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Jane E. Fountain, *University of Massachusetts - Amherst*

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JANE E. FOUNTAIN

Toward a Theory of Federal Bureaucracy for the Twenty-First Century

THE INTERNET PROMISES vast changes in American government that range from Internet voting to interactive online services for the public to virtual diplomacy. As a vehicle for disjunctive change in communication, coordination, and control, the Internet and related information technologies make possible new and exciting developments in operations, regulation, and enforcement. In spite of its revolutionary power, the potential benefits of the Internet, and its potential perils, will be strongly influenced by the current organizations and institutions of government, for it is within the constraints posed by these structural arrangements that government actors make decisions and information networks that connect to form the World Wide Web are designed, developed, and used.[1]

One of the most intriguing and important questions for scholars and practitioners concerns the structural transformation currently taking place within and across government agencies, the part of government political scientists refer to as the bureaucracy. The intrigue stems from the potential for developing new organizational arrangements that will use the information-processing potential of the Internet and related information technologies. The importance for government arises because such a fundamental change in the structure of bureaucracy bears on central concepts of governance such as accountability, task specialization, and jurisdiction.

Some theorists and futurists have suggested replacements for bureaucracy, including networks, markets, and even self-organizing systems. Approximately a decade ago, as the Internet began to be widely used, others suggested that the nation-state itself would be replaced by a variety of subnational, supranational, and transnational forms of governance. For the foreseeable future, at least the next twenty-five years, it is unlikely that bureaucracy will be superceded by other forms of organization. Moreover, evidence is accumulating that the nation-state not only retains its importance but has taken on new roles as globalization continues. If a new dominant form is emerging to replace bureaucracy, it is not evident just what it is.

Looking back in time, it is useful to place bureaucracy and the modern American state in historical context. The modern American state is a child of the industrial revolution. As the political scientist Stephen Skowronek has observed, the American bureaucratic state was built from a nation of parties and courts. It was born during the final decades of the nineteenth century and the first two decades of the twentieth century. Although the term *bureaucracy* has come to connote much that is inefficient and ineffective about government, it is important to remember that bureaucracy replaced patronage appointments with a professional civil service and, through a protracted series of political negotiations, substituted merit for political loyalty as the key measure of fitness for employment in the professional public service.[2]

There is little theory and no coherent research program within the discipline of political science that seeks to account for the potential or likely effects of major changes in information processing on the bureaucracy. This silence is curious given that during the past two decades, in popular writing and in political practice, many actors have been engaged in "breaking down," "abolishing," and "bashing" bureaucracy. Indeed, the stillness of political scientists on this matter has contributed to a verbal sleight of hand. Rather than use the term *bureaucracy* in its accurate meaning, political and media actors have shifted its definition to mean an organizational form productive of a set of inferior, outmoded processes and outputs. It is not even clear whether one should speak in terms of a postbureaucratic government or of an evolutionary adaptation, or modernization, of bureaucracy.

Political science requires a theory of bureaucracy that accounts for far-reaching, fundamental advances in information processing and a sustained, coherent research program to develop such a theoretical perspective. This chapter outlines the elements of such a research program. It is difficult to

argue against the importance and centrality of the bureaucratic form throughout twentieth-century American government. The structure and its constituent processes are largely responsible for the production of binding collective decisions and coordination of policy implementation. If changes in information technology have serious implications for bureaucracy, then theorists must account for such a modification in underlying assumptions regarding information processing.

A useful starting point for a theory of information-based bureaucracy is provided within current bureaucratic and organizational theory. At minimum, an adequate theory must offer guidance to structure systematic research efforts. It should direct the attention of theorists to aspects of the terrain that are important. For the moment, I put aside the requirement for predictive power. Let us first decide on the variables of importance. Adequate theory also guides development of new policy tools, including organizational and program design, to foster improvements in government performance, accountability, and responsiveness.

It is impossible to sensibly discuss how information technology affects the bureaucratic paradigm without returning to the roots of that paradigm, the Weberian bureaucracy. This approach, although less exciting than intellectual excursions into cyberspace and sweeping speculation on the society of the future, provides an important starting point for the development of theory.

Modern Officialdom: Fundamental Properties of Weberian Bureaucracy

Although Max Weber describes bureaucracy as an ideal type, he argues several times in his voluminous output that bureaucracy is the only form of organization able to cope with the complexity of modern enterprise.[3] His delineation of the chief elements of bureaucracy has been central to conceptual understanding of the form and the role of the bureaucrat. The extended quotation that follows, delineating the "characteristics of modern bureaucracy," establishes the definition of bureaucracy used in this analysis.

> Modern officialdom functions in the following manner:
>
> I. There is the principle of official *jurisdictional areas*, which are generally ordered by rules, that is, by laws or administrative regulations. This means:
>
> (1) The regular activities required for the purposes of the bureaucratically governed structure are assigned as official duties.

(2) The authority to give the commands required for the discharge of these duties is distributed in a stable way and is strictly delimited by rules. . . .

(3) . . . Only persons who qualify under general rules are employed.

In the sphere of the state these three elements constitute a bureaucratic *agency*, in the sphere of the private economy they constitute a bureaucratic *enterprise*. Bureaucracy, thus understood, is fully developed in political . . . communities only in the modern state, and in the private economy only in the most advanced institutions of capitalism. . . .

II. The principles of *office hierarchy* and of channels of appeal [or "levels of graded authority" in a different translation][4] . . . stipulate a clearly established system of super- and subordination in which there is a supervision of the lower offices by the higher ones. . . .

III. The management of the modern office is based upon written documents (the "files"), which are preserved in their original or draft form, and upon a staff of subaltern officials and scribes of all sorts. The body of officials working in an agency along with the respective apparatus of material implements and the files, make up a *bureau*. . . .

IV. Office management, at least all specialized office management—and such management is distinctly modern—usually presupposes thorough training in a field of specialization. . . .

V. When the office is fully developed, official activity demands the *full working capacity* of the official. . . . Formerly the normal state of affairs was the reverse: Official business was discharged as a secondary activity.

VI. The management of the office follows *general rules*, which are more or less stable, more or less exhaustive, and which can be learned. Knowledge of these rules represents a special technical expertise which the officials possess. It involves jurisprudence, administrative or business management.

The reduction of modern office management to rules is deeply embedded in its very nature.[5]

Jurisdiction

Weber offers, in the first characteristic of bureaucracy, the kernels from which theorists have developed the powerful concepts of division of labor, functional differentiation, and clear jurisdictional boundaries. One of the chief effects of advances in information technology on bureaucratic organization has been the ability to structure information using information systems rather than through strict delineation of role and organizational subunit. Professional and operational roles will continue, but they have become broader and more fluid. Recent major revisions to the descriptions and classification system of civil service positions provide evidence for the current restructuring of roles within the federal bureaucracy. Similarly, jurisdictional boundaries have changed character. Although they have not disappeared, boundaries have become more permeable.[6]

Hierarchy

Weber's second characteristic, hierarchy, forms the essence of bureaucracy for many theorists. Herbert Simon, a key figure in both bureaucratic theory and automated information processing, traces the dominance of hierarchy through a variety of natural as well as social systems.[7] Simon argues that hierarchy represents a structural form that encompasses and enables the decomposability of complex problems. The ability to factor complex problems and then to assign the results to specialists is the chief reason that complex organization—bureaucracy—supercedes other forms of organization. Simon offers as evidence of the superiority of complex organization not only greater efficiency of output but also the exceptional robustness of decomposable systems able to withstand and recover from interruptions and disruptions from a variety of sources.

Information technology, primarily in the form of shared databases and electronic communications, has promoted greater use of cross-functional groups and teams at both the operational and professional levels. The predominance of these problem-solving groups diminishes the centrality of hierarchy. The ability to place information and computing power at the operational levels of a hierarchy while making results rapidly transparent at upper levels underlies current capacity to devolve decisionmaking to operational personnel. Thus, "empowerment," often viewed from the perspective of human relations, may be understood as a structural (and cultural) artifact of technological advancement.

Theorists as early as the 1950s predicted the demise of middle management as a direct result of mainframe computer use in complex organizations.[8] Their forecast was based on the clear obsolescence of middle

management tasks in light of office automation. That their prediction took more than thirty years to come to fruition merely illuminates the difficulty of making deep structural modifications in complex organizations. The lag between technological and social change often is substantial. But a high proportion of positions lost through the downsizing of federal employees at the outset of the National Performance Review, the major government reform initiative undertaken by the Clinton administration, consisted of middle management.

In spite of some "flattening" and loosening of command and control systems, hierarchy remains central to most complex organizations. The important question for students of bureaucracy concerns the optimal, or appropriate, types of hierarchy in information-based organizations. Reductions in levels within the chain of command in several bureaucracies signal the natural experiment currently under way. The rapid rise of scholarly interest in network forms, both within organizations and among them, has obscured the fact that networks continue to rest largely on a hierarchical base. Changes in hierarchy and its function in the bureaucracy have implications for the structure and practice of authority as well as for other properties, practices, and politics that flow from command and control systems of decisionmaking.

The "Files" and the Staff

The third chief characteristic according to Weber, the "files," constitutes an equally important departure from the idiosyncratic, personalized office. As bureaucracy became central to the modern state, for example, tax collectors could no longer individually define their operational methods. Written rules and the evolution of standard procedures, stored in the files, formed the basis for the rationalization of the state and the economy.

Digital files structured as shared databases place data and information throughout bureaucracy rather than in the hands of actors assigned specific functions and at specific levels. A notable result has been the detachment of information from individuals holding a particular role. This fundamental structural shift has important implications for the meaning of the statement "information is power." Much has been written concerning the assumed democratization expected to occur as a result of information sharing and transparency.

Bureaucratic Neutrality

Weber also articulates the role of the bureaucrat as neutral with respect to organizational direction, impersonal with respect to application of law and administrative regulations, and expert in the conduct of a particular, clearly defined office. Although several theorists have discounted the notion of bureaucratic neutrality,[9] the concept remains normatively powerful and a key feature of civil service professionalism. The chief contemporary changes in the bureaucrat's role have derived from the increasingly cross-functional and enlarged character of many positions in organizations in which project teams form and disband according to agency requirements.

General Rules

Finally, Weber outlines the rationalization of bureaus and offices increasingly ordered by rules and procedures. Weber's then radical perspective captures the transition from patriarchal, patrimonial, intensely political, and personal systems of organization to the rational, impersonal, efficient, rule-based bureaucracy currently under siege. Information-based organization is equally, if not more strongly, rule based and more highly rationalized. However, rules embedded within information systems become less visible and seemingly less constraining to bureaucratic discretion. Embedded rules will increasingly replace overt supervisory control. Indeed, in many cases, so-called empowerment represents little more than a shift from overt to covert control through embedded rule systems and peer groups.[10]

Bureaucratic Transformation: Three Levels of Analysis

Theory must be sensitive to levels of analysis. Three levels are important for this analysis. Weberian properties focus implicitly on the bureaucratic structure as a whole, thereby missing intraorganizational (individual, group, subunit) and interorganizational phenomena. I flag some of the key implications of information processing advancement for the federal bureaucracy at each level. The main point is to extend the focus of Weberian analysis to capture effects that range from those operating primarily at the level of the individual to those that transcend the boundaries of the bureaucracy.

At the intraorganizational level, effects on individuals, groups, and subunits are found. I note substantial change in the design of work, an area addressed partially through process redesign efforts initiated as part of the Clinton administration's National Performance Review and continuing in the Bush administration. Knowledge workers and knowledge work have replaced simple, repetitive clerical tasks required in paper-based bureaucracy. Caseworkers, whose desktop computing capacity provides access to several databases and powerful analytic tools, perform work previously disaggregated into several positions. In some cases, automated tools allow relatively unsophisticated employees to make sophisticated evaluations. Task integration owing to information technology has resulted in a collapse in the number of job categories and simplification of the position classification system in the federal bureaucracy.

The information revolution carries with it a host of human resource implications, such as the appropriate design of careers, reward systems, and performance measures in the bureaucracy. As command and control decision systems have modernized, a stream of secondary effects requires systematic attention. These include modifications to supervisory roles, transformation of hierarchical relations, and, at a deep cultural level, modernization of the nature of authority structures and systems.

At the organizational level, major advances in information technologies have led to several structural changes. The dominance of the manager, a direct outgrowth of bureaucratic development, formed a dominant focus of scholarly attention after World War II.[11] Technology has substituted machines for labor, leading to a sharp decrease in traditional middle-management positions. An equally important, though less well recognized, effect lies in the enormous number of new positions required to develop, maintain, and service the information-based organization and the information society. Growth of information technology–related positions is predicted to vastly outstrip labor market supply during the next decade.[12] Scholarly attention during that time may usefully be directed toward the growing dominance and influence of systems analysts within information-based bureaucracy.

Information technology diminishes, and in some cases eliminates, time and distance barriers, leading to the proliferation of work groups whose members are geographically distributed, to new agency arrangements, and to new types of government services. One of the most important developments has been the growth of cross-functional arrangements. These arrangements exist both in human form, as cross-functional teams, and in

automated form, as process redesign—the consolidation and streamlining of tasks previously accomplished sequentially. In many cases, "business" units (responsible for particular products or services) have been created in place of functional units.

Finally, interorganizational-level change has been catalyzed as the external boundaries of agencies and other organizations have become more permeable. Agencies have increased partnerships with other agencies, with private and nonprofit entities, and with customers to gain efficiencies through improved problem solving and more effective design of production and operations. Although this phenomenon is best known through the efficiencies gained from contracting for business services, a comparable level of partnership activity characterizes many government activities.[13] Through the use of electronic data interchange, agencies have overcome the costs of coordination to gain its efficiencies: reduced paperwork, increased speed and accuracy of transactions, improved control of inventories and suppliers, strengthened channel control, improved relationships with customers, resource and risk sharing, and integration and synergy without ownership.[14]

This inquiry thus far has classified some of the chief properties of information technologies that either presently affect or are likely to affect the bureaucracy. It has also outlined some of the chief modifications to bureaucracy in terms comparable to those used by Weber. I have done this because theory development requires more precise language than is typically found in discussions of technology and government. The invention of new terms provides excitement but obscures theory.

Implications of Technology for Capacity and Control

One more lens is required through which to view the implications of the information revolution on the bureaucracy. Although bureaucratic theorists think in terms of structure and process, typical discourse in public administration and management uses a closely related but different terminology. It focuses on the activities of the bureaucracy and their achievement through agency capacity and control. Weber's concepts represent antecedents of capacity and control. Theoretical development, therefore, invites examination of technological change in light of these properties of the administrative state.

The National Performance Review was criticized roundly by public administration scholars. This criticism reflects the lack of theory adequate

to guide analysis of technological change and bureaucratic behavior. Misled by rhetoric touting empowerment, critics ignored fundamental technological change and its implications.

For example, as part of an extended critical essay on the National Performance Review, Gerald Garvey asked,

> How do you retain control when you eliminate bureaucracy, *whose essence is control achieved through the codification of knowledge, the inculcation of habits, and the structuring of hierarchical authority?* The answer may be you do not retain control. Or, if the existing system of controls is too deeply entrenched, you just talk about eliminating bureaucracy—citing anecdotal instead of systemic evidences of radical change—instead of really doing it.

This critique follows from well-known principles of public administration. Administrative behavior must satisfy the dual requirements of capacity and control. Capacity indicates the ability of an administrative unit to achieve its objectives efficiently. Control refers to accountability owing to "higher authority, most particularly to elected representatives in the legislative branch."[15]

Democratic accountability, at least since the Progressive Era, has relied upon hierarchical control, control by superiors of subordinates along a chain of command that stretches from the apex of the organization, the politically appointed agency head, and beyond to the members of Congress down to operational-level employees. The reform effort that began with the National Performance Review, according to Garvey and most critics, "involves the substitution of bottom-up control, that is, control of officials in their day-to-day work by those officials' 'customers,' the citizens whom they serve."[16]

The scientific managers of the early and middle twentieth century developed governmental structures according to the scientific method of Frederick Taylor and the normative explanations of bureaucratic behavior developed by Max Weber.[17] The bureaucratic structure of modern organizations in the private and public sectors is a lineal descendent of Taylorism. It solved the problem of how to achieve capacity in complex problem solving requiring coordination of a large number of subtasks and functions while retaining control over a disparate enterprise.

Political scientists typically explain the rise of the modern administrative state as a response to industrialization during the industrial revolution in

the United States.[18] However, organizational forms developed by state and industry also were rendered possible by the technological achievements that underlay the industrial revolution. The steam engine, the telegraph, the telephone, and early adding machines all made possible bureaucracy, as well as the interorganizational forms underlying business and government, by allowing the development of vertical integration and spatially dispersed headquarters and field organizations. Technological developments did not determine these forms in an inevitable fashion, but they made them possible and, in some cases, were completely logical developments.

Information technology differs from other technologies in its capacity as a general-purpose manipulator of symbols used in all types of work. It resembles the steam engine, in the generality and breadth of its applications, and is having effects on a scale similar to that of the steam engine during the industrial revolution. Information technology is different from other types of technology because it affects production of goods and services (or capacity) as well as coordination and control.[19]

One indicator of the tremendous applications of and demand for information technology is cost. The cost of information processing has decreased enormously during the past twenty years and is projected to continue to drop dramatically. As the economics of information technology continue to drive down its costs, its effects should continue to proliferate throughout government. Current estimates show cost-performance ratios to be declining at a rate of 20 to 30 percent a year.[20]

I have already briefly noted the lag between advances in information technology and bureaucracy. In spite of stunning examples of innovation in the federal government as well as in other sectors, empirical studies find few examples of fundamental organizational change to date either in the private or public sectors. I have argued in previous research that institutionalized norms and values, bureaucratic politics, and tightly coupled routines are highly resistant to change. Indeed, organizations often appear to change technology, rather than their own practices, by using or enacting technology in suboptimal ways that allow the status quo to continue.[21] It is easy to discount the deep political and social adjustments that have to occur for organizations to leverage the potential afforded by information technologies.

Five processes underpin and influence organizational capacity and control: production, coordination, control, direction, and integration. Information technologies affect and potentially reshape each process and,

in doing so, have the ability to restructure capacity and control in government organizations.

Production

A key aspect of production, or capacity, in government affected by information technology is intellectual production or knowledge work. "The degree to which a person can be affected by [changes in information technology depends upon] how much of the work is based on information—that is, information on what product to make or what service to deliver and how to do it (the production task), as well as when to do it and in conjunction with whom (the coordination task)."[22] Government officials who develop loans and other financial instruments, provide counseling, write contracts, regulations, and legislation are involved in intellectual production. Other knowledge workers in the federal government include engineers, designers, budget analysts, and lawyers. The knowledge worker adds value to information.

Clerical tasks, of which there are an enormous number in government, are affected by information technology. These tasks, often classified as "information work," include accounts receivable, billing, and accounts payable. Thus social security administration, tax administration, welfare disbursements, student loan programs, and a large number of other programs have been transformed by information technology—or have that potential easily at hand.

A major potential advance for government concerns the application of information technology to knowledge production in the form of workstations for those who assemble qualitative products, such as loans, letters of credit, and contracts, and for those who design "soft" products, including legislation or new software. The application of information technology to knowledge work has been much slower than its application to physical production. Production processes involved in knowledge work—for example, professional expertise, research, creativity, and judgment—are less well understood and far less easily routinized. Experience with knowledge-based programs or expert systems demonstrates that rule-based systems work well as aids to clearly defined problems but tend to produce poor results outside well-bounded domains. Organizations, particularly in government, have been slower to exploit information technology in the area for this reason.

Coordination

Much of what federal agencies do falls under the category of coordination. Communication networks enabled by information technology are being built within subunits and agencies as well as among agencies and countries and constitute essential elements of much-needed information infrastructure. The National Performance Review itself was sustained and disseminated in part through a telecommunications network linking federal employees. The Internet and its predecessor, ARPANET, developed by the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense, are among the largest networks connecting government employees and millions of other users. As an outcome of Information Technology Initiative 6 of the National Performance Review, the prototype of an integrated trade data system was negotiated and developed. The system was an effort to standardize and link trade-related data among more than sixty federal agencies and bureaus with responsibilities for trade policy and administration. Lack of consistent standards continues to inhibit the proliferation of communication networks both within and outside government. As standards are negotiated, the growth of electronic networks should increase dramatically.

Information technologies potentially alter coordination through their effects on the relations among information, distance, time, and memory. First, distance becomes far less relevant with regard to information flow. This has implications for partnerships and the location of work. Second, time becomes more fluid as federal organizations and their partners in different time zones shift work to gain efficiencies. Store-and-forward systems and common databases make time far less relevant. For example, the Social Security Administration shifts telephone calls dialed into its teleservice centers from one time zone to another in order to expand its service to the public beyond the typical federal workday.

Third, organizational memory, in the form of shared databases, collects data from and provides it to all authorized points in agencies as well as maintains information in easily retrievable and malleable form over time. Organizational memory is an important aspect of coordination. Agency and interagency databases constitute a "memory" that can be accessed systematically and analyzed to benefit administration and future decision-making. For example, personnel databases may be used to identify skill mixes, possible succession plans, and candidates for positions. Shared data-

bases containing retrievable, manageable information affect coordination through their potential to allow decisionmakers to better detect patterns.

These three aspects of coordination—time, distance, and memory—make it possible for agencies to establish and use teams whose members work in disparate locations, whose work is conducted without face-to-face meetings, and whose production is shared throughout the team's existence. Telecommunications networks allow decisionmakers within the administrative apparatus to locate nearly any information, any time, anywhere, and in nearly any format. This coordination capacity depends upon an infrastructure that is being put into place at different rates in different agencies. With this telecommunications infrastructure comes the ability to virtually link employees and work both within agencies and, increasingly, across agencies and entities.

Control

Two aspects of control are important to consider in relation to public management. First, measurement of agency or program performance against a set of criteria is critical to control, although sometimes devilishly difficult to implement in government. The second aspect of measurement involves timely, clear, and accurate feedback of measured results to decisionmakers, interpretation of those results, and subsequent decisions based on interpreted feedback.

Information technology cannot determine the appropriate performance measures for agencies, but it embeds routines in programs and procedures that make data collection easier, data collation automatic, and report generation in a variety of forms simple. Information technologies rationalize elements of tasks more powerfully than standard-operating-procedures manuals and first-line supervisors are capable of doing. Software applications make clear to federal employees those aspects of their tasks that are discretionary; and databases collect information so that control is far greater than is possible in a traditional bureaucracy because the actions of most employees are captured electronically and easily stored and analyzed in terms of quantity and some qualities of output. So information-based organizations codify knowledge and inculcate habits in a somewhat different, but much more powerful, fashion than is possible in traditional bureaucracy. The control problem in government has never been easier to manage.

The marginal discretion granted to employees is meant in part to enhance "customer service" or empowerment or some other human relations objective. But greater discretion also is critical to prevent technologically constrained jobs from becoming completely uninteresting to employees. Given the capability to control employee behavior and outputs to such a great extent, added discretion at the margins achieves benefits without loss of discipline.

It is certain that a solid core of hierarchy and functional specialization will remain in information-based organizations. The control apparatus that required multiple layers in the chain of command has been greatly simplified, however, with gains in accountability, through information technology. With information systems that render employee behavior largely transparent, hierarchical authority is relieved of the task of physically observing employees. Shirking is obvious, as is greater output, in a transparent system. Hierarchical authority takes on the more important task of setting the direction in turbulent environments, keeping officials current with environmental changes, and ensuring the alignment of task, technology, human resources, and goals.

Control systems traditionally serve three functions. First, they help decisionmakers use resources more effectively by providing feedback, thereby making the production process more "visible." Second, they serve to put disparate units and divisions of the agency in line with agency goals. Finally, they provide data for decisionmaking at the strategic and operational levels.[23] Information technology has provided the potential for more than efficiency gains in existing processes and systems. It has created a set of new tools for collecting, managing, and using information. One of the challenges for gaining these new capacities lies in linking program managers, control staff, and information resource managers in agencies in order to put information into the most valuable locations.

Data storage is relatively inexpensive. To sustain innovation, the federal government should "reinvent" all information systems that stymie the efforts of users to manage information and that make information retrieval slow and complex. Those frictions are outmoded. Information-based control systems should be able to respond to changes in external conditions. Decisionmakers can use information-based control systems to decide where information should appear and in what form. For example, data collected at remote field locations is as easily available at headquarters as it is in those field locations and may be transferred without having to travel

through several hierarchical layers. In other cases, the value of information generated at headquarters might be enhanced by making it available to operating managers in field locations. One of the important benefits of automated battlefield management systems for the U.S. Army, to note one example, is the ability to provide the same data to each battalion or brigade commander in a division nearly simultaneously, thereby providing a consistent view of the battlefield to each decisionmaker.

Information technology renders the tension between centralization and decentralization obsolete. Data can be placed at either or both headquarters and field locations in forms useful to decisionmakers at several levels. So a critical management task becomes deciding which data are needed at various organizational locations, how timely those data should be, and in what forms they would be most useful to the decisionmakers who will use them.

In some cases, centralization of data collected from branch offices may be useful. Data that have been filtered through several hierarchical layers are less useful because "bad news" is routinely filtered out of aggregate numbers and because the data are often outdated by the time reports reach headquarters staff. Information systems allow for objective data reduction and near-real-time transmission. Alternatively, if field personnel lack the information to make effective operational decisions, then agencies may benefit from decentralization of some data. When performance incentives are linked to control systems through shared information, the effect on performance is powerful and meaningful. Many managers perform suboptimally because they either are not fully aware of agency goals, lack the informational resources to make intelligent decisions, or lack motivation because their incentives fail to match their externally supplied objectives.[24]

Integration

Reengineering, a process redesign method widely attempted in the federal government, captures some of the coordination and integration capacities of information technology. It is limited, however, by several constraints. First, integration of production processes depends largely on the telecommunications infrastructure available to make integration feasible. Second, some skill in work design, management of change, and leadership is necessary both to design the integration and, more important, to implement it.

Integration is actually a broader, more powerful concept than business process redesign, or reengineering. It can be classified into four levels. First, integration can occur within the operational processes of an agency. This is

the typical application of reengineering in which teams are formed around one process linked by a local area network. Agencies have improved capacity greatly by breaking down barriers between functional areas and, more modestly, by reducing barriers between employee classifications. The increased ability to coordinate provided by information technologies makes the traditional need for narrow task specialization far less important.

Second, agencies have a growing ability to electronically integrate production that lies across organizational boundaries. This capacity greatly speeds the flow of information and services across organizations. The ability to integrate processes in this way relies on electronic data interchange. Organizational boundaries in information-based organizations are highly permeable with respect to these interorganizational arrangements. Third, agencies can subcontract and outsource larger pieces of production processes to other state and local governments, private firms, and nonprofit organizations. Information technology enables these arrangements by greatly reducing coordination costs, by standardizing data elements across sites, and by making communication easier across organizational boundaries. Finally, information technology has made electronic markets possible.

Each of the levels of integration reduces coordination costs and increases the effectiveness of coordination by eliminating the need for buffers—"inventories" of supplies, information, and expertise—and by pooling expertise.[25] The capacity to provide resources where they are needed when they are needed removes time lags (or wait times) and further reduces the need for buffers.

These four types of integration require a threshold level of information technology infrastructure in communications capacity, data standardization, applications software, and human expertise.[26] Major increases in capacity, coordination, and control as a result of integration still reside largely in the future and await sufficient infrastructure.[27]

The ability to integrate in various ways is changing and will continue to change the contours of government, the relation between competition and collaboration among actors, and government-business relations. To cite one example, the Internal Revenue Service has created the capacity to receive electronic filing of individual income tax returns prepared by tax preparation firms. The shift to electronic processing creates enormous efficiency gains within the IRS. Moreover, this integration creates opportunities for lending or borrowing approximately $70 billion, thereby driving a set of new opportunities among several actors in the financial services

business. This example also highlights the importance of the federal government's role with regard to setting standards because of the potential impact of federal decisions on the competitive structure of most industries.

Direction and Transformation

To understand the effect of information technology on capacity and control, the executive functions of direction and transformation must be considered. Direction involves sensing environmental occurrences, including changes that may affect a policy or program and public response to governmental action. It also involves interpretation of these data and decisionmaking designed to respond to feedback from the environment. The information technology systems involve strategic planning systems as well as systems to capture customer feedback.

The enormous potential of information technologies to both quantitatively and, more important, qualitatively improve and enlarge capacity should prompt agencies to rethink their missions. Many operational decisions are based on existing capacity. New capacities should prompt rethinking. Without direct competitive pressure, the federal government has an opportunity, but relatively little pressure some would say, to rethink its operations. However, I have argued elsewhere that citizens expect transactions with their government to be roughly as efficient as those with private sector organizations.[28]

Developments within information technology have spawned a progression in some organizations from automation to information to transformation. Automation has occurred, and continues to occur, as production costs are reduced by automating work formerly carried out by people. Automation of traditional paper processing is proceeding in the federal government but needs to progress much further. Tracking tools, scanners, and bar codes have greatly improved knowledge of the status of processes and shipments in agencies as disparate as the Immigration and Naturalization Service, which processes applications for residency and citizenship, and the Defense Industrial Supply Center of the Defense Logistics Agency, which processes purchasing requests from the military services. Those workers who are not replaced by technology require new skill sets to work closely with information technologies. Their work has become more abstract, less tactile, more mathematical, less heuristic.

The same technologies that potentially reduce production costs, however, also, in most cases, provide the capacity to capture and systematically

organize information as a by-product of the process. Shoshana Zuboff coined the term "informate" to denote this capacity created by information technology and, until recently, largely ignored by automation efforts.[29] Informating processes not only implies capturing and generating useful information but also requires human resources and new internal processes to make use of this new information. Both operating-level personnel and managers must modify their skill sets to recognize useful patterns, exceptions to patterns, and information that may be usefully transmitted to others.

Indeed, information generated by technologies used in government has spawned entire businesses. The Defense Department sells maps and other information collected by sensors, satellites, and related technologies. In other cases, information collected by the government, and paid for by taxpayers, is packaged and marketed by private firms. The amount of valuable information generated by the government will increase dramatically as information technologies are more fully exploited. The use of that information prompts a set of policy, procedural, and economic questions regarding markets for information.

The third and most ambitious step, transformation, refers to organizations' use of information technologies to build internal and external infrastructures for communication, information transfer, and more that have taken advantage of integrative and coordinative capacities provided by those infrastructural elements. In many cases, new services have been developed, the boundaries of the organization have effectively changed, and work has been substantially redesigned. This level and degree of change, however, has so far been relatively rare in the private as well as public sectors. Technology is a necessary but far from sufficient condition for substantial structural change and redirection. Transformation occurs as a result of several years of knowledgeable, effective executive leadership and investments in technology and human resources.

The potential effects of information technology on capacity, coordination, control, direction, and transformation hint at the potential of information technology to substantially redistribute power, functional responsibilities, and control within and across federal agencies and between the public and private sectors. As coordination costs continue to decline dramatically and economics of scale change through technology, the effects on institutional design will be felt. The "metabolic rate" of administration is increasing in rapidity and quality.[30] Both greater rapidity in information processing and greater interdependence require new administrative systems

to measure, reward, and motivate desired behaviors and new skills for operational employees, public managers, and appointed and elected officials.

There appear to be two chief requirements for using information technology to increase capacity, coordination, and control in public administration. The first is difficult: Implementation and use of systems must be optimized to support a set of goals. Agencies often must espouse vague, conflicting goals for political survival. No amount of rationalization, either through performance measures or new technologies, has altered this fundamental political reality. Increased rationalization of information technology is at odds with this political fact. Second, a threshold is crossed when information infrastructure is put into place, allowing for integration in data collection, management, communication, and retrieval. Both a technical infrastructure and a set of standards are required for a high level of coordination to be possible. The sheer scale of many federal operations, in addition to the balkanized culture that characterizes many agencies, creates considerable drag on infrastructure construction and interoperability.

Most agencies have constructed a rag-tag assortment of incompatible systems. Capital investments have been made, but to suboptimal effect. Information resource managers traditionally have held operational, rather than strategic, roles. It is in the domain of information resources management, particularly strategic management of technology, that public managers require development.

Conclusions and Broader Implications

I have presented evidence to argue for the development of a theory of information-based bureaucracy. The line of evidence also supports the second argument of this chapter, namely, that a useful starting point for theory already exists in bureaucratic theory. A series of underlying assumptions regarding the character of information processing require fundamental alteration if we are to understand current efforts to modernize bureaucracy.

Predictive theory is not important to develop at this juncture. First, such development would be premature. Second, this discussion has omitted critical intervening variables that strongly mediate any hypothetical direct effects of information technology on elements of bureaucracy. I have analyzed the role and importance of these intervening variables extensively in the technology enactment framework developed in *Building the Virtual*

State.[31] This chapter simplifies causal analysis to identify and focus on key independent variables that have been neglected by students of government. I have shown several of the enabling properties of information technology in relation to bureaucratic structure and practice but have presented a simplified version of technology enactment.

Weberian bureaucracy is the foundation of the modern state. Its chief properties–official jurisdictional areas, hierarchy, management by "files," and generalized rules–are affected in various and complex ways by the information revolution. It is insufficient, in fact it is inaccurate, to claim that bureaucracy is outmoded. Although greatly altered by changing information technology, each element of bureaucracy remains central.

For many students of government, "the bureaucracy" is a phrase synonymous with the civil service. The bureaucrat of the information age will require a vastly different set of skills and expertise. The structure of careers and mobility with the Civil Service has already been altered as a second-order consequence of changes in information technology. Similarly, the incentive structure and behavior of key groups within the bureaucracy—task forces, interagency working groups, committees, and the like—have been irrevocably altered, with implications for policy and politics.

Attention to the interorganizational level of analysis and the implications of technological change illuminates key phenomena. The level of contracting available to agencies is directly related to the technical means available to coordinate across jurisdictions. Recent emphasis on partnership also represents a form of coordination not available without current information technologies in place. The new public management emphasizes the economics of organization but requires additional attention to the economics of information to account for the explosive growth of partnerships and networks.

The perspective on capacity and control presented in this chapter provides a counterargument to critics of recent government reform efforts such as the National Performance Review. Absent an understanding of technological change and its effects on capacity and control, students of bureaucracy can make little sense of either the rhetoric or reality of changes in human relations, such as empowerment, increased employee discretion, and customer service. Rules embedded in hardware and software form a system of control unimaginable in paper-based systems. Discretion in an embedded rule regime is highly constrained.

Information technology affects production, coordination, and control—the nervous system of government. The breadth and importance of

these implications have yet to be fully appreciated by researchers or practitioners. Political scientists must develop a political economy of information that accounts for the effects and the enactment of new information and communication technologies.

A theory of information-based bureaucracy should account for stability as well as change in the form of organization that undergirds the modern state. Just as bureaucratic theory, like all theory, accretes through successive refinements, a theory to account for vast changes in the information-processing capacity of the bureaucracy will necessarily evolve during the next several decades. The features of information technology and bureaucracy outlined in this chapter present the basis for a research program to bring bureaucratic theory into the next century.

Notes

1. The argument developed in this chapter is presented in greater detail in Jane E. Fountain, *Building the Virtual State: Information Technology and Institutional Change* (Brookings, 2001).

2. Stephen Skowronek, *Building a New American State: The Expansion of National Administrative Capacities, 1877–1920* (Cambridge University Press, 1982).

3. Max Weber, *Economy and Society*, 2 vols., ed. Guenther Roth and Claus Wittich (University of California Press, 1978).

4. Hans Gerth and C. Wright Mills, eds., *From Max Weber: Essays in Sociology* (Oxford University Press, 1946).

5. Weber, *Economy and Society*, vol. 2., chap. 11, pp. 956–58.

6. This change is addressed later in the chapter.

7. Herbert A. Simon, "The Architecture of Complexity," *Proceedings of the American Philosophical Society*, vol. 106 (December 1962), pp. 467–82.

8. Harold J. Leavitt and Thomas L. Whisler, "Management in the 1980s," *Harvard Business Review* (November–December 1958), pp. 41–48.

9. Among those theorists who at least partially reject the idea of bureaucratic neutrality are Chester Barnard (*The Functions of the Executive* [Harvard University Press, 1948]), James March and Herbert Simon (*Organizations* [John Wiley, 1958]), Anthony Downs (*Inside Bureaucracy* [Boston: Little, Brown, 1967]), and Oliver E. Williamson (*The Economic Institutions of Capitalism* [Free Press, 1985]).

10. See the special issue "Critical Perspectives on Organizational Control," *Administrative Science Quarterly*, vol. 43, no. 2 (1998), especially John M. Jermier, "Introduction: Critical Perspectives on Organizational Control," pp. 235–56, and Graham Sewell, "The Discipline of Teams: The Control of Team-Based Industrial Work through Electronic and Peer Surveillance," pp. 397–428. See also Frederick M. Gordon, "Bureaucracy: Can We Do Better? We Can Do Worse," in Charles Heckscher and Anne Donnellon, eds., *The Post-Bureaucratic Organization: New Perspectives on Organizational Change* (Thousand Oaks, Calif.: Sage Publications, 1994).

11. See, for example, James Burnham, *The Managerial Revolution* (New York: John Day, 1941); William H. Whyte Jr., *The Organization Man* (Simon and Schuster, 1956).

12. Office of Technology Policy, Technology Administration, *America's New Deficit: The Shortage of Information Technology Workers* (U.S. Department of Commerce, Fall 1997).

13. Jane E. Fountain, "Social Capital: Its Relationship to Innovation in Science and Technology," *Science and Public Policy*, vol. 25, no. 2 (1998), pp. 103-15.

14. See James I. Cash Jr., Robert G. Eccles, Nitin Nohria, and Richard L. Nolan, *Building the Information-Based Organization: Structure, Control, and Information Technologies* (Boston: Irwin, 1994).

15. Gerald Garvey, "False Promises: The NPR in Historical Perspective," in Donald F. Kettl and John J. DiIulio Jr., eds., *Inside the Reinvention Machine: Appraising Governmental Reform* (Brookings, 1995), pp. 91, 87 (emphasis added).

16. Ibid., p. 88. I share concern regarding the customer service metaphor as a tool of government, but my critique differs from that of Garvey; see Jane E. Fountain, "Paradoxes of Public Sector Customer Service," *Governance*, vol. 14, no. 1 (2001), pp. 55-73.

17. Frederick Winslow Taylor, *Principles of Scientific Management* (1911; W. W. Norton, 1967).

18. For an extended analysis, see Skowronek, *Building a New American State*.

19. I am indebted to Joanne Yates, Michael Scott Morton, and other students of information technology and organization at the Massachusetts Institute of Technology for research and analysis, cited in the notes that follow, on the relationship between current information technology and earlier technologies. Michael S. Scott Morton, ed., *The Corporation of the 1990s: Information Technology and Organizational Transformation* (Oxford University Press, 1991).

20. Joanne Yates and Robert I. Benjamin, "The Past and Present as a Window on the Future," in Morton, *The Corporation of the 1990s*.

21. Fountain, *Building the Virtual State*.

22. Yates and Benjamin, "The Past and Present as a Window on the Future."

23. William J. Bruns and F. Warren McFarlan, "Information Technology Puts Power in Control Systems," *Harvard Business Review* (September–October 1987), pp. 89–96.

24. Ibid.

25. Michael Hammer and James Champy, *Reengineering the Corporation* (New York: Harper Business, 1993); Yates and Benjamin, "The Past and Present as a Window on the Future."

26. Regarding the convergence of intelligent transportation and the national information infrastructure, see, for example, Lewis Branscomb and James Keller, eds., *Converging Infrastructures* (MIT Press, 1996).

27. For similar examples at the state level of government, see Jane E. Fountain, with Carlos A. Osorio-Urzua, "Public Sector: First Stage of a Deep Transformation," in Robert Litan and Alice Rivlin, eds., *The Economic Payoff from the Internet Revolution* (Brookings, 2001).

28. Jane E. Fountain, Linda Kaboolian, Steven Kelman, and Jerry Mechling, "Summary, Findings, and Recommendation," in *Customer Service Excellence: Using Information*

Technologies to Improve Service Delivery in Government (Strategic Computing and Telecommunications in the Public Sector Program, John F. Kennedy School of Government, Harvard University, 1993).

29. Shoshana Zuboff, *In the Age of the Smart Machine: The Future of Work and Power* (Basic Books, 1984), p. 10.

30. Yates and Benjamin, "The Past and Present as a Window on the Future," p. 18.

31. Fountain, *Building the Virtual State.*