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Abstract: Discusses the effectivity of data resource management (DRM) based on the study conducted to 276 organizations in United States. Experimental methodology used in the study; Benefits of data base management system (DBMS); Effectiveness of DRM tasks; DRM effectiveness factors; Factors that defines DRM; Conclusion.

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HOW EFFECTIVE IS DATA RESOURCE MANAGEMENT?

Reassessing Strategic Objectives

For more than a decade, data base management systems (DBMSs) have been proclaimed as the panacea for data integration and redundancy problems. Are organizations reaping the benefits of data base technology? What specific data resource management task. have they failed to address effectively? A study of 276 organizations seeks to address these questions and to describe and diagnose the data resource management problems that corporations face today.

STUDIES REPORTING ON THE STATUS of data resource management (DRM) activities in corporations have been almost nonexistent. In contrast, articles expounding the need and importance of using data base technology to achieve effective data resource management are too numerous to mention. The few articles that have tempered these claims with a cautionary note were all based on empirical data.

In a 1978 survey, 60 data base administrators revealed that their organizations had achieved independence, integrity, control, and flexibility of data, but there were few integrated applications and maintenance costs were on the rise. The same study also found that DBMSs increased both operational inefficiencies and storage and software costs. The survey nonetheless concluded that when systems analysts and programmers overcame their resistance to data management, its benefits to the organization far outweighed its costs. In 1980, a survey of 150 organizations reported that the average investment in a DBMS was $105,000. Despite this investment, less than 15% of the applications in these companies had been using a DBMS. Both studies emphasized the need to plan carefully for data base technology in order to realize its potential.

A 1984 survey of 160 Hong Kong-based companies found that 52% of them considered the strategic

advantages of data bases (e.g., centralized control, integration of applications, and the recognition of data as a resource) to be more important than the technical advantages (e.g., powerful file management, improved throughput, and reduced development time). Senior management support, user involvement in data base projects, and a managerial data base administrator were found to be essential for maximum efficiency and effectiveness of the DBMS.

Two other surveys conducted in the early 1980s revealed increased data base activity and senior management support, though most of the data base administrator's functions remained primarily technical in nature. A survey of 56 large companies, published by the Association for Computing Machinery (ACM), found that the larger the company, the greater the likelihood of a successful data management department. However, only data documentation, consistency, design, and data sharing were found to be actually improved by the existence of a DRM function.

All these surveys have provided interesting insights into the ways organizations perceive and use data resource management and DBMSs. However, a more useful assessment of the effectiveness of DRM in today's organizations can be obtained by delineating specific tasks and rating how well each is being performed. This information will help organizations arrive at definite priorities for the future. This article presents the results of such a survey of 276 organizations.

METHODOLOGY

An initial questionnaire based on published articles and discussions with practitioners asked respondents to rate the extent to which some commonly cited data base benefits were realized in their organizations. Through pilot testing of this questionnaire, a comprehensive list of specific DRM tasks was compiled and refined. Face-to-face interviews with executives responsible for data management in organizations in the Pittsburgh area produced suggestions for rewording items before distribution of the final questionnaire, which asked respondents to rate the effectiveness of each DRM task on Likert-type 5-point scales.

In all, 1,200 questionnaires were sent out to the individual responsible for the data management function in each organization. The target group consisted of medium-sized to large corporations (more than $10 million in revenues) in Pennsylvania, Ohio, New York, and West Virginia. The response rate was 23%. Of the 276 usable responses received, 171 reported having operational data bases in place.

Sample Profile

The final sample includes organizations from a wide spectrum of industries, with the two largest groups being manufacturing (36%) and wholesale or retail sales (14%). Eighty percent of the organizations surveyed have more than 1,000 employees; about 25% employ more than 10,000. In general, the larger the organization, the larger the size of the IS department. IMS is the predominant transactional data base in use, closely followed by IDMS and DB2.

REALIZED BENEFITS

Eight distinct benefits of a DBMS were listed for the respondents, who were asked to rate on 5-point scales the extent to which each of these benefits had been realized to date. The mean score results from the 171 respondents are shown in Exhibit 1.

The three most written-about benefits of the data base approach are reduced data redundancy, integration of applications, and the ability to handle unanticipated information requests. In this study, however, the benefits that scored highest were improved data integrity and the provision of a more powerful file management method. Surprisingly, the most direct benefits of data independence (i.e., reduction in applications development time and cost, reduction in system maintenance time and cost, and the ability to handle unanticipated information needs on a more timely basis) all ranked low on the list, separated by almost a 1-point spread from the top-rated benefits. Reduced redundancy, increased integration, and security benefits occupied the middle tier of benefits realized.

The relative ranking of these benefits indicates the disparity in their realization. Despite the organizations' experience with DBMSs (i.e., the average age of the DBMS in use was seven years), the real benefits of data independence are not yet being realized to the extent that those of data integrity and file management functions are. There are many reasons for this. Inadequate applications integration, lack of ad hoc reporting ability, and excessive development and maintenance time could all be attributed to a lack of set standards, uncommitted or marginally committed management, and ineffective logical and physical design. However, the study also reveals that current practices still tend to emphasize technical aspects of the DRM function, which have mainly operational rather than strategic consequences. Because data resources planning and the identification of data sharing opportunities are performed less effectively than some operational tasks, many companies may have been prevented from fulfilling the lofty goal of applications integration.

THE EFFECTIVENESS OF DRM TASKS

Respondents rated a list of 16 DRM tasks on a 5-point effectiveness scale. The results are shown in Exhibit 2. Four natural break points occurred in the scores; these categories have been labeled A, B, C, and D.

Tasks in category A are performed relatively effectively. These tasks are primarily concerned with logical and physical design aspects of data bases. Subsumed within this category are data base tuning and capacity planning. The fact that effective efforts are being made to maintain the accuracy, integrity, and security of data explains the higher realization of related data base tasks.

Category B tasks are performed somewhat less effectively than those in category A and include the selection of hardware and software, the training of IS personnel, and data dictionary activities. The relatively high score (3.62) for hardware and software selection suggests that, despite the proliferation of data base hardware and software products, corporations experience few problems with this aspect of DRM.

Category C tasks are performed significantly less effectively than those in category A. These tasks primarily center around data base planning: policies of data control and ownership, strategic data base plans, procedures for data retention, opportunities for data sharing, and controlling data redundancy. Category D tasks, which were judged to be performed least effectively, involve organizational-level data planning (e.g., developing an organizational model for data and conducting organizational data requirements planning).

In addition to being complex in terms of their components and interrelationship with other systems, data base systems must meet the continually changing needs of users during the 1990s. Long-range data planning and an organizational-level framework or model are therefore essential for organizations wanting to implement a variety of systems. The overall informational model ensures consistency with organizational goals and objectives and can be translated into conceptual systems models from which consistent development plans can emerge. The poorer performance of today' s organizations in such strategic aspects of DRM bodes ill for focused, accelerated growth of data resources in the near future.

DRM EFFECTIVENESS FACTORS

The 16 DRM tasks listed in Exhibit 2 were analyzed using a statistical technique called factor analysis. A factor can be defined as an internally consistent group of measures that tend to move together (i.e., if one measure is higher, the others tend to be higher). Many measures can usually be grouped into a few factors that can be interpreted and assigned descriptive labels.

Several factor analysis techniques can be used. For this study, the most commonly employed method, called varimax, was chosen because it attempts to come up with distinct, independent factors.

Five factors were extracted for the factor analysis, and they are listed in Exhibit 3. Labels given to the factors represent their primary content. Factor 1 consists of redundancy control, which almost invariably involves the effective use of a data dictionary. Factor 2, data base design and operation, represents the technical core of responsibilities for data resource management. Logical and physical data base design are naturally correlated; the ability to tune data base performance is an important consideration in physical data base design. Performance tuning and maintaining the accuracy, integrity, and security of data are both critical

aspects of daily data base operations.

Factor 3, administrative control and management, includes the establishment and enforcement of administrative procedures as well as the managerial decisions involved in selecting hardware and software. Factor 4, data base planning and implementation, involves preparing the plans and the associated activities in actually implementing them. The implementation efforts entail scouting for data sharing opportunities as well as training users and IS personnel to facilitate the introduction of innovative approaches based on data bases.

Factor 5 pertains to broad-scoped data resource planning and policies at the organizational level. This factor naturally involves the development of data architecture and policies for data ownership and access control for the entire organization.

DATA RESOURCE MANAGEMENT

The five factors in Exhibit 3 constitute a general definition of DRM; specific tasks associated with each are identified. Interestingly, the first two factors are related to the technical aspects of data base operation, whereas the last two are almost exclusively concerned with managerial issues in data resources strategy and policy. The middle factor, factor 3, addresses middle-level management functions in control and monitoring. Therefore, an empirically derived profile of the DRM function emerges in the form of a typical managerial pyramid, as shown in Exhibit 4. However, the results of the study also indicate that most of the technical activities are performed more effectively than the managerial responsibilities.

Clearly, the diverse nature of DRM, which spans a managerial and technical continuum, must be organizationally resolved. To accomplish this, some organizations are distinguishing between data administration and data base administration. When this distinction is made, data administration represents a senior management function responsible for developing and administering plans and policies for the overall organization, protection, and use of information. Data base administration can then report within the IS department to handle the technical and operational aspects of data base systems.

This separation of functions is usually successful, especially if clear reporting relationships between the two groups are defined. However, also emerging is the concept of user managers acting as data stewards, who are responsible for bridging the gap between the data administrator and data base administrator by managing an organizational data resource. Such intermediate personnel can promote organizational data sharing, a task that, as indicated by the survey findings, is being poorly performed by organizations.

CONCLUSION

The results of this study illustrate that there are many DRM issues to resolve before all the proclaimed benefits of data bases can be realized. Among the DRM tasks, the technical and operational aspects are being performed more effectively than the global and business-related aspects. This lack of sophistication in DRM can be related to earlier findings about DBMS benefits: strategic benefits (e.g., reduced applications development time) are realized to a much lesser extent than operational benefits (e.g., file management and data integrity).

In most organizations, there are two functions prescribed for the management of data: the data base administrator and the data administrator. The former generally has a more technical orientation, whereas the data administrator provides the organizational framework within which data base technology can be successfully employed.(n1) The results of this survey suggest that the time has come to implement the data administration concept and enhance the strategic orientation of the DRM function. Organizations hoping to effectively harness DBMS capabilities for global business objectives should reassess their DRM practices and their organization accordingly.

Notes

(n1.) P.S. Ravindra, "Data Administration: An Old Function Adapts to Its New Role," Journal of Information Systems Management (Fall 1986), pp 47-51.

EXHIBIT 1 Actual Benefits Achieved Through DBMS

Benefit	Mean Score
Improved data integrity	3.97
Provision of a more powerful file management method	3.85
Reduced data redundancy	3.49
Enhanced security and privacy of data	3.43
Integration of applications and sharing of data bases	3.35
Satisfaction of unanticipated information needs on a more timely basis	3.14
Significant reduction of system maintenance time and cost	3.11
Significant reduction of applications development time and cost	3.07

Note:
All numbers represent means on a Likert-type scale ranging from 1 (not realized) to 5 (greatly realized).

EXHIBIT 2 DRM Tasks and Their Effectiveness

Task	Mean	Standard Deviation
Category A		
1. Conduct physical data base design	4.05	0.83
2. Maintain accuracy, integrity, and security of data	3.90	0.88
3. Conduct logical data base design	3.80	0.92
4. Conduct data base tuning and capacity planning	3.78	0.94
Category B		
5. Set and enforce operational procedures and standards (e.g., coding, error detection, and backup)	3.66	0.91

6. Evaluate and select hardware and software	3.62	0.88
7. Provide consulting and training to IS personnel	3.61	0.88
8. Establish and maintain a data dictionary	3.60	1.12
Category C		
9. Set procedures for data retention	3.42	0.95
10. Identify opportunities for data sharing and potential data base applications	3.39	0.98
11. Develop and enforce policies governing data ownership and access control	3.38	0.99
12. Prepare strategic and technical data base plans	3.34	0.92
13. Provide consulting and training to users	3.30	0.97
14. Control data redundancy	3.29	1.02
Category D		
15. Conduct organizing data resource requirements planning	2.93	0.99
16. Develop an organizational data model and data architecture	2.76	0.99

Note:
Evaluation was on a Likert-type scale ranging from 1 (not effective at all) to 5 (highly effective).

EXHIBIT 3 Five-Factor Model of the DRM Function

Factor 1: Redundancy Control

Control data redundancy
Establish and maintain a data dictionary

Factor 2: Data Base Design and Operation

Conduct a physical data base design
Conduct a logical data base design
Conduct data base tuning and capacity planning
Maintain accuracy, integrity, and security of data

Factor 3: Administrative Control and Management

Evaluate and select hardware and software
Set procedures for data retention
Set and enforce operational procedures and

standards (e.g., coding, error detection, and backup)

Factor 4: Data Base Planning and Implementation

Prepare strategic and technical data base plans
Identify opportunities for data sharing and potential data base applications
Provide consulting and training to IS personnel
Provide consulting and training to users

Factor 5: Organizational Data Resources Planning and Policies

Develop and enforce policies governing data ownership and access control
Conduct organizational data resources requirements planning
Develop an organizational data model and data architecture

EXHIBIT 4 Hierarchy of DRM Factors

Senior Management

Data Base and Organizational Data Resources Planning

Middle Management

Administrative Control and Management

Technical Operations

Redundancy Control, Data Base Design, and Operations

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