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Information Resource Management: Is It Sensible and Can It Work?

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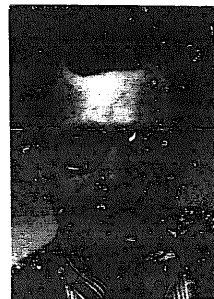*University of California, Irvine, CA 92715, USA*

Information Resource Management, or IRM, is founded on the assumptions that organizations are systems amenable to systematic control, and that information is a resource that can be managed in economically efficient ways. The management techniques embodied under the IRM rubric are said to improve the efficiency and effectiveness of information management in organizations. These assumptions are questioned. Systems approaches to organizations have proven inadequate in most instances where they have been tried, and there is little reason to believe the IRM approach will be different. Information is not a resource in the conventional sense of the term, and economic techniques for dealing with information as a resource are lacking. Implementation of IRM suffers from ambiguities about what it is supposed to accomplish, the breadth of its intentions, and the practical constraints of implementing top-down reforms in complex organizations. The broad vision of IRM is useful for articulating goals for information management, but the efficacy of IRM as an organizing framework for actual management of information practices is limited.

Keywords: IRM, Information Resource Management, IS Management, Economics of IS.

1. Introduction

Information Resource Management burst on the scene in the early 1980's with considerable fanfare. The IRM concept has laudable intentions: the treatment of information as a resource to be managed effectively and efficiently; the development of consistent information management policies, principles and standards; and evaluation and enforcement to ensure that the objectives of IRM are being accomplished. It also ties together various information handling techniques, including paper-based systems, reprographics, computerized systems, and telecommunications systems. Under IRM, it is said, the management of information should be made more economical, more effective, and more supportive of fundamental organizational and social goals ([21], [23], [25], [30]).

The IRM concept has considerable appeal, but IRM in practice has been quite different from the

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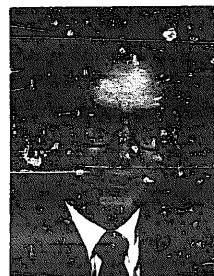
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ideal [14]. This paper explores questions about the soundness of the intellectual rationales behind IRM and the practicality of its use as an organizing concept for managing information incomplex organizations. It places IRM in an intellectual framework where it can be assessed by those who support, oppose, or simply question the concept.

2. Is the IRM Concept Sensible?

The IRM concept rests on two fundamental beliefs: that organizations are systems amenable to systematic control, and that information is a resource amenable to economic analysis and rational management. We explore each in detail.

Organizations as Systems

The first belief is that organizations are complex systems, and that management is the task of designing and controlling such systems [7]. Organizations assimilate "inputs," process them in some predictable manner, and produce "outputs." Some inputs are used to keep the production system operating; others are transformed into outputs. Efficiency and effectiveness of producing is controlled through cybernetic feedback, in which agents within the system use knowledge about performance to alter production processes. Most of the writing on IRM begins with at least an implicit characterization of management as control of systems.

The systems view of organizations is popular but it has serious limitations. Systems views derive from positivistic, and usually mechanistic, concepts about organizational behavior. Real organizations, particularly complex organizations, exhibit behaviors that confound systems explanations ([6], [20]). For example, most organizations do not have clear goals and objectives on which all organizational participants agree. Understanding of intended organizational outputs, and thus goals and objectives, vary from person to person and subgroup to subgroup. The actions taken by organizations are due as much to conflict and internal dissent as they are to consensus and rational deliberation. The systems view is analytically useful, but until there is a detailed understanding of all subsystems and their components, as well as the ways these work together in a larger

system, the overall approach has limited prescriptive value.

Research on the impact of computing systems on organizations has revealed the weakness of the systems approach to understanding computing ([9], [26], [28], [29], [31]) though few IRM discussants make special note of the political aspects of organizational life that make application of the system concept difficult ([15], [30]). As long as control over information affects power relationships, making absolute hierarchies of authority difficult to maintain, the systems-oriented perspective of IRM will be difficult to maintain.

The political character of organizational life readily illustrates this weakness of IRM in the IRM debate itself. IRM serves particular interests within organizations. It is a movement led by people with a stake in its success. Proponents of IRM are generally information systems managers or consultants to such managers. They address themselves to people like themselves ([13], [22], [38], [39]). Information system professionals desire to expand their jurisdiction within the organization, and see IRM as a means of doing so. They are stakeholders in the IRM concept, and IRM's implementation benefits them directly. How does one differentiate the self-serving, promotional components of the IRM vision from the rational bases on which the IRM concept is argued? The systems view does not answer the question. The systems view offers an abstract framework for assessing how to deal with information in organizations, but the abstraction is too extreme.

Information as a Resource

The second belief is that industrialized economies are moving toward being "information economies," and that managers must begin to treat information as a resource in the same way they manage more traditional resources such as capital, land and labor. Information, therefore, cannot be ignored as a critical organizational resource. Analogies are drawn to air and water, once considered free goods but now considered resources [21]. Information is considered an important input to the organizational system and must be managed as a resource.

A resource is a source of supply or support, and information in a general sense can conform to this definition. But the concept requires specific con-

formance in order to be sensible, and this poses problems. The tools to assess the economic value of information are not well developed ([18], [19]). It is extremely difficult to place a value on information ([3], [4], [8], [12], [37]). Every piece of information has potential value in hypothetical situations that might arise, but how does one judge whether collection and retention of information is justifiable, given the hypothetical value of information? The values imposed will be judgemental and case-specific, making a mockery of the effort to establish objective value for information across agencies.

IRM proponents suggests application of an analog of the economic valuation process used for natural resources. Unfortunately, there important limits to the assignment of value even to commodities such as minerals and water for which the term resource have traditionally been used [16]. Among other things, most resources must be valued in some larger economic context that accounts for externalities such as pollution and waste arising from exploitation and use of the resource. Simple market economics does not deal well with such externalities, making the true value of resources difficult to ascertain. The use of "experts" to impose values to account for externalities is common practice, but this merely shifts the uncertainty to the task of deciding which expert to believe.

This problem could conceivably disappear when economists become more adept at dealing with it, but uncertainty is only one part of the problem with the valuation of information. Another is that information cannot be intrinsically scarce once it is created. It can be given away to literally everyone in the world and still retain its intrinsic value, and it is not depleted through use. There is no need to replenish the supply unless the original information is lost. In order to impose economic value on information one must create artificial scarcity. This is possible in two ways: maintenance of economic control over intellectual property such as written works and software, traditionally done through copyright; and imposition of artifical scarcity by restricting dissemination. The former is difficult to ensure because modern technologies for photocopy reproduction have made it almost impossible to copy-proof documents, and information is increasingly stored in machine-readable form that is easy to transfer. Restricting

dissemination is useful only so long as the restriction is enforced. Once information is in the hands of a party that does not subscribe to the restriction, the ease of copying makes the imposition of artificial scarcity difficult. Lack of inherent scarcity makes information very difficult to categorize as a resource in economic terms.

The IRM view does encourage attention to the economic importance of information (the lack of it, the collection of it, the maintenance of it, and the use of it), and this is useful. But strictly speaking, the IRM focus on resources is much more sensibly directed toward the components of information handling than toward information itself.

3. Is IRM Workable?

IRM proponents argue that specific attention to the management of information within the organization will enhance organizational efficiency and effectiveness. This is in keeping with long-standing ideas on development and management of computer-based information systems (e.g., [2], [10], [32], [40]). IRM promises to improve the planning, controlling, accounting and budgeting of information requirements, allowing managers to select the best mix of information resources to do a given job. It will also help deal with information overload, provide a rigorous and discipline framework in which to evaluate the benefits of collecting and using information against the costs of doing so, provide an incentive for managers to reduce the amount of information they require to a minimum, and give management a working tool to deal with increasing information costs [24].

This is a tall order, and one should question whether the noble goals articulated by the IRM proponents can be achieved. Two issues of IRM workability are worth considering: whether the cure is better than the sickness, and whether there will be unanticipated effects from implementation of IRM.

The Sickness and the Cure

It is not clear that traditional ways of dealing with information in organizations, with all their flaws, are so unbearably bad that IRM is necessary. All aspects of information management bring

costs, but are these costs "too high?" With few exceptions, only a small fraction of organizations' operating budgets are spent on computerized data processing. More is spent on the processing of information outside of data processing, but even so, it is doubtful that these costs represent more than a fraction of most organizations' expenditures. There is probably always room for improvement, but the proponents of IRM provide little evidence that IRM is anything more than a marginal solution to a marginal problem.

There is also a problem with the breadth of objectives IRM is expected to achieve. IRM focuses on the big picture of organizational information use; a lofty goal but an impractical one in the context complex organizations. Herfindahl [17] notes that in most circumstances it is pointless to spend too much time on the "overall rationale" behind information collection and use because most organizational decisions address narrowly circumscribed issues, and not organization-wide goals and objectives. The information needed for most decisions is gathered by those involved with the decision, and not by central elites. Decisions that do involve organization-wide goals usually require information that is hard to come by: strategic information about the current state, probable futures, and the likely consequences of alternative actions. Such information seldom resides in usable form in the databases of subunits. For these reasons it is a mistake to move from the top down in assessing organizational information management practices.

The broad array of IRM objectives specifies a set of control tasks so sweeping that the IRM executive would have to be super-human to accomplish them. In addition to overseeing all existing data processing operations, those in charge of IRM would be called on to control all information entering into corporate decisions, to change other managers' minds so they view information as a resource, and to ensure that organizational information needs are considered routinely in all aspects of the organization's enterprise. Levitan (30:327) provides list of "corporate-wide" IRM objectives drawn from work by ([1], [11]) and others; it includes ten charges to the IRM executive: (1) Ensuring that only relevant (not all) information flows into corporate decisions; (2) Making sure that costs of getting and managing information are compared with projected benefits; (3) Chang-

ing people's attitudes so that information becomes viewed as a major asset in the organization; (4) Analyzing requirements before acquiring information technologies instead of the reverse; (5) Legitimizing the role of the Information Manager so he or she can challenge other managers on their IRM practices; (6) Establishment of training so other managers can implement the IRM program; (7) Making users responsible for their information activities by including them in system design and other decisions, charging them for services, and making them accountable for resources they need to produce information; (8) Identification of in-house and outside opportunities for improving applications of information resources to organizational decisions and problems: (9) Fixing accountability for use and husbandry of information resources on designated people in the organization; and (10) Making consideration of organizational information needs routine in all aspects of the enterprise.

This describes a person with exceptional skills in administration, budgeting, information theory, technical systems, planning, policymaking, human relations, and operational knowledge of the organization's functions; such people are likely to be hard to find. Moreover, any manager with this mandate would face formidable obstacles in overcoming the inertia of established organizational practice, not to mention the obstreperous actions of other top-level administrators attempting to contain the extraordinary power implied in the job description of the IRM executive.

This condition produces confusion over just what IRM is supposed to accomplish. Although Levitan claims that IRM is more a management philosophy than a method for management [30:227], it is not clear what this philosophy is supposed to address at the practical level. IRM is enacted to treat information as a resource, but in practice its focus is mainly on the management of information technology ([5], [22], [23], [34], [35], [41]). The great breadth of IRM objectives is so far out of the reach of most managers that, in practice, their IRM "strategy" immediately devolves to management of technology. The goal of managing information seldom is resurrected. This cripples the larger vision of IRM because the focus on information is lost. Managing information requires control over what information is collected, how it is maintained, and what is used

for. This requires careful attention to organizational missions, and thus to the ideologies of key organizational actors and their beliefs about what is "appropriate." Efforts to control use of the technology will seldom alter the larger issues of information management. A discrepancy between the larger vision of IRM and its shortcomings in practice is not surprising. Managerial reform movements often do little more than temporarily redirect peoples' attention from routine activities to basic issues. And in this small way they can be very useful. But IRM could bring more serious consequences by lulling organizational leaders into thinking information is being managed well when it is not.

Possible Unanticipated Effects

IRM has the potential to bring about serious, unanticipated effects in organizations. These appear not to have occurred to the IRM proponents, and in fact, work against the implicit goals of those proponents.

One of these possible side effects is the production of subtle tendencies toward centralization. Every articulation of IRM implementation strategy carries the call for the creation of an IRM manager, whose job is it to govern nearly all aspects of organization information activity. The IRM "corporate-wide" objectives listed above demonstrate the extraordinary authority this manager would hold over activities central to the organization's functioning. Although proponents of IRM do not argue for centralization, or embody it as a goal of IRM, they do nothing to dispell the prospect of centralization inherent in their statement of IRM objectives. Centralization is not necessarily a bad thing, but it should be a matter of conscious policy rather than an artifact of other policies. In any case, the consequences of centralization should be clear. A useful axiom in considering centralization/decentralization issues is that those closest to the problem are the best determiners of how to solve the problem [27]. Organizational departments manage information in the context of accomplishing their missions, and not as an end in itself. It does not make sense to abstract information management from the programmatic missions of subunits. Accountability should be focused instead in mission performance, leaving decisions

about information management within the mission to the agencies themselves. A centralized approach to handling information is unlikely to help improve the performance of subunits, and is probably a waste of time for top management. In some cases there probably is a legitimate need for consolidating control over aspects of information handling to high-level managers, but in practice top managers seldom want to deal with such tasks. They usually hand the control for such tasks over the data processing professionals, in spite of the stated IRM objective of focusing top management attention on the issues. This seems to erode further the expectation that IRM will produce its hoped-for results.

Perhaps more important than IRM's contribution to an illusion of efficiency and effectiveness is the potential IRM-spawned constraints on the collection of information. These constraints arise from the "cost-benefit" presumptions in IRM. Since it is almost always easier to estimate costs of data collection than to estimate the dollar value of benefits, strict cost-benefit analyses usually focus on costs. Decisions based mainly on cost discount other criteria, such as need, and can easily suggest that needs are "not proven". Much organizational information is collected as insurance, on the chance that it might be needed. The heuristics used to determine what information should be collected and kept for such purposes are not easily amenable to cost-benefit analysis. They might, for example, be based only on the hunches of experienced people who are close to the issues at stake. In the absence of rigorous cost-benefit analysis, decisions to collect and keep information are usually left to those with such experience. It is difficult to predict whether a move toward more formal analysis of costs and benefits for collecting and keeping information will improve judgement on such matters. IRM proponents argue that vague reasons for collecting and keeping information are a primary cause of waste in information management, akin to keeping unnecessary inventory on hand. Perhaps this is so, but the issue is not whether it is sensible to keep "only what is needed" the issue is how one determines "what is needed". The formal analysis approach based on the assumption that information can be treated as a resource is not, at first glance, a promising replacement for current means of making such determinations.

4. A Different Interpretation of the Message

The critique above is aimed primarily at IRM in its most pure and attractive form. In a world of fallible people and missed expectations, it is advisable to ask whether there is value in a compromised view of IRM. We believe there is. Conceptual and practical problems notwithstanding, IRM makes several useful contributions to the problem of dealing with information and information technology.

The Growing Importance of Information

Whether or not economics has come to grips with information, it is clear that information in its various forms has become increasingly important to organizations. IRM recognizes this fact, and calls attention to it in a compelling manner. New developments over the decades have brought about important changes in organizational life, and new organizational arrangements have arisen to deal with them. The organization of labor, for example, was initially fought by management, then accepted through compromise, and eventually accommodated through the institutionalization of management jobs for labor relations specialists. A similar but more recent example is the establishment of special offers in organizations to deal with problems of affirmative action, environmental impact, and legislative relations. In some ways, the IRM movement is a call to action for organizational leaders to recognize the growing importance of information in the organization. Even if the movement does not succeed in its larger goals of creating, in the minds of managers, a resource-oriented view of information, it is already raising the consciousness of management about the need to pay attention the information-related issues.

The IRM movements also fills a void in organizations between the growing managerial awareness of the importance of information processing functions and the ultimate purpose for information processing. As long as information processing was either an ad hoc concern of department-level functionaries or a specific task for data processing specialists, it was just like any other "back office" activity. It was acknowledged as important for the organization, but only in the same sense that keeping the telephones working and the heating system functional were important. As organiza-

tions have become more depending on computer-based systems for managerial and other tasks, it has become difficult for managers to dismiss information processing in such a cavalier manner. But in the absence of a broader goal and purpose for processing information, there has been no target for managers to aim at. IRM provides such a target, albeit a flawed and abstract one. It elevates information to the status of such critical organizational inputs as capital, labor and land. The fact that information is really quite unlike these resources makes many of IRM's specific recommendations problematic. But the expression of a broader vision for the challenge of information processing is a valuable service. It is important not to dismiss this useful contribution simply because there are problems in the more obvious features of the IRM concept.

New Status for Information Systems

By raising the sights of managers toward the goals of information processing, IRM has the immediate but secondary effect of focusing managerial attention on the infrastructure and apparatus of information processing. While the goals of IRM might be abstract, intangible, and unattainable, the existing systems for handling information are concrete and in need of serious attention. IRM in many organizations has fallen far short of its loftier aims, but has contributed greatly to bringing needed support to the IS function. Among other things, the IRM rubric calls for treating the processing of information as a special and valuable organizational function worthy of investment and nurturing.

The staggering growth in organizational expenditures on information systems over the past decade has already captured the attention of top management, but the attention has often been hostile. Large expenditures usually evoke questions of return on investment, payoff and payback, and so on. Unfortunately, demonstrating direct and tangible cost savings from IS activities is exceedingly difficult to do. IS managers are often left with only vague claims about the importance of IS for overall organizational welfare to justify their growing expenditures. IRM provides a means for broadening the context of evaluation of IS functions from the specific information processing tasks performed by computing applications to the

challenge of managing the organization's critical information activity. Even if the concept does not hold up under careful scrutiny, it captures the imagination of managers who understand that ephemeral concepts like organizational strategy, employee morale, and business good will are important factors in business success. This is an important breakthrough for the IS profession.

A Useful Rallying Point

Finally, IRM, with all its problems, does provide a useful rallying point for people with academic and professional interests in organizational information systems, management, and information economics. The goal of IRM efforts should not be to whitewash the shortcomings of the current articulation of IRM, but to make progress on the constituent components of IRM in the broader interest of making progress toward the effective and efficient use of information in organizations. Managerial reforms come and go, and the list is long: Planned Program Budgeting; Zero Base Budgeting; Management by Objectives; Management by Walking Around, and so on. All offer more than they can deliver, and all make a contribution to effective management. IRM is likely to do the same. This is not an ignoble destiny; it is merely less noble than the IRM proponents prefer.

5. Conclusions

Movement toward IRM has been slow, and the problems noted above suggest IRM in it's full articulation might be unimplementable. Mehra [33] makes the plea not to let IRM become a buzzword. This fate could well befall IRM as an organizing rubric for management of information and information technology. But it would be unfortunate if the larger vision of IRM then was lost. IRM derives much of its impetus from the observation that collection, maintenance, and use of information can be expensive, and those costs should be at least offset by benefits gained. This seems a perfectly sensible concept for guiding decisions about information related activities, as long as the shortcomings of economic knowledge and the important aspects of application context are borne in mind. The shortcomings in economic

knowledge constrain our ability to determine with precision the real utility of information-related tasks, and thus make the concrete goals of benefit-cost analysis elusive.

We doubt that the IRM reform movement will produce the desired changes articulated by IRM proponents. However, with sufficient care and attention to the lessons that are learned from the IRM experience, the practicability of the underlying concepts of IRM could be improved dramatically over the coming decades.

References

[1] Authur Young and Company (1979). An information management study for Headquarters, Department of the Army. Washington, D.C.: Arthur Young and Company.

[2] Blumenthal, S.C. (1969). Management Information Systems: A Framework for Planning and Development. Englewood Cliffs, NJ: Prentice-Hall.

[3] Braunstein, Y. (1981). Information as a commodity: Public policy issues and recent research. In Mason, R.M. and Creps, J.E., Jr. (eds.), Information Services: Economics, Management and Technology. Boulder, CO: Westview Press.

[4] Cattela, R.C. (1981). Information as a corporate asset. Information and Management, 4(1), 29–37.

[5] Carroll, D. (1983). Information resource management: a costing perspective. Information Management, 17(10), 24–26.

[6] Churchman, C.W. (1971). The Systems Approach and Its Enemies. New York: Basic Books.

[7] Commission on Federal Paperwork (1977). Information Resources Management, and Final Summary Report. Washington, D.C.: U.S. Government Printing Office.

[8] Connell, J.J. (1981). The fallacy of information resource management. Infosystems, 28(5), 78–84.

[9] Danziger, J.N., Dutton, W.H., Kling, R., and Kraemer, K.L. (1982).

[10] Computers and Politics: High Technology and American Local Government. New York: Columbia University Press.

[10] Dearden, J. and McFarlan, F.W. (1966). Management Information Systems: Text and Cases. Homewood, Il: Richard D. Irwin.

[11] Diebold Research (1981). Research in progress: The Information resource. New York: The Diebold Group.

[12] Edelman, R. (1981). Management of information resources. MIS Quarterly, 5(1), 17–28.

[13] Greenwood, F. (1979). Your new job in information resource management. Journal of Systems Management, 30(4), 24–27.

[14] Guimaraes, T. (1985). IRM revisited. Datamation, March, 1985: 130–134.

[15] Head, R.V. (1984). IRM and Reality. Government Data Systems. May/June, 45–46.

[16] Herfindahl, O.C. (1969a). Is resource economics unorthodox? Journal of Soil and Water Conservation, 24 (1), 10–11.

[17] Herfindahl, O.C. (1969b). Natural Resource Information for Economic Development. Baltimore: Johns Hopkins Press.

[18] Hirshleifer, J. (1973). Where are we in the theory of information? American Economic Review, 63(2).

[19] Hirshleifer, J. and Riley, J.G. (1979). The analysis of uncertainty and information: an expository survey. Journal of Economics Literature, 17(4), 1375-1421.

[20] Hoos, I. (1972). Systems Analysis and Public Policy: A Critique. Berkeley: University of California Press.

[21] Horton, F.W., Jr. (1979a). The information resource. Washington, D.C.: The Information Industry Association.

[22] Horton, F.W., Jr. (1979b). Occupational standard for the information resource manager. Journal of Systems Management, 30(5), 35-41.

[23] Horton, F.W., Jr. (1981). Information is a manageable resource. Information and Records Management, 15(4), 9.

[24] Horton, F.W., Jr. (1982). The Information Management Workbook: IRM Made Simple. Washington, D.C.: Information Management Press.

[25] Horton, F.W., Jr., and Marchand, D.A. (eds.), (1982). Information Management in Public Administration, Arlington, VA: Information Resources Press.

[26] Kling, R. (1979). Social analyses of computing: Theoretical perspectives in recent empirical research. Computing Surveys, 12(1), 61-110.

[27] King, J.L. (1983). Centralized vs. decentralized computing: Organizational considerations and management options. Computing Surveys, (16)4.

[28] Kraemer, K.L., Dickhoven, S., Fallows, S., King, J.L. (1987) Datawars: Computer Models in Federal Policymaking, New York: Columbia University Press.

[29] Laudon, K.C. (1974). Computers and Bureaucratic Reform. New York: Wiley.

[30] Levitan, K.B. (1982). Information Resource(s) Management. Annual Review of Information Science and Technology, V.17, 227-266.

[31] Markus, M.L. (1983). Power, politics, and MIS implementation. Communications of ACM, 26(6), 430-444.

[32] Martin, E.W., Jr. (1965). Electronic Data Processing. Homewood, Il: Richard D. Irwin.

[33] Mehra, B.K. (1981). Do not let IRM become another buzzword. Infosystems, 28(12), 58-59.

[34] Meltzer, M.F. (1971). The Information Imperative, Washington, D.C.: American Management Association.

[35] Meltzer, M.F. (1981). Information: The Ultimate Management Resource, How to Find, Use and Manage It. New York: AMACON.

[36] Oettinger, A.G., (1979). Information resources: Old questions, new choices. Bulletin of the American Society for Information Science. 6(1), 1-19.

[37] Petersohn, H. (1981). Management of information resources: Basic concepts and principles of organization. Information and Records Management, 15(9), 65-77.

[38] Synnott, W.R. (1981). Changing roles for information managers. Computerworld, 15(38), "In Depth," pp. 19-28.

[39] Synnott, W.R., and Gruber, W.H. (1982). Information resource management: Opportunities and Strategies for the 1980's. Online Review, 6(3), 269-270.

[40] Withington, F.G. (1966). The Use of Computers in Business Organizations. Reading, Ma: Addison-Wesley.

[41] Yurow, J. (1981). Issues in information policy. Washington, D.C.: Department of Commerce, National Telecommunications and Information Administration.