Network Organizational Development in the Public Sector: A Case Study of the Federal Emergency Management Administration (FEMA)

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Research findings from the organizational theory tend to support the position that management uses Information Technology (IT) to maintain existing organizational hierachy and control. Another body of research from information technology advocates suggests that Information Technology's inherent capabilities transform organization hierarchy and control outside of management's control. In addition, advocates from governmental change toward a more responsive type of government advocate adoption of IT as a form of change mechanism. This aritcle explores these conflicting positions. The authors examines one instance of the development of a form of network organization within the federal government, and the processes of IT change that have occurred over the past 20 years. The agency selected for study is the Federal Emergency Mangagement Administration.

Introduction

Today, organizations at the Federal, State, and Local levels of government are engaged in efforts to change traditional bureaucracies into citizen-oriented forms of organizations by using advances in both automation and telecommunications. (An extensive list of web sites that relate to transforming government agencies into citizen oriented agencies are beyond the scope of this article. Still several sites are available for persons interested in a general idea of the extent of this effort. Some of the more in-depth sites are: http://www.npr.gov.—Vice-President Gore's National Partnership for Reinventing Government. http://www.alliance.napawash.org.—Alliance for Redesigning Government–National Academy of Public Administration. http://statenews.org.—The Council of State Governments. http://www.statelocal.gov.—U.S. State and Local Gateway. http://excelgov.org.—The Council for Excellence in Government.) Leading political figures, such as Vice-President Gore and former House Speaker Gingrich, believe that by embracing such "networked organizations" we can create a new foundation for democratic governance and administration (Gingrich, 1995; Gore, 1993).A wide range of both popular and academic literature supports this view of networked organizations as a vehicle for creating both democratic openness and administrative responsiveness in government (de Solla Pool, 1983; Galbraith, 1968; Naisbitt, 1982; Roszak, 1988; Toffler, 1980). Concepts such as a "virtual community" (Rheingold, 1993), "social change agent" (Negroponte, 1995), "collective restoration" (Senger, 1991, p. 58), and "enabler" (Hammer & Champy, 1993, pp. 83–101) are recurrent themes within this literature.

Those who view positively the role of information technologies in supporting organizational change argue that

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newer forms of information technology, specifically networks, have altered the fundamental nature of work within private organizations (Burkhardt & Bass, 1990; Liu, Denis, Kolodny, & Stymne, 1990). They conclude that this change in work's nature leads to changes in work processes, which eventually change the organizational structure, control systems, and authority allocations (Ives, 1994; Miles, Snow, & Mathews, 1997; Nadler, Gerstein, & Shaw, 1992; Oakey, 1999; Sproull & Kiesler, 1991). Furthermore, they assume that adoption of networked information technologies and organizational systems in government will result in similar beneficent changes within governmental processes and organizations (Gingrich, 1995; Gore, 1993; Hammer & Champy, 1993; Negroponte, 1995; Rheingold, 1993; Senger, 1991). The hope of all of these technological advocates is that in the end we will achieve a more effective form of democracy and government administration, one more suited for a society dependent on information processing and transformation (Gingrich, 1995, pp. 51–61; Gore, 1993, pp. 112–119).

At times, though, this literature seems to verge on determinism, as though the nature of the technology itself will create an inexorable force toward positive results. Human intentions and actions are considered, but they seem minor obstacles in the path of this new and presumably beneficent technological juggernaut. Unfortunately, this literature is often speculative in nature rather than based on factual data or cases. Nonetheless, the general literature on this area is so positive, so sure of technologies positive consequences, that it sometimes appears to be almost a form of "high-tech fever" (Forester, 1987).

The problem, though, is that the above assumptions and findings cannot be reconciled with some of the existing research findings in organizational theory, which has developed an extensive body of research findings on management's use of technology within organizations. This research generally shows that management tends to use technology as a means of maintaining existing hierarchical control and centralization of organizational decisions and work processes (Clawson, 1980; Clegg & Dunkerley, 1980; Edwards, 1979; Hill, 1981; March, 1988; Marglin, 1974; Noble, 1978; Perrow, 1967; Salaman, 1978; Stone, 1974; Thompson, 1967; Woodward, 1965). These research findings tend to view management's adoption of technology as a more conscious and directed effort. While the research shows that technological development leads to improved efficiency of the existing system, the developmental path is within the current organizational authority and control structures. There may be surface changes in the allocation of certain aspects of decision making, but the organization will maintain the basic underlying system of management authority and control. Regarding information technology (IT) specifically, the findings tend to support the view that management's use of IT also reinforces existing organizational hierarchies and control systems (Gotlieb & Borodin, 1973; Heydebrand, 1985; Kling, 1991; Kraemer & King, 1989; Mitcham, 1994; Mosco, 1989; Orlikowski, 1988; Pennings & Buitendam, 1987; Robey, 1981).

A few voices, grounded in this body of organizational research, question the positive view of networked technologies' impact on either democracy or effective and responsive government (Neumann, 1995; Postman, 1993; Teich, 1993). This less widely read body of research finds that networked organizations and technology may lead to negative impacts that diminish democratic possibilities (Nederman & Jones, 1995), human potentialities (Sullivan-Trainor, 1994), and responsiveness of government services to the public (Garson, 1989). While research findings directly related to management's use of IT in the public sector are limited, the few researchers' reports tend to support the same findings discovered in the private sector, namely, that the use of IT in the public sector is also a means to reinforce existing organizational hierarchy and control systems (Bernard, 1999; Feng Chen, 1994; Willcocks, Currie, & Jackson, 1997).

Comparing research from organizational theory with that from information technology leads one to contradictory conclusions. On the one hand, information technology research might lead one to conclude that the nature of the technology, itself, leads to a wide series of beneficent changes, within the organization, in terms of authority and control system. This research appears to assume that it is the capacities inherent in informational technology rather than management's conscious intentions, which drive these changes. On the other hand, the conclusion one would reach from organizational theory research is that management consciously develops information technology within the organization to maintain and support the existing system of authority and control. This may or may not be a beneficent outcome. Thus, considering the level of contradiction, it would seem that "positivists" conclusions regarding the nature of technologies' impact on public organizations might be premature.

These contradictions leave information science with an important unresolved question. That question is: "Does information technology 'pull' the organizational management toward change in terms of authority and control, (changes largely beneficent). Or is information technology 'pushed' through the organization, by management, to maintain (for good or ill) its existing system of authority and control?"

Resolving this question is critical to information science. To advise government officials, information scientists must have reliable case study information that assesses the impact such technologies have on public agencies. Unfortunately, little case study material exists on the development of network technologies in the public sector. This lack of case study examples limits the ability of information science to advise government officials on effective means of linking IT to organizational processes and services.

The authors of this article hope that the following case study will be a step in meeting this need by examining the Federal Emergency Management Agency's (FEMA's) evolutionary relationship with information technologies. If the

proponents of information technology's positive impact on organizational change are correct, then FEMA's adoption of an information network base should lead to major changes within the internal and external management structures of the organization. If such changes did occur, the changes should be of a type that a "reasonable" person would likely find to be positive or beneficent. Specifically, changes should occur in the following areas: the nature of work and work processes, organizational hierarchy and authority allocation, and internal and external control structures. If, on the other hand, the findings from organizational research are correct, then FEMA's work processes within the organization may change superficially, but still maintain the existing management systems of authority and control. Given FEMA's problematic history, which we will explain in this article, such superficial changes would lead a "reasonable" person to conclude that the organization had attained either a neutral or a negative outcome.

Case Study

To examine the impact of IT within FEMA it is necessary to examine the history of the agency, and the various issues faced by the agency as it attempted to apply IT. For this study, IT development within FEMA is divided into two phases. The first phase spans the years between 1980 and 1992. The second phase concentrates on 1993 to the present.

Phase One of IT Development within FEMA

Emergency management has followed a torturous evolutionary path in American history. For purposes of this article, we do not need to delve deeply into that history or the forces driving that evolution. We can simply begin with the mid-1970s when the national security requirements of the post-World War II Cold War, coupled to increasing demands for effective federal response to natural disasters, led to extensive federal involvement. Unfortunately, these two trends had led to a number of organizations and programs being developed, and scattered widely through out the government with little or no coordination. The result was fragmented and ineffective responses to natural disasters, and an increasing level of criticism from both state and local government officials. This criticism eventually led to a major study by the National Governor's Association, (NGA). This report, issued in 1977, recommended that the federal government develop a more comprehensive and professional approach to emergency management (National Governor's Association, 1978).

The issuance of the NGA report coincided with a study and recommendations from President Jimmy Carter's "President's Reorganization Project," which called for improvement of internal operations and service delivery on the part of federal agencies. While the Carter Administration was in general accord with the NGA Report concerning the need to create an effective response system, it faced a major problem with Congress in terms of creating such a system. Each one of the various agencies, with responsibilities for some aspect of emergency management, reported to different committees of Congress, and had different political constituencies. Any attempt by the Carter Administration to create a consolidated and integrated agency would have encountered strong political opposition.

To avoid a prolonged struggle with important congressional figures and interest groups, the Carter Administration created a consolidated, but by no means integrated, agency using a series of Executive Orders (President of the United States, May 14, 1978). In essence, the various program areas were brought under the same "umbrella agency," FEMA, but retained their programmatic identity and autonomy within FEMA. The result was that each program continued to have the same pattern of political interaction with various interest groups, operated under the same statutory authority, and fell under the purview of the same legislative committees of appropriation and oversight (Wamsley Interviews, 1992–1993).

As envisioned by the NGA, and the Carter Administration, FEMA was to deal, primarily, with floods, droughts, hurricanes, and other natural disasters. In this role, FEMA was to be the central point of contact and coordinated response when called upon by state and local governments that felt overwhelmed by a natural disaster. These roles, designated as Emergency Management, became FEMA's primary mission. At the same time, however, the Carter Administration mandated a secondary role or mission for FEMA, generally referred to as civil defense. As envisioned by the Carter Administration, in this secondary role, FEMA was to coordinate various aspects of a total civilian national response to a nuclear war or attack on the United States (Wamsley Interviews, 1992–1993).

The reasoning behind placing civil defense within the same agency with general emergency management was the presumption that responses to both natural disaster and nuclear attack would necessarily be similar. In many ways, the response to either a natural or a man-made disaster, by government, is an ever-widening organization focused on resource exchange. The resource destruction that occurs is such disaster is so complete that the entire system of societal infrastructure exists in a state of chaos. To bring the system back into a state of equilibrium, basic resources must be located in nonaffected areas, and transported into the affected areas. To achieve this state of resource exchange, there are established temporary organizational systems to facilitate the exchange process. In the end, the formal response to a natural or a manmade disaster becomes a broad-based effort requiring cooperation on the part of a large group of autonomous organizations, both public and private, suddenly placed into a temporary organizational hierarchy.

In many ways, the initial inception of FEMA was an early form of what we refer to today in both organizational theory and information science literature as a network organization (John Macy, the Carter Administration's agency director, envisioned a "dual-use" system, which used high-

speed networks to form temporary organizational linkages for disaster response. His original development plan sought to link all levels of government, and agencies, into a "response network" directed at the specific type of disaster.) As originally envisioned, FEMA sought to marshal resources and support from a variety of separate organizations to deal with the onslaught of a natural or man-made disaster. The response system created formed temporary organizations to deal with these natural disasters. Officials within the Carter Administration felt that the cohabitation of the fragmented programs and the dual missions would result in a kind of serendipitous synergy that would facilitate response to any type of disaster (Wamsley Interviews, 1992–1993; Ward Interviews, 1998).

Obviously, if such serendipity existed, the use of complex and advanced systems of data processing and telecommunications would aid such a response system. Such advanced data and communications systems would allow for the locating of necessary resources, and the continuing assessment of various needs as the impact of a disaster unfolds. In addition, advanced systems could provide an effective means of coordinating various agencies during their temporary response alliance. This fact was evident to the Carter White House, and specifically delineated in the rationales for the creation of FEMA (Memo for the President, 5/15/78; White House Fact Sheet, 6/19/78)

However, the development of this initial form of network organization for FEMA, and its subsequent use of IT as a coordinating mechanism, floundered on a major point of ambiguity within the Carter Administration's plan. The major flaw in the Carter Administration's vision was the failure to realize that all network organizations are highly dependent on sustained, and shared, goals and missions (Mohrman, Galbraith, Lawler, & Associates, 1998; Nadler, Gerstein, & Shaw, 1992; Oakey, 1999).

While the Carter Executive Orders could place the various agencies within a single organization, the retention of the separate legislative and program authorities created an agency with multiple, and conflicting, agendas. Because the agency had no single comprehensive legislative charter, its mission was subject to pulling and hauling by the various program units and their allies in Congress, and within other executive agencies. In addition, because the agency had no single comprehensive legislative charter, but rather multiple charters, agency emphasis was subject to changing presidential political agendas. Future Presidential Administrations could decide to change the agency's mission without consultation with Congress, or state and local governments, using additional Executive Orders. Unfortunately for FEMA, the second possibility of changing presidential priorities came into being even before the agency had formalized its initial administrative structure.

Using Executive Orders, the formal authorization of FEMA as a federal agency occurred on April 3, 1979, with a full budgetary line allocation set for the upcoming October start of the 1979/1980 fiscal year. By the time, though, that FEMA's budget allocation was formalized, the Carter Administration found itself in a losing Presidential Campaign against Ronald Reagan. Reagan's defeat of Carter, in November of 1979, placed the entire process of developing FEMA on hold as the presidential transition dominated the attention of the administrative branch of the federal government. Uncertainty, within FEMA, ratcheted higher when the Reagan Administration delayed, for 16 months, the selection of a new director for FEMA while it considered what role FEMA should play in the newly emerging "Reagan philosophy of government."

By the early part of 1981, the Reagan Administration had finalized its view of FEMA's role in the new Reagan philosophy of government. In essence, the Reagan Administration shifted the major emphasis of the agency away from natural disasters, and emphasized, instead, the secondary civil defense mission. For the Reagan Administration, with its focus on the Cold War struggle with the "evil empire" of the USSR, it was natural to switch the priorities that the Carter Administration had envisioned for FEMA. FEMA's new priority now became the survivability of the United States after the outbreak of a nuclear war.

To emphasize this new agency priority, in May 1981, the Reagan Administration appointed a director for FEMA, Louis O. Giuffrida. Giuffrida had been Reagan's chief advisor and organizer for California's civil defense and emergency management training programs. In addition to being Reagan's former head of California's civil defense effort, he was also a retired Lieutenant Colonel in the United States Army's Military Police, and a general in the California National Guard. Giuffrida's personal background helped to stress the new agenda assigned to FEMA. [Giuffrida further personally emphasized the quasi-military nature of the agency's civil defense priority by requiring that his subordinates address him as "The General" (Ward Interviews, 1998)].

Further backing the new emphasis for FEMA, the Reagan Administration proposed a 7-year, 4.2 billion-dollar national preparedness program to deal with a possible nuclear attack. Designated as National Security Emergency Planning, the new program advocated the survival of a substantial portion of the industrial and economic infrastructure, within the United States, in case of a major nuclear attack. Although details of the program remain highly classified, enough information is available from unclassified sources to define its general outline of action. A major component of the program was the development of a classified computer and telecommunications network located within FEMA's National Preparedness Directorate (NPD). The primary mission, for this new response system, was to assure the continuity of the United States civilian government after a nuclear attack by the Soviet Union. This aspect of the plan was designated, within FEMA, as the "Continuity of Government" program (Ward Interviews, 1998).

The development of this advanced response network fell under the direct control of the National Security Council (NSC), and became subsumed within the broader Depart-

ment of Defense's (DoD) national defense information network. To assure the security of the response system, it received the highest level of national security designation, and restricted access to the system to only authorized agencies and divisions within the DoD and NSC Chain of Command. The security classification prohibited civilian use of the response network, and budgets for support and development of the system received a "Top Secret" classification. Development and expenditures for the system were under the direct authorization of the National Security Council, and within the requirement for seamless interconnection within the broader DoD network system (Ward Interviews, 1998).

FEMA's "Continuity of Government" response system had an additional, unstated, goal beyond the DoD designation, which related to a national Civil Defense profession. Civil Defense emerged after the Second World War when the possibility of nuclear war lead to the creation of civil defense systems across the United States. While the programs and systems were well intentioned, the public's negative perception of life after a nuclear attack limited the effectiveness of the various programs. Starting in the late 1960s, public and political support for Civil Defense began to decline. By the time that the Reagan Administration took office, Civil Defense system's viability were questioned, and no longer considered as realistic in terms of a national civilian survivability to a nuclear attack. Civil Defense, as a publicly funded program and profession, faced a bleak, and possibly short, future (Ward Interviews, 1998).

The Civil Defense group within FEMA recognized that a civil defense emphasis never would, on its own, stand scrutiny by Congress. Placing Civil Defense, though, within the broader Continuity of Government program offered an opportunity to reinvigorate Civil Defense. By restricting access through the NSC and DoD, and classifying both budgets and expenditures as "Top Secret," Civil Defense could avoid the overall watchful eyes of Congress. (Once a program is classified "Top Secret," Congressional oversight of a program is restricted to a handful of very powerful members of both the House and Senate. In addition, the consolidation of budget items into general categories removes specific item designation from the presentations.) With Congress blocked from oversight on the agency's budget, and the agency's budget linked to the DoD attack scenarios, Civil Defense hoped to continue the pursuit its own professional agenda (Wamsley Interviews, 1992–1993; Ward Interviews, 1998).

To assure the maintenance of the unstated agency agenda, Giuffrida, and his predecessors, constructed the agency's organizational hierarchy with the goal of maintaining the civil defense priorities. A critical key to this strategy was assuring that the majority of IT assets, within the agency, stayed directed exclusively toward civil defense, and, more specifically, the continuity of govrnment program.

Management divided FEMA into five major areas: Fire Administration, State and Local Support for emergency management, Federal Insurance programs, External Affairs, and the National Preparedness Directorate (NPD) program. Of the five areas, the NPD was the essential civil defense operation, and contained the classified Continuity of Government program. To ensure that the majority of the IT assets remained directed toward civil defense, the Office of Information Resources Management's (IRM) was created, and its organizational designation placed it under the NPD (Ward Interviews, 1998).

While FEMA's overall Deputy Director had the designated authority for IT development for emergency management operations, and was supported by an agency wide Information Resources Board (IRB), this authority was only superficial. Neither the Deputy Director nor the upper management assigned to the IRB had technical knowledge concerning IT. To assess proposed IT development within the agency, both the Deputy Director and the IRB had to rely on the technical staff located within the IRM. By forwarding all IT proposals to the IRM, in effect, IRM gained control over all IT development within FEMA (Wamsley Interviews: 1992–1993).

Internal agency requests for IT development and support, from all divisions and programs within FEMA, required IRM review and approval. In addition, IRM set the standards for systems development, for hardware and software, oversaw the actual procurement of needed equipment, and finalized all contracts for special system's program development. In essence, IRM, and the National Preparedness Directorate, became the IT czars for all of FEMA's programs (Wamsley Interviews, 1992–1993; Ward Interviews, 1998).

IRM exclusively focused on the Continuity of Government program. To maintain agency focus on the civil defense agenda, IRM refused to develop a flexible approach towards overall agency systems building, preferring, instead, to develop both hardware and software architecture within the DoD system and network standards. This top/down approach toward systems development resulted in IRM refusing to support IT needs in other divisions of FEMA, or developing systems integration within the various divisions and programs. The end effect of IRM's position was to leave the other divisions and sections within FEMA without IT guidance or integration. These other divisions and sections usually had to pursue IT development, within their area of authority, alone. This lack of coordinated IT development lead to a situation where, by 1992, there were over 100 different IT systems operating within FEMA's other divisions, the majority of which were incompatible in terms of network interfacing (Wamsley Interviews, 1992–1993).

IRM's focus on the Continuity of Government program, though, did pay off handsomely for the NPD program. For example, the Congressional War Offices, located under the Greenbrier Resort in West Virginia, received a complete update on all of its networks and systems. Mount Weather, VA, the relocation site for the President, Cabinet, and Supreme Court, received a similar upgrade. However, the main

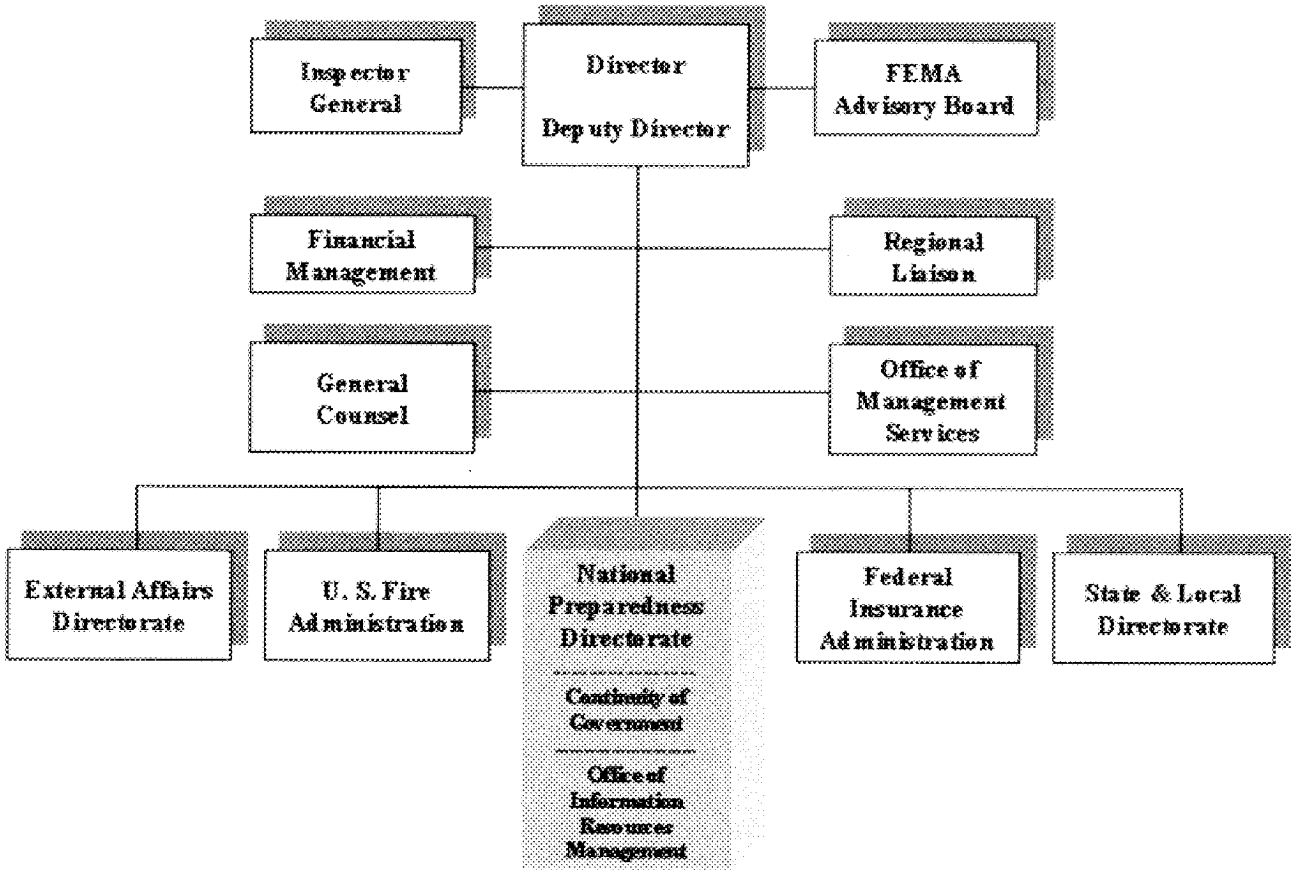

FIG. 1. FEMA: 1980s.

recipient for the IRM focus was Raven Rock, MD—the relocation center for the Pentagon in case of a nuclear war. Raven Rock was completely retooled in terms of network architecture, global communications systems, real-time satellite and aerial reconnaissance systems, and ground breaking modeling and situation assessment software. In addition to the three ground locations, a fleet of four 747s were constructed to serve as flying offices and communication systems, and were designated Mobile Air Transportable Telecommunications System (MATTS). IRM also supported the development of five ground mobile support and communication systems designated the Mobile Emergency Response Support fleet (MERS). In case of a nuclear war, the trucks would fan out across the United States to locate essential government officials who may have been away from Washington at the time of an initial strike. Both MATTS and MERS remained in constant contact with the three relocation centers (Ward Interviews, 1998).

To this day, no one knows exactly how much the NPD spent on these advanced networks and software development. The closest anyone has come to estimating the costs was done in 1993, when the National Academy of Public Administration completed a study of FEMA that was mandated by Congress. At that time, NAPA estimated that FEMA spent approximately 27% of its annual budget on the effort—about $100,000,000 per year. (The figure of $100 million per year came from various audits conducted after a 1992 congressional request for a review of FEMA's operations and programs. While the audit figure was officially set, large portions of other funds were never accounted for, and to this day remain a mystery as to the total amount actually spent on the program) (NAPA, 1993). While the system was also designated for use in emergency management, only a small portion of the IT assets actually supported civilian operations. The somewhat "Dr. Strangelove" mentality of the operation resulted in all of the advanced technological capacity being classified, and restricted in its use for the support of civilian natural disasters. The result was that FEMA developed one of the most advanced network systems for disaster response in the world, yet none of it was available for use in dealing with civilian natural disasters or emergency management.

Through the 1980s, as FEMA refused to invest in IT support for natural disaster response, criticism of the agency mounted. As early as 1981, the Government Accounting Office (GAO) issued a report criticizing FEMA's lack of natural disaster IT development, especially as it related to damage evaluations and determinations of disaster impacts. The GAO found that FEMA's disaster designations tended to be arbitrary, and recommended that FEMA should develop computer models and networks for damage assessment that would provide for consistency of evaluations.

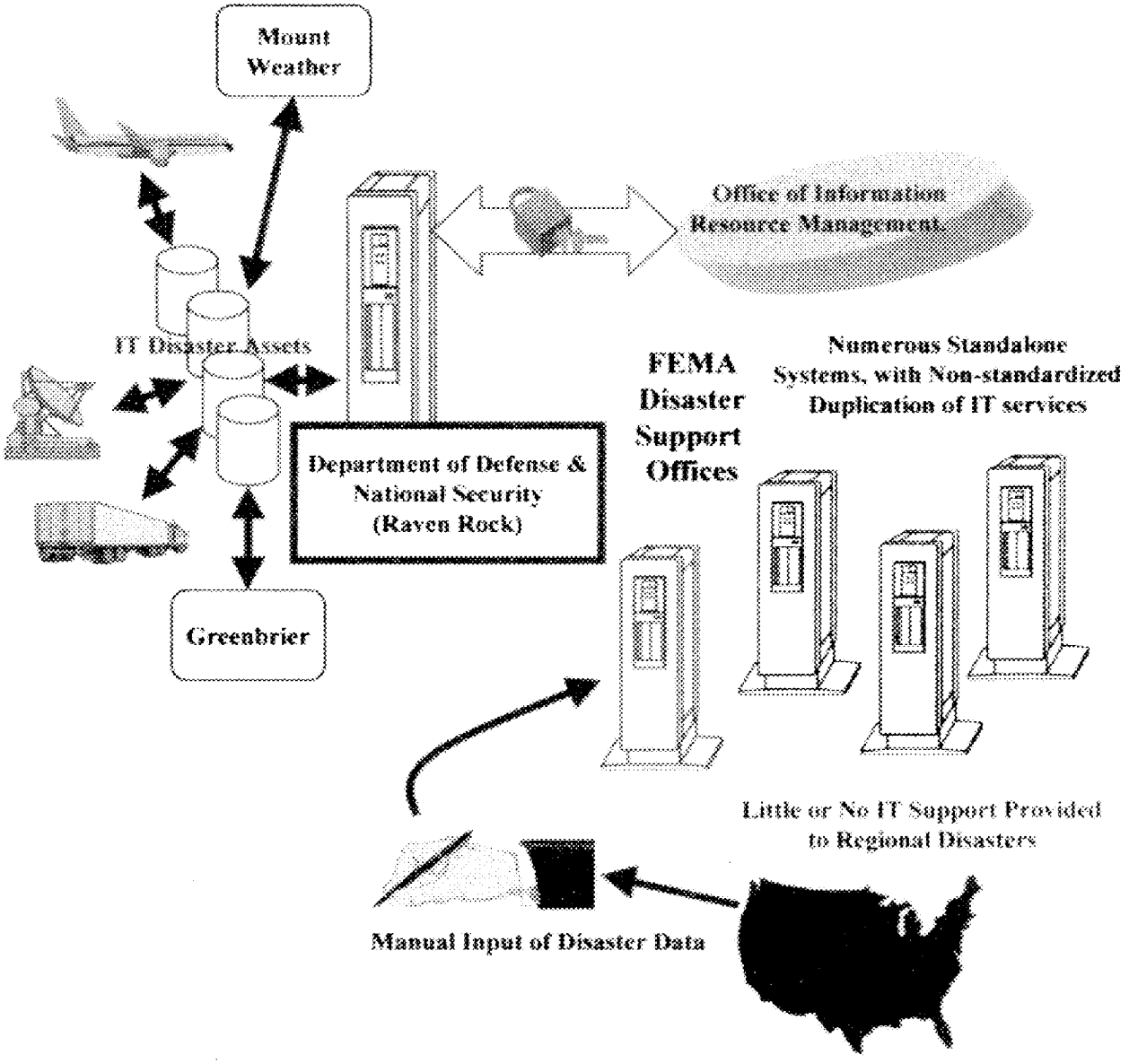

FIG. 2. FEMA IT Disaster architecture: 1980–1992.

FEMA's IRM responded that such a system was impossible to develop because each disaster was different. FEMA did agree to develop a standardized manual procedure for damage assessment, but made it publicly clear that it would be done without the support of IT applications (Washington Post, 3/22/82).

Unknown to the GAO or Congress, IRM, after issuance of the GAO report, awarded a disaster assessment IT contract to a private consulting company. The company delivered both software and IT emergency management recommendations. Both NPD and IRM reviewed the software and recommendations. After their review, NPD shelved both the software and the IT emergency management recommendations. It was felt, by the officials within both NPD and IRM, that release of the software and recommendations would undercut the Continuity of Government program. FEMA's Inspector General, who also had access to the report, seriously questioned IRM's priorities, but IRM and NPD ignored his objections (Wamsley Interviews, 1992–1993).

The lack of IT development for emergency management began to seriously affect FEMA's response capacity to natural disasters. By the late 1980s, FEMA's emergency disaster response system was beginning to fail, affecting both its public and political reputation. Still grounded in a paper-based system, and relying on the public switched telephone network for communications, it was slow to respond to a disaster, and ineffective in dealing with the aftermath. In 1989, when Hurricane Hugo took a direct hit on Charleston, SC, FEMA was unable to marshal the resources needed to provide relief to the area. FEMA's lack of coordination and support capability led to Senator "Fritz" Hollings (D/SC) declaring on the Senate floor that FEMA was ". . . the sorriest bunch of bureaucratic jackasses I've ever known." Shortly after Hurricane Hugo, in 1990, the

Loma Prieta earthquake hit California. Swamped by over 70,000 paper applications for disaster assistance, FEMA's manual disaster assessment system failed, leaving thousands of residences without any form of support. Representative Norman Y. Mineta, D-Calif., publicly declared that FEMA "could screw up a two car parade." He also announced his intention to "write legislation that will have Congress rebuild this system." Mineta's remarks followed, in June 1992, a report from the House Appropriations Committee, which criticized FEMA's lack of technological development and support for emergency management, and its civil defense priority rather than natural disaster response. The report went as far as to publicly label the agency a dumping ground for incompetent political appointees (Congressional Quarterly Weekly Report, 9/12/92).

The timing of the Congressional Report preceded, by only 2 months, the worst response by FEMA to a natural disaster. On August 24, 1992, Hurricane Andrew hit Southern Florida. In its wake, Hurricane Andrew's fury left 250,000 people directly affected by destroying the physical infrastructure of one of the most heavily populated areas in the United States. FEMA's IT response to the disaster was, to say the least, disgraceful. With no IT support from IRM, the Office of Emergency Management (OEM) had to purchase 300 personal computers and commercial software locally. In addition to local purchase of systems, the OEM then trained the operators in how to use the computers within the Disaster Assistance Centers that were established. OEM also attempted to speed up the disaster assistance process by establishing a teleregistration center. The system was so antiquated though, that the operators had to take the requests in writing, and only later was the information keyed into the computers—further leading to errors, lost reports, and delays in providing assistance. The situation became so bad, that President Bush took the Andrew disaster assistance and response out of FEMA's hands, and gave it to the Secretary of Transportation and the Joint Chiefs of Staff (DoD) (Wamsley Interviews, 1992–1993).

The aftermath of Hurricane Andrew, for FEMA, did not stop with the physical damage to Southern Florida. Within 1 month of Hurricane Andrew Senator Barbara A. Mikulski, D-Md., Chairman of the Appropriations subcommittee that directly oversaw FEMA's budget, demanded that the General Accounting Office conduct a full study of the national disaster system. Mikulski stated that her intentions were to open hearings for a complete overhaul of the national disaster system, and FEMA, within 1 year (Congressional Quarterly Weekly Report, 9/12/92). By the end of 1992, it seemed likely that Congress would either abolish FEMA, or reassign the majority of its programs to other departments of the federal government.

Analysis of the First Phase of FEMA's IT and Network Development

An examination of the development of IT and network building within FEMA's first phase of organizational history would tend to support the previous findings within organizational theory research rather than the findings of the technological positivists research. IT and network development, within the agency, was "mission" driven by the upper management of the agency. Both areas of technological development were used to reinforce upper management priorities, and to sustain centralization of organizational decisions, hierarchical control, and work processes. While the technology itself had the capability of a flexible and adaptive application to emergency management, upper management restricted such development to sustain agency focus, and resources, on the designated civil defense priority.

As for the assumption that adoption of such network technologies will lead to a more publicly responsive form of government operation, the first phase of FEMA's IT development would tend to disprove this assumption. Public and congressional criticism and pressure to develop a more responsive program in support of emergency management was soundly ignored by both the upper management of FEMA, and the section directly overseeing IT development. Although FEMA had developed a disaster response system capable of dealing effectively with any possible disaster scenario, it refused to release access to the system in support of civilian emergency management. Driving this refusal to develop a public and politically responsive system was an upper management fear that such an emphasis would undercut management's primary civil defense objective.

One can conclude, at least in this specific case, that IT organizational development is a conscious and strategic application by upper management. Rather than IT capability pulling an organization toward change, in fact, management attempts to push the technology through the organization to support its own decisions and objectives. While IT may have the potential for producing a synergistic impact on organizational processes and services, manifestation of such an inherent technological and organizational potential requires the conscious acquiescence by upper management.

One may also conclude that while adherents of IT adoption within government may hope for an emergence of a more responsive approach to IT capability for government services, such an emergence will require more than just implementation of advanced systems. Upper management of government agencies must consciously concur with the IT proponents agenda for improved government for such technological capabilities to emerge within government services. Even mounting political criticism from external persons situated in politically powerful positions will not necessarily alter an existing IT development path within an agency. Once upper management sets the IT development path that development path will tend to be retained, no matter what other capabilities may be inherent within the technology.

The obvious next question, in terms of IT development within government, is how would someone successfully change management's focus on IT for other forms of technological capabilities to emerge. We can gain some insight

into this problem, and possible change strategies, by examining the second phase of IT development within FEMA. This second phase, which started approximately in 1992, shows a marked change in both organizational and IT development within the agency.

Phase Two of IT Development in FEMA

The first phase of FEMA's IT development corresponds to the Presidencies of both Ronald Reagan and George Bush, a total of 12 years. Both administrations emphasized a conservative fiscal and social role for the federal government, but strong support for national defense. This priority weakened, though, when the Soviet Union devolved from a unified national state, in the late 1980s, and there was a subsequent drop in the possibility of a direct nuclear confrontation between the United States and the Soviet Union. In 1992, William Jefferson Clinton assumed the Office of President with a political orientation that switched the previous presidential agendas. Namely, Clinton sought an increase of fiscal and social roles for the federal government, and deemphasis on national defense. A major part of the Clinton agenda for the federal government was the implementation of an organizational movement that had become widely known as "Reinventing Government" (Gore, 1993).

Reinventing Government has generally come to mean "reengineering" and "redesigning" both governmental structures and processes. Such an approach seeks to maximize output and capacity by bridging both organizational hierarchies and organizational separation. The focus of this effort is on a total rework of existing organizational processes, and a "crosscutting" of organizational lines to use existing capacity located within another agency or group. In the end, reinventing seeks to create more system's output with the same, or less, level of resources (Willcocks, Currie, & Jackson, 1997, pp. 617–649). To achieve this goal, the reinventing process relies heavily on IT, and specifically the application of global communication, network linkage, and knowledge management/enhancement (Harris, 1998).

To institute this new governmental redesign movement at the federal level of government, President Clinton initiated the "National Performance Review" (NPR) program, and required that all agencies of the federal government participate in the reengineering effort. President Clinton appointed Vice-President Albert Gore to head the program, and Gore personally emphasized the need for developing advanced IT applications within all agency-reengineering efforts (Gore, 1993).

The NPR program also corresponded to the presidential appointment, in 1993, of a new Director for FEMA, James Lee Witt. Witt, a 14-year veteran of state emergency management, assumed his duties with a specific charge to improve FEMA's natural disaster response system following the NPR initiative. To improve emergency management response, and save the agency from dismemberment by Congress, it was essential that Witt gain access to the IT assets secured within the Continuity of Government program. To accomplish this end, gaining access to the IT assets, Witt instituted an external and internal reorganization of the agency. The first reorganization priority related to FEMA's external relationships (Ward Interviews, 1998).

For FEMA to move toward an improved natural disaster emphasis and response, a new agreement between FEMA, the Department of Defense, and the National Security Council was needed over use of the classified IT assets. Witt entered negotiations with the Department of Defense and the National Security Council concerning the IT assets. The negotiations resulted in a "tiered" system of access to the IT assets. Portions of the assets were declassified, and designated "dual use" operations. These assets included the emergency mobile fleet, computer modeling of damage projections, and satellite surveillance feeds for area damage assessment. The agreement also provided for linkages to the DoD backbone network, which allowed "field" computer and communications satellite uplinks and downlinks for on-site team assessment and real-time audio, video, and data feeds from ground locations. All of these "dual use" systems were available directly from FEMA's natural disaster response center (Ward Interviews, 1998).

More advanced, and classified, systems remained under DoD control, and housed at DoD command centers. These advanced systems, integrated into the restricted DoD defense and response systems, required access through a series of formal authorization protocols. The Secretary of Defense authorized access to the various restricted systems, in support of natural disaster, within a set of defense priorities defined within a Department of Defense Directive. The Directive designated the Secretary of the Army as the DoD Executive Agency for support of civil and natural disaster emergencies (United States Department of Defense. Directive 3025.1).

While the agreement with the DoD and National Security Council immediately improved FEMA's ability to respond to natural disasters, the system was cumbersome. The various levels of authorization for release of advanced IT assets slowed the response system from the desired optimal level. In addition, the use of DoD restricted backbones made it difficult to develop network linkages to other nonsecure systems located at the state and local levels of government. If FEMA wanted to develop a comprehensive disaster network, linking all disaster networks at all levels of government, it was necessary to locate this network within FEMA's internal operations. To accomplish this end, Witt directed his attention toward reorganizing FEMA's internal IT structures (Ward Interviews, 1998).

Witt proceeded to dismantle the NPD, and eventually pulled the "fangs" of NPD's dominance over IT within the agency by removing IRM from NPD. The IT authority, previously held by IRM, was now placed within the newly created Information Technology Services Directorate (ITS). ITS was charged with providing agency-wide IT services and systems for both routine operations and emergency

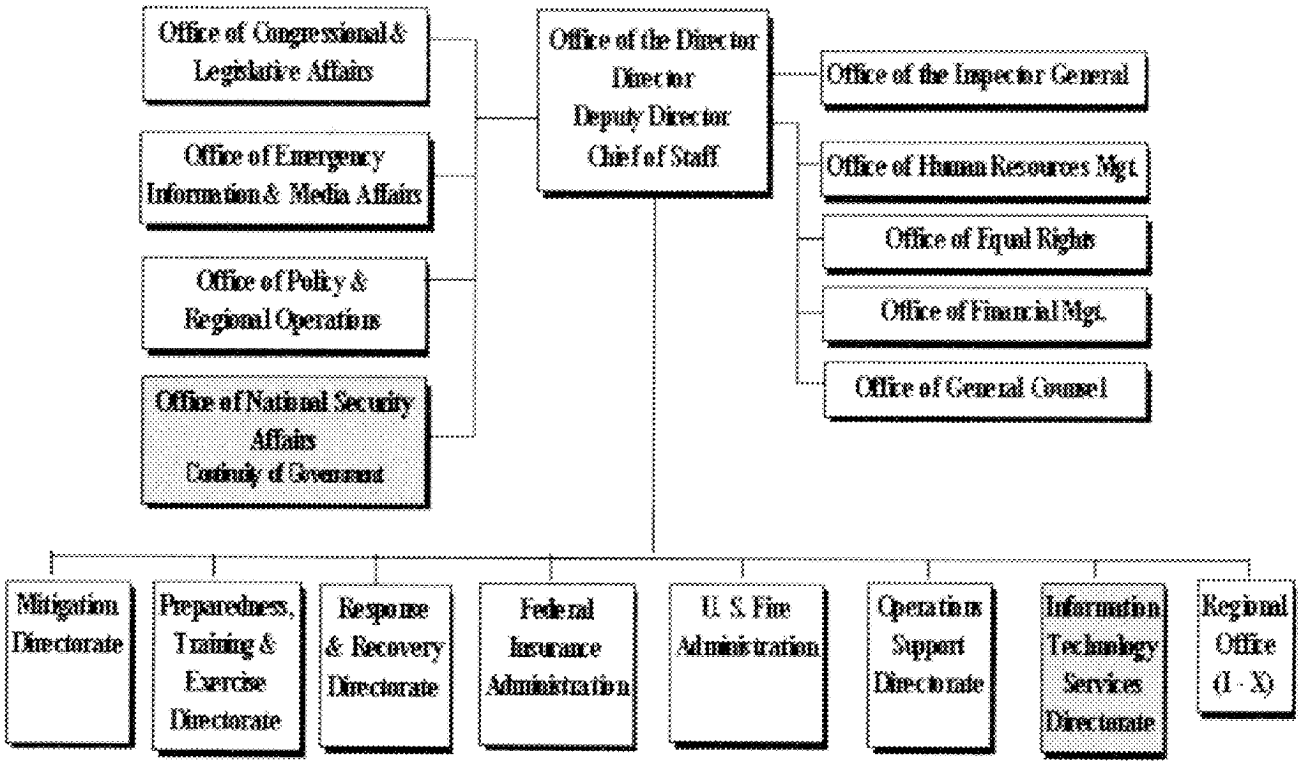

FIG. 3. FEMA: 2000.

management response. In essence, ITS became the main point, within FEMA, for coordinating all IT efforts by other federal agencies, and state and local governments, involved in any aspect of emergency management. ITS's authority extended over all aspects of IT policy and planning (Ward Interviews, 1998).

During this time that Witt was involved in reorganizing the external and internal structure of FEMA, the Emergency Management Directorate (EM) had been experimenting with different forms of network systems building. Usually without the support of IRM, EM's technical staff had been developing prototype systems to supplement and improve its field response for natural disasters. The impetus for this effort was a direct result of EM's experience during Hurricane Andrew (Ward Interviews, 1998).

Shortly after Hurricane Andrew struck Southern Florida, Digital Matrix Services, Inc. (DMS), a Miami-based geographical information system (GIS) software company, contacted FEMA's EM operation. DMS made available to FEMA its on-line digital database of Southern Florida, and the system was used by both FEMA and the Army's Special Forces transport division to assess damage, and to coordinate disaster relief into the hardest hit areas. After Andrew, EM continued to work with DMS on how to apply the GIS system, especially in terms of linking the system to field efforts. The basic premise of the development project was to build a portable, ready-to-go database of geographical information. EM would construct a database, before a natural disaster, of populated areas likely to suffer natural disasters. In case of a disaster, the database's information would automatically configure to the affected area. Once the disaster was past, the system would reconfigure to a "wait" status, and continue to build its resource of information (Ward Interviews, 1998).

EM developed a prototype system using commercially available street network files. Rectification of the images in the database allowed for the actual size and distance of images to appear in a true proportion to the ground structures. Linking ground structure images to individual addresses and homeowner information allowed for a direct match between structure damage assessment and homeowner assistance application. Special vans, equipped with the system, could drive down the devastated areas, feeding visual information on damaged buildings directly into the database through satellite links, and providing an immediate damage assessment of the affected areas. The system also linked to computer modeling systems to provide "what-if" analysis for determining possible further damage resulting from the aftershocks of an earthquake. After Witt assumed the leadership of the agency, he threw his full weight in behind these preliminary efforts by EM (Ward, Interviews, 1998).

By June of 1993, EM tested the prototype system of field support, in cooperation with the Army Corps of Engineers, at Salt Lake City. The first trial of the proposed "Disaster Management Information System" (DMIS) involved the linking of laptop computers with microwave and satellite data links. Two-way wireless

modems carried voice, data, and graphics to an earth station uplink that then bridged the communications gap to field offices. The laptop computers, mounted in recreational vehicles, provided relief workers with full access to power, water, and telephone grid maps, along with satellite assessment of fire and building damage in the affected areas. The initial field test of the prototype DMIS was successful (American City & County, 3/93, p. 38).

Under the direction of the reorganized IT section of FEMA, the IT and EM technical staff began further development of the DMIS, with an especially heavy emphasis on the use of GIS as the primary information enhancement system. Another group within the federal government, known as the Federal Geographic Data Committee (GDC), supported them in their efforts. Under an Office of Management and Budgeting (OMB) Circular, the Geographical Data Committee was established and charged with coordinating data collection, establishment of standards, and the purchase of all federal GIS systems. All federal GIS systems must be capable of linkage to other systems, and form the National Spatial Data Infrastructure (NSDI). In essence, the Committee is to develop a "shared vision" of data supporting multiple tasks, and held together by a common emphasis on geography (United States Office of Management and Budgeting, Circular, A-16. Washington, DC, 1967, revised 1990.)

Under GDC's direction, FEMA began to evaluate both the existing GIS systems available within the federal government, and commercially available modeling software. The evaluation of the various systems and software showed that systems could be developed to not only assess damage from natural disasters, but provide preliminary assessments of damage prior to an event actually occurring. The proposed system, called Consequences Analysis Tool Set (CATS), could use off-the-shelf GIS software and hardware, and link the system to remote sensing devices, resource databases, and demographic data, plus land plats, to deliver assessment information. The system would have the capability of estimating damage before an actual event, provide direct support during a disaster, and, during normal times, used for preparedness training and mitigation planning. The proposed CATS system could also be linked to the National Oceanic and Atmospheric Administration (NOAA) hurricane warning system to develop profiles of a hurricane's path and velocity, and to estimate potential damage assessments prior to landfall. Further refinements would allow the DMIS to determine the degree of damage that would result from wind, storm surges, waves, and flooding, and the number, and type, of both people and businesses affected. This predisaster assessment model, linked to a resource assessment model, could estimate the level of resources needed, and the locations for prepositioning of the resources. The GDC reviewed the initial proposal for the system, and then authorized FEMA to proceed with systems development (Ward Interviews, 1998).

The project was jointly funded by FEMA and the Defense Department's Nuclear Agency, who provided access to the United States Army Construction Engineering Research Laboratory's Geographical Resource Analysis and Support System (GRASS), which formed the base system for CATS. During the summer of 1993, testing of a prototype occurred when Hurricane Emily hit the Outer Banks of North Carolina. CATS estimated the destruction of 674 homes, and the actual damage resulted in 683 claims filed. Further modeling was developed by FEMA, and eventually models were constructed for floods, earthquakes, fires, and other less common disasters such as chemical spills. By 1995, both the DMIS and CATS were operational. The only element still lacking was a form of "national disaster response" telecommunications network outside the DoD network (Ward, Interviews, 1998).

Using the capacity of both the DMIS and CATS systems, the IT staff at FEMA modified the U.S. Army's GRASS system, and linked it to the mobile field vans operating with the DMIS. Field inspectors sent to assess damage used portable touch-pad computers. The data from the damage assessment units fed, via Ethernet, into various servers located at FEMA Regional Offices. Each of FEMA's Regional Office servers were then linked to the other Regional Office Servers. Using Cisco System routers, the sites could then distribute the workload on applications across the country (InfoWorld, 3/21/94, p. 62).

At first, the direction of the new telecommunications system focused on increasing the processing time for disaster applications. As the application system's effectiveness became apparent, the system, further modified, fed data directly into other state or federal agencies involved in the disaster response. It became apparent that the field agents, in place, were able to feed current information into the total system concerning the immediate level of damage on the ground. The system then expanded to allow the data assessment to feed not only into the application system, but also into the Disaster Command Centers seeking to deal with response to the event. The combination of DMIS, CATS, field vans, and field agent's information, via satellite, fed from FEMA's Disaster Response Center to field operations and Command Centers across the country. The final system provided a "real-time" environment with direct feed from the disaster area, and all levels of response sharing the same level of information for coordinating the response effort (Ward Interviews, 1998). With the final development of a "natural disaster telecommunications network," FEMA's transition from civil defense to natural disaster was complete.

During the last half of the 1990s, FEMA has continued its process of network building and IT development. The emergency support function of FEMA's network now links across the spectrum of federal agencies. In case of a natural disaster, FEMA's network is able to bring to disaster relief systems capable of providing information on everything from weather forecasts to the location of small businesses

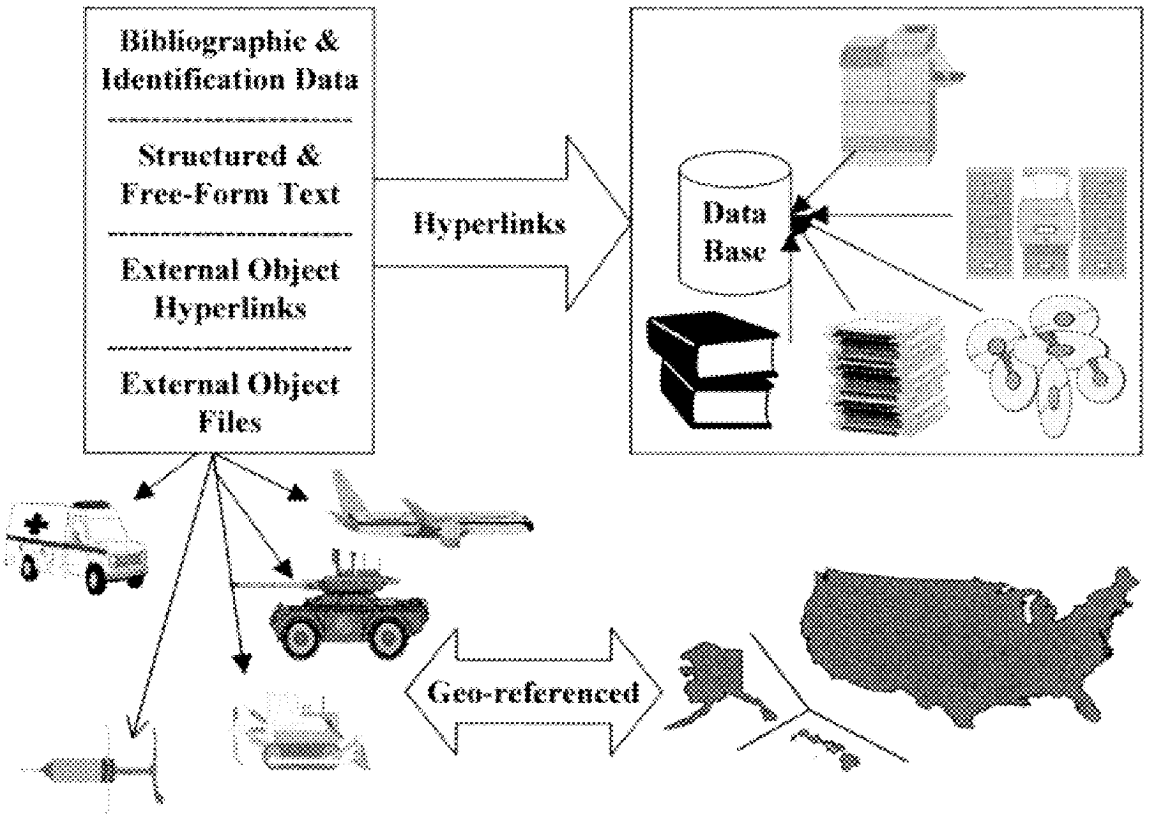

FIG. 4. Integration of documents and data with an object-relational document model: SGML/XML-tagged.

and schools located in affected areas. (A partial list of agencies linked to the system include: Department of Agriculture, Department of Commerce, Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of the Interior, Department of Justice, Department of Transportation, Department of the Treasury, American Red Cross, Environmental Protection Agency, National Aeronautics and Space Administration, National Communications System, Nuclear Regulatory Commission, Small Business Administration.) The FEMA Switch Network (FSN) now provides the backbone communications services, which allow for interconnection to the network from the disaster site within 24 hours of the event occurring. Through the FSN, FEMA provides gateways to other agencies, federal, state, and local, responding to the disaster, offering access to FEMA's major assets and other nodes on the network. The system is capable of not only providing a real-time assessment of the disaster impact and magnitude, but also the location of food, supplies, and shelter necessary to sustain human life in the impact zone. Supporting the network are a series of databases and programs dealing with human services, infrastructure support, mitigation, and coordination of emergency disaster response, all available to any level necessary to bring the affected area back into social and physical equilibrium. [FEMA, Information Resources Management (IRM) Policy and Procedural Directive, 1999.]

FEMA's transition from a civil defense emphasis to a natural disaster emphasis, and its success in this area, is not solely the result of the change it has made in IT development and deployment. Supporting this change has also been a wide-ranging series of other steps, internal and external to the agency, which have gained the agency both political and social support. While article space limits our ability to discuss these other factors, which do not directly relate to IT, needless to say that without these extensive changes in both the personnel and culture of the agency, FEMA's "reinvention" would never have succeeded. Still, it is the IT and network development that has given FEMA the necessary tools required for successfully achieving its mission. Without such development and change, it would be likely that FEMA, today, would no longer exist as an agency of the federal government.

Analysis of FEMA's Second Phase of IT and Network Development

In examining the second phase of FEMA's IT and network development we see, once again, that the organizational history would tend to support the previous findings within organizational theory research rather than the findings of the technological positivist's research. The fall of the Soviet Union, and the subsequent drop in the threat of a nuclear war, undermined the agency's primary mission, civil defense. While the agency's second mission, natural

disaster, was an alternative primary mission for the agency, the agency's failure to support the second mission had undercut its credibility to claim the area. In addition, the agency's focus on developing support relationships within the civil defense network resulted in a lack of external relationship support for efforts to develop a natural disaster network. While the initial IT and network development within the agency could, technically, have supported both missions of the agency, upper management's fear of undercutting civil defense support blocked IT deployment for natural disaster. Thus, the technological capability existed within the agency, but it was unable to be applied, or developed, because of management's reinforcement of existing organizational decisions, hierarchical control, and work processes.

The subsequent change in the emphasis for IT and network development, within FEMA, was a result of changes that occurred in upper management's decision making, and specifically upper management's selection of new agency priorities. The election of a presidential administration with an emphasis on domestic services rather than national defense, coupled to the NPR emphasis on reengineering and IT deployment, formed the basis for technological changes within the agency. The appointment of a new agency director, charged with fulfilling these two presidential priorities, resulted in a major shift in both IT and network development within the agency. Thus, the change in agency IT and network development did not occur because of changes in technology, but rather because of changes in staffing of upper management, and changes in upper management priorities.

While upper management's priorities changed, and lead to changes in both IT and network development, the changes that occurred were grounded on upper management's retention of centralization of decision making, and maintenance of existing hierarchical control. The organizational restructuring occurred within the framework of developing upper management's new priority. The subsequent second phase of IT development was a conscious and strategic application by upper management in support of the new priority. Again, rather than IT capability pulling the organization toward change, management pushed the technology through the organization to support its own decisions and objectives.

As for the assumption that adoption of network technologies will lead to more publicly responsive government, the organizational history would tend show that such responsiveness is due to management priorities rather than the form of technology that is applied. In the second phase of FEMA's IT development we do see a major shift toward "customer" support. The shift in responsiveness, though, is toward the group receiving the benefit of the new management priority, and occurs at the expense of the previous customer's benefit, namely civil defense. The technology has the capability of satisfying both customer benefits, but the technological capability selected, by upper management, rewards only one of the potential customers. Again, the type of responsive government that emerges is due to management's conscious decisions, not the inherent capabilities of the technology itself.

Our examination of FEMA's IT development leads us to conclude that the findings from organizational research in support of management use of technology to reinforce control are still valid. While new forms of IT and network technologies offer a variety of possibilities for organizational development and services, the types of organizations and services selected are still within the control of upper management's intentions and goals. While the technological positivists may hope that new forms of network and IT development may lead to a more enlightened form of organization, one more suited to a new information age paradigm, such hopes may not, in fact, be realistic.

Conclusion

Today, FEMA's overall agency emphasis, and IT applications, stand in strong contrast to the first 12 years of its existence as a federal department. When examining the agency, today, one hardly recognizes the FEMA of the 1980s. The older, rigid NPD/IRM domination of IT has been transformed into a new technology emphasis, by the ITSD, which stresses flexibility, interconnectivity, and knowledge enhancement/sharing. Rather than an agency hunkered down in a bunker waiting for the nuclear war to start, we find an agency seeking to expand IT technology in support of common human problems. However, what have driven this transformation have not been the capabilities of IT, but rather the capabilities of mankind. In the end, what we see is a government agency seeking to deal with the natural assaults that all nations face that exist on this unstable mass in the universe we call Earth. Driving that focus is a very basic human motivation, not technological, namely physical survival. IT technology may assist mankind in that ultimate human goal, but, in the end, it is mankind that will decide how that technology is, or is not, used to support that goal.

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Acronyms

CATS, consequence analysis tool; DoD, Department of Defense; EM, emergency management; DMIS, disaster management information system; DMS, digital matrix services; FEMA, Federal Emergency Management Ad-

ministration; GAO, Government Accounting Office; GDC, geographical data committee; GIS, geographical information system; GRASS, geographical resource analysis and support system; IRB, Information Resources Board; IRM, Information Resources Management; IT, information technology; ITS, information technology services; directorate; MATTS, mobile air transportable telecommunications systems; MERS, mobile emergency response support; NOAA, National Oceanic and Atmospheric Administration; NSDI, national spatial data infrastructure; NPD, National Preparedness Directorate; NPR, national performance review; OEM, Office of Emergency Management; OMB, Office of Management and Budget.

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