conducted studying 31 data management efforts in 20 large corporations during the 1985-86 period. The authors suggest four elements for consideration in the contingency approach to managing data: identifying the business objective, scope of the data management project, the data planning process, and the product of the data management effort. Although it was stated that business benefits can result from improvements in data management, five organizational issues were identified for the 1990’s. One of the most profound issues resulting from ineffective data administration involves the new responsibilities for managing user involvement.

In summary, to date it has been advocated that data must be managed so that information is accessible to the right persons on a timely basis. Hartog and Herbert (1986) and Brancheau and Wetherbe (1987) found data utilization to be one of the top five critical IS issues in the late 1980’s. We anticipate data management issues will continue to be critical in the next decade. The results of several empirical studies suggest that corporate data should be managed with shared responsibility. With this type of management scheme, users would be respon-

sible for the integrity and security of the data they generate or use and the IS group would perform a custodial role, providing access and support for user's data needs.

Study Method

In order to further investigate the data management issues identified in previous research as critical, a field study was conducted with end users in 21 large corporations. Forty Fortune 500 firms were chosen which were located in the southeastern United States, within a one-day driving distance from Atlanta. All of the firms which agreed to participate in this study reported growing end-user computing environments, were located in multiple industries, and had a large variance in terms of sales dollars and number of employees. We asked each end user to identify data issues relative to only one application that was utilized within a corporate functional area. A long list of end users was initially drawn up by our contact person within each firm. The researcher, who had no knowledge of individuals, randomly selected three persons from each functional area in the organization to avoid response bias.

The survey yielded a response rate of 64 percent with an average of 25 end users per firm for a total sample size of 394. The average sales for all firms was just over \$6.5 billion, while employing an average of 45,000 employees. Applications were identified in firms where access to corporate data was mandatory. Table 1 illustrates the functional area location of end-user respondents. The distribution, in terms of functional area, closely paralleled the end-user distribution in Rockart and Flannery's study (1983) with the exception of the IS staff. The majority of end users developed financial and strategic applications. IS developers and supporters, if identified as end users, were randomly selected for this study in accordance with the proportion of IS developers in a firm. Consequently, this sample is felt to be more represen-

Table 1: Functional Area of End-User Developers

Functional Area	% of Sample	Comparison with Rockart/Flannery
Corporate Strategy - Planning/Forecasting	11.6	11.4
Marketing Research	4.6	5.7
Marketing Planning	8.5	6.4
Finance - Accounting	7.6	7.2
Finance - Planning/Analysis	19.7	5.0
Purchasing/Scheduling	4.3	6.4
Human Resource/Personnel	7.3	6.4
Actuarial	9.4	3.6
Production/OR	4.2	3.6
Engineering	5.7	8.6
IS/Developer/Supporter	6.2	14.3
Customer Service	9.4	4.3
Other - Legal	1.3	2.1

tative of the distribution of end users in an average large firm.

Finally, respondents were given certain definitions of the end-user computing environment as derived from Martin (1982) and Rockart and Flannery (1983):

Developer	A person who develops an application primarily for his or her own use.
End-user computing	An environment that supports the end-user developer with a problem to solve requiring access to computer and data resources.
software End-user	Software which is "user friendly" containing English-like commands, help facilities, menus, and full-screen editing.
application End-user	A working information system developed in a functional area, such as accounting or production, with the purpose of solving a business problem.
Application development	The process of defining the problem and information requirements, creating file structures, output reports and input forms, programming, and testing with the goal to produce a working

Study Findings

End-User Data Applications

Of significant interest were the types of applications being developed by end users requiring data extraction. As shown in Figure 1, report generation (92.9%), data manipulation (70.5%), data analysis (66.7%), and data queries (44.2%) were targeted as the crucial applications requiring access to corporate data. Other applications, such as data modeling, graphics, and statistics, were also identified as secondary applications utilizing corporate data. Most end users reported developing a median of four applications in the past year and planned to develop an average of two applications in the next 6 months. Over 70 percent of the applications reported were categorized as personal applications, while less than 5 percent were multi-departmental in scope. These findings appear to be consistent with other recent surveys by Pyburn (1986), Lee (1986), Rockart and Flannery (1983) and Quillard, et al. (1983).

Access to Corporate Data

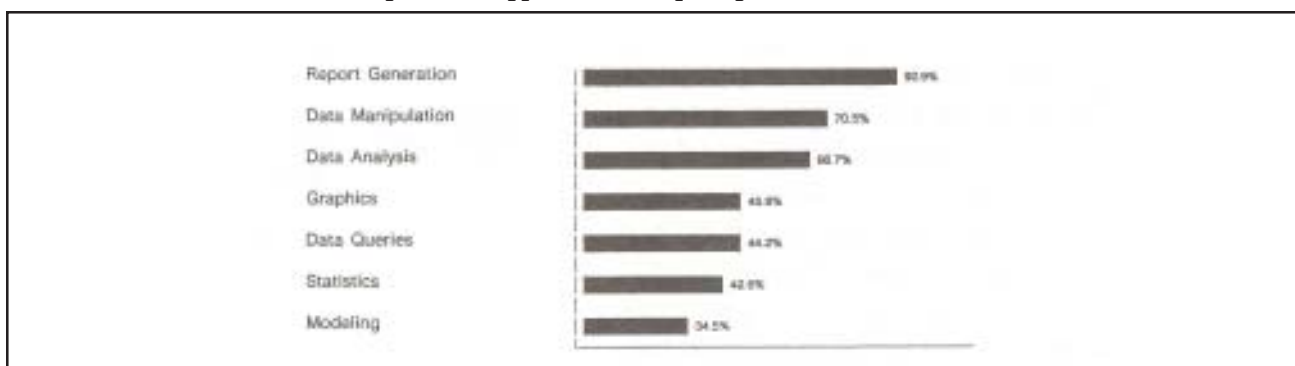
Earlier studies (described above) pointed out the need for end users to have access to corporate data in order to develop successful applications. Without such access users will have to create their own files or data bases, often by rekeying from reports or other sources. Respondents in our survey were queried as to their

degree of access to corporate data, on a continuum of 1 (no access) to 6 (complete access). Almost 70 percent of respondents reported having at least "good" access to corporate data, which corresponds to a 4 on the previously referenced continuum. However, almost the same percentage felt that complete access was important in the development of successful end-user applications.

Although many of our respondents reported "good" access, there is still obviously a large gap between current practices (good access at best) and what is needed (complete or full access). This becomes evident when we recall that well over half of all data used in end-user developed application is rekeyed from other sources. Thus, it is obvious that organizations must improve access to corporate data for end users. However, improved access also increases the level of risks to data security and integrity. Data base administration must take an active role in developing policies to contain these risks. For example, to improve data integrity, data base administration might sponsor a policy that end users can download corporate data to their applications, but cannot upload their data into the corporate data base. To improve data security, end-user workstations can be configured with hard disks only (no floppy disk drives) so that corporate data cannot be downloaded and easily removed from the premises.

Data Management Training

Figure 1: Applications Requiring Data Extraction



End-user developers were asked to provide information on the type of computer-based training they had received on a continuum of 1 (no training) to 5 (excellent training). The majority of end users (74.5%) reported average or below average training in data retrieval. This finding differs from other types of application training, such as word processing or modeling, where above average results were found. Further, over 75 percent of respondents reported to be self-trained rather than receiving training from other sources such as the firm, vendor, or college. This finding is consistent with the Quillard, et al. (1983) and Nelson (1985) studies where 76 percent of users said they taught themselves primarily with a software package.

Inadequate training in the use of high-level languages can be expected to lead to poor quality application and insufficient use of computing resources. For example, numerous studies have revealed that spreadsheet applications being used to support management decision making often contain errors that render the results meaningless. Similarly, lack of training in the use of query languages (such as SQL) often lead to syntax errors or queries that give unexpected results. Different ways of formulating the same query can dramatically affect system performance. For example, in one test a complex SQL query required over one-half hour to perform on a personal computer. However, by reformulating the query using a different syntax the response time was reduced to less than one-half minute. Obviously, an investment in improved end-user training in most organizations will pay large dividends.

Computer Experience With Data

Respondents were then asked to report their level of computer experience on a continuum of 1 (no experience) to 5 (extremely experienced). Most of the users surveyed reported a high degree of experience in most categories with the exception of creating programs using a query language. User experience relative to data

management was analyzed for this study, including data access, developing file structures, and creating programs using a query language. Over 54 percent of respondents reported less than an average level of computer experience using a query language. Over 60% of respondents reported a relatively high level of computing experience, scoring either a 4 (very) or 5 (extremely) on the instrument. Conversely, less than 38% of end-user developers reported a high level of development experience.

Lack of user experience in the use of query languages (and other development languages) suggests the need for at least three organizational responses:

- (1) Improved end-user training (described above);
- (2) Expanded information center support for end-user application development;
- (3) Sponsoring experienced end users to act as consultants assisting less experienced end users within each department or other organizational unit.

Data Management Policies

The importance of data management policies and standards has been addressed by every empirical EUC study in the past three years. Alavi and Weiss (1986) stressed the need for formal written data management policy statements to be established and enforced. End users, in this study, responded to a series of questions designed to measure their awareness of certain EUC corporate-wide issues. Respondents were asked to rate several types of end-user policies as to their existence and helpfulness. The policies included access to corporate data and data backup procedures. Figure 2 illustrates users' responses to end-user data policies. Both of the policies relative to data issues showed a somewhat flat distribution with significant representations at both ends of the continuum, 5 (extremely helpful) to 1 (not known or not helpful).

Written comments and interviews further revealed significant differences on the existence of certain end-user policies between one user and the next. For example, a certain end user claimed (s)he had never heard of a certain data backup policy, while another respondent, in the same firm, considered the identical policy to be very helpful in the development of end-user applications. This situation suggests a lack of organizational communication and a weakness in top management direction during the creation and implementation of data management policies.

To improve the effectiveness of their data management policies, many organizations need to adopt a more participative approach in developing and implementing those policies. Some organizations are establishing task forces to manage end-user based applications. The task force should consist of business unit managers, personal computing managers, and central IS staff. The task force should develop guidelines and policies regarding data management, identify company critical applications, and mandate controls for which business unit managers are

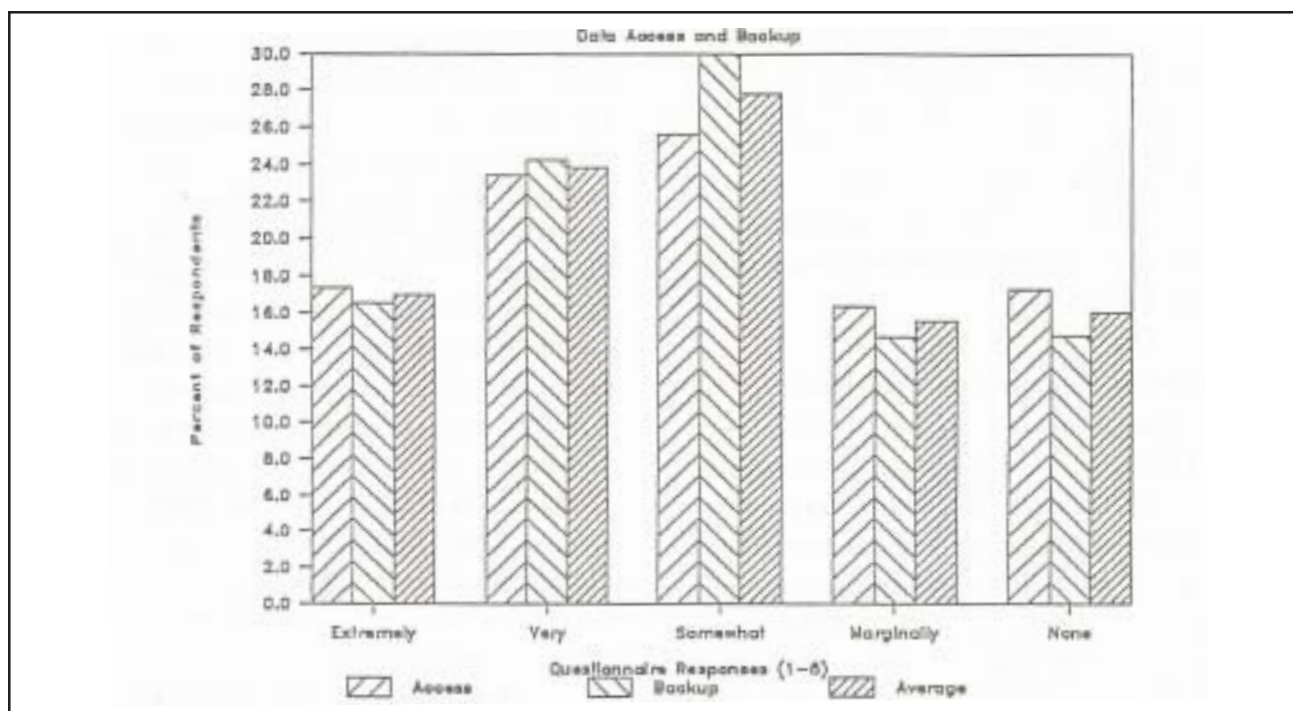
responsible (Moad, 1989)

Discussion

Data pollution is the contamination of the information supply with incomplete, inconsistent, or incorrect information. The data management environments described in the organizations represented in this study seem very vulnerable to such data pollution. They seem to suffer from the same potential liability as some environmental waste sites — no problem may be apparent at present, however contamination is a real threat and may surface at some future date. The current “data management hot seat” is highlighted when one examines the participants’ responses relating to training in data access and retrieval. The majority of users reported average or below average training in these areas. Yet, a large number of these minimally trained users noted that they accessed corporate data on a fairly regular basis.

The data access environment profiled in this study found 50 percent of users were accessing corporate data in such applications as report

Figure 2. End-User Data Policies



generation, data queries, data manipulation, and data analysis. Although 70 percent of the applications were categorized as personal applications, reason would dictate that the information generated from these applications could impact and potentially pollute the information base of the organization. A smaller number were accessing data and applying it to multi-departmental applications representing a potentially larger threat to information accuracy.

The downloading of corporate mainframe data has been an issue in the literature for several years. Corporate data appears to occur frequently and obviously is required for multi-user applications. However, the rekeying (which is often done) without the accompanying data validation used with mainframe data entry poses a real threat to the validity and integrity of the subsequent applications. There is a need for the development of effective "data migration" procedures that would eliminate the need for rekeying data and thus wasting corporate resources.

Certainly, such findings suggest that many organizations are not taking seriously the mandate to provide controls for data integrity and to view the data as a corporate resource. Further exacerbating the data management problem are data management policies that are not widely distributed nor known to many of the participants surveyed. In fact, no formal corporate-wide data management policies were established at many of these organizations. These findings further substantiate the Quillard et al. study (1983), where few firms had adopted formal data policies, and the Sumner study (1987) where no standards were set in the organizations surveyed.

Further, a majority of users of microcomputer applications were totally responsible for their data and operations suggesting an environment where backup and security procedures are loosely enforced.

These findings are alarming to the authors and should be a real concern to practicing managers. Research has been presented since

1982 indicating the lack of data management policies followed by many organizations. Such findings should serve as a real warning to IS professionals and to top managers. Haphazard data management procedures cannot continue without serious risk to the information processing capability of the organization.

New corporate policies governing data management are needed and they should be promulgated. End users today are confused about the actions taken in many organizations. They strongly desire to know exactly what support and what future directions they can expect from information systems management. Since multiple users seem to have access to corporate data, one of the primary questions generated here is what will they do with it. Multiple copies of the data create problems of data integrity and reliability. Procedures should be established for data design, data access and data quality assurance. Management should consider an appropriate organizational structure which will effectively allow users access to corporate data while minimizing risks.

We recommended a contingency approach to managing corporate data. A number of alternatives exist for achieving centralized data storage and control. For example, data policies found to impact end users directly might be revised to include the IS department's examination or approval of large data extracts by end users. Or, where redundancy of non-key data is found which leads to conflicting conclusions, departmental liaison positions could be established for determining the reliability of corporate data. Whatever the organizational variables, alternatives should be chosen which provides the most appropriate match between the individual user and the organizational environment.

The need exists for the development of a substantial education program. The majority of users reported below average training in data retrieval. Jarvenpaa and Machesky (1986) put it clearly when they stated that "data analysis requires learning." Further, there is a need to

educate top line management — or at the very least corporate decision makers — as to the tools, techniques and potential impact of the end-user computing era, so that the need for effective data policies can be understood, communicated to the organization, and then implemented and enforced.

Concluding Remarks

In the past decade, a substantial portion of the IS literature has addressed end-user computing. Resulting from end-user computing is the widespread dispersion of corporate data. However, common practices concerning user access and retrieval of corporate data have not received the same attention in the IS literature nor in many organizations. If organizations do not shift from computer management to data management, they virtually assure the creation of an information supply that is incomplete, inconsistent and incorrect. The interjection and growth of end-user computing in the past decade has made it even more difficult to manage the data issues presented in this paper. It has been the goal of the authors to identify data issues that are critical within the scope of end-user computing environments in large organizations, and to provide recommendations for improving the management of data.

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Donald L. Amoroso is assistant professor of information systems at the College of Business and Administration, University of Colorado, Colorado Springs. He has five years in industry as an information systems consultant and systems analyst. He has published in the Journal of MIS, Information and Management, Data Base, Information Resources Management Journal, and the Journal of Information Management. Dr. Amoroso's research interests lie in the areas of information engineering, end-user computing, and measuring the effectiveness of emerging technologies.

Fred McFadden is professor of Production Management and Information Systems at the University of Colorado at Colorado Springs. His education includes an MBA from UCLA and a Ph.D. in Industrial Engineering from Stanford University. Dr. McFadden has authored three books, the most recent being Data Base Management by Addison-Wesley. He has also published numerous articles in professional journals.

Kathy Brittain White is an associate professor in the Joseph M. Bryan School of Business and Economics at the University of North Carolina at Greensboro. She specializes in the strategic use and organizational integration of technology. She has consulted in these areas with major firms such as Merrill Lynch and AT&T. She has authored over 30 papers concerning the organizational and personnel issues affecting information technology that have appeared in such publications as MIS Quarterly, Information and Management, Journal of MIS, Journal of Systems Management, Computerworld, and Data Management.

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