BUREAUCRACIES, BUREAUCRATS
AND TECHNOLOGY

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INTRODUCTION

Bureaucracy. The term is laden with negative connotations. One thinks of large, rigidified organizations with baroque, ritualized procedures incapable of adapting to changing needs and conditions in the environment. In mentioning the term bureaucracy one usually also speaks of its means of perpetuation: the professional bureaucrat. These are usually cast as unimaginative, plodding individuals socialized into the rule system of the bureaucracy to the point where the rules themselves, and not the purposes behind the rules, become the reason and guides of their employ. In recent years, another force has appeared which threatens to spread the phenomenon of bureaucracy even further; namely the implementation of these bureaucratic rules and procedures in the form of computer-based administrative systems.

The purpose of this paper is to review in somewhat more depth the nature and interaction of these three forces: the bureaucratic organization itself; the

bureaucrats that populate such organizations; and the special impact of information technology on their operation.

BUREAUCRATIC ORGANIZATIONS

The term "bureaucracy," as both a popular and scientific term, has come to have a variety of often overlapping definitions. As a starting point, consider the criteria proposed by Downs (1967; pp.24-25):

1. a large organization (e.g., where the highest official knows less than half the employees),
2. a majority of its members are full-time employees who depend on the organization for most of their income,
3. initial hiring of personnel, their promotion and retention is based at least partly on their performance in their organizational roles as opposed to, e.g., family connections, religion, etc., or being elected to the position by some outside constituency,
4. the major portion of its output is not directly or indirectly evaluated in any competitive markets.

It is this last characteristic which distinguishes bureaucracies from large profit-oriented organizations. Downs elaborates further:

> Unlike most other large organizations, bureaus are economically one-faced rather than two-faced. They face input markets where they buy the scarce resources they need to produce their outputs. But they face no economic markets whatever on the output side. Therefore, they have no direct way of evaluating their outputs in relation to the costs of the inputs used to make them. This inability is of profound importance in all aspects of bureaucratic behavior. ...

> Thus, for all practical purposes, there is a complete separation of each bureau's income from its expenditures. As a result, the bureau's ability to obtain income in a market cannot serve as an objective guide to the desirability of extending, maintaining, or contracting the level of expenditures it undertakes. Nor can it aid the bureau in determining how to use the resources it controls, or in appraising the performance of individual bureaucrats. In short, the major yardsticks for decisionmaking used by private nonbureaucratic firms are completely unavailable to men who run bureaus.

> This does not mean that no tests of efficiency whatsoever can

be devised for bureaucratic behavior. Nor does it mean that the tools of economics cannot be fruitfully applied to the allocation of resources within bureaus. Nevertheless, the inability of bureaus to rely on markets as objective indicators of output value affects their entire operation.

Following this definition, nearly all government agencies qualify as bureaucracies since few government services are sold in competitive markets. Also included are other non-profit organizations such as private foundations, educational and religious institutions, provided they satisfy the other three criteria of large size, paid employment and evaluation of performance. Under this definition, bureaucracy is not only widespread but also increasing. In European in particular the increasing trend towards socialism is putting more more and more services under bureaucratic control--e.g. socialized medicine, social insurance, post, electronic communications, energy production, etc. Moreover, in the soviet countries, bureaucracy seems to have long since become an entrenched facet of the society; witness Trotsky's comment back in 1936:

> [According to the party program, the state as a bureaucratic apparatus was to begin withering away on the very first day of proletarian dictatorship.] "This is what the Party program says: and it has still not been canceled. Strange: it sounds like a voice of a ghost from out of the mausoleum....Bureaucracy has not only refused to disappear, as it could have done by entrusting its role to the masses, but is has become an uncontrolled power which dominates the people." from *The Revolution Betrayed*, quoted in Abrahamsson, 1977, p.46).

Even in such supposed bastions of capitalism as the U.S. bureaucracy appears to be steadily growing. Downs (1967, pp.32:34) cites a number of factors. One is the case of consumer goods with large "external" costs or benefits. An external cost or benefit is one not reflected in good's free market price—for instance, the smog created by automobile exhaust, or non-biodegradable detergents which pollute rivers. The point is that market mechanisms do not take

these external costs into account in selecting an equilibrium consumption level. To compensate for these inadequacies, a bureaucracy is often created.

Another case where a free market mechanism does not operate well is with so-called "collective goods." These are goods with indivisible benefits; once the good exists, everyone benefits whether or not they have paid their share. An example is national defense. In a free market, each person is motivated to avoid paying his/her part; since everyone makes this assumption, the collective good is not acquired. Again, to avoid this pathology of the market system, control of such goods is given over to a bureaucracy.

A somewhat related situation arises in certain industries such as oil production or telephone services where economies of scale or patent controls create strong monopolistic tendencies. In order to protect the consumer from unfair pricing, two options have been employed, both bureaucratic. One, is to nationalize the entire industry into a governmental agency. Examples are PEMEX, Mexico's national oil company and the various PTT's in European countries. The other alternative, effectively only slightly different, is to create a governmental regulatory agency to control the monopoly's behavior, e.g., the FTC and FCC in the U.S.

Other motivations for the creation of bureaucracies in capitalist or socialist countries are such common social functions as poverty programs, judicial systems and monitoring of the government itself.

In a now classic study, the sociologist Max Weber (1956/1978), observed another important aspect of bureaucracies. To Weber, the process of bureaucratization is a shift from organizational management based on the interests and personalities of specific individuals, to one based on explicit *rules* and procedures. These rules and procedures are identified with *roles* in the organization rather than individual people. Bureaucratic organizations thus take on an

impersonal, mechanical character. To Weber, this is a positive development leading to greater effectiveness and efficiency:

> Bureaucracy develops the more perfectly, the more it is "dehumanized," the more completely it succeeds in eliminating from official business love, hatred, and all purely personal, irrational, and emotional elements which escape calculation [Weber 1956/1978:975].

Weber however also recognized that the very success of such a bureaucracy is one of its dangers--namely that it becomes an immovable power in the society:

> Once fully established, bureaucracy is among those social structure which are hardest to destroy. Bureaucracy is *the* means of transforming social action into rationally organized action... the ruled, for their part, cannot dispense with or replace the bureaucratic apparatus once it exists, for it rests upon expert training, a functional specialization of work, and an attitude set on habitual virtuosity in the mastery of single yet methodically integrated functions...
>
> Such an apparatus makes "revolution," in the sense of forceful creation of entirely new formations of authority, more and more impossible--technically, because of its control over the modern means of communication (telegraph, etc.), and also because of its increasingly rationalized inner structure [Weber 1956/1978:987-989].

Weber's usage of "bureaucracy" is slightly different than the one introduced above; namely, it is a "rationalized" organization which, presumably, may or may not compete in an open market.

However, it is generally observed that bureaucracies in the first, non-competitive sense tend to be even more rationalized and rule-bound than their competitive counterparts. Michael Dempster (1980) suggested a possible explanation for this. In a competitive environment, the organization is more likely to be put in situations where it must either change or die. The prescription of the organization's operations in terms of formal rules and procedures seems to be at odds with its ability to change. Thus, overly rule-bound organizations tend to be weeded out by a process of competitive selection.

Bureaucracies, on the other hand, are (by the first definition) immune from this type of competitive threat, and so their rules and procedures may persist, even to the point of ritualization. This presents an interesting anomaly. Bureaucracies presumably seek to rationalize their operations for reasons of efficiency and uniformity of policy. However, this very effort at efficiency may, after time, become a serious pathology of the bureaucracy.

Another suggestive point was also raised, namely that formalization of operations and organizational adaptability *seem* to be conflicting principles. The key question is whether this is an inherent property of systems of rules and procedures *per se*, or whether certain sociological factors involving the personalities in the organization also play a part. This leads to the second aspect of bureaucracies to be examined here, the bureaucrat.

THE BUREAUCRATIC PERSONALITY

Seldom are bureaucracies discussed without considering the role played by the people who staff them. Weber for instance remarks:

> the professional bureaucrat is chained to his activity in his entire economic and ideological existence. In the great majority of cases he is only a small cog in a ceaselessly moving mechanism which prescribes to him an essentially fixed routine of march [Weber 1956/1978:988].

A bureaucrat, unlike many other vocations, is heavily socialized and hence psychologically dependent on his/her active role in the organization. Bureaucracies such as have been described generally only arise in large organizations and then usually only a fairly long period of adjustment and stabilization. Thus the activities of a bureaucrat are not only explicitly prescribed, but their full extent and interplay with other parts of the organization is also complex and difficult to learn. The bureaucrat therefore becomes an expert in his/her role in

the *particular* organization. This is for instance quite different from profession-
als or trade workers whose specialities are generally transferable to other
organizations.

A bureaucrat's training is thus peculiar to his/her organization; which
makes it unsurprising that these people cling tenaciously to their positions,
building defenses and guarding informational resources to make their positions
more secure.

This, I think, is one of the primarily reasons why bureaucracies are so per-
sistent. Indeed, they survive even national revolutions. For instance, speaking
about the post-revolutionary period in Russia, Lenin complained:

> [During the revolutionary upheavals, the bureaucrats from
> the Tsaristic time had been shaken up and placed in new
> posts. But they did not remain there. They tried to regain
> their old positions.] The Tsarist bureaucrats began to enter
> the Soviet institutions and practice their bureaucratic
> methods, they began to assume the coloring of communists
> and, for greater success in their careers, to procure member-
> ship cards of the Russian Communist Party. And so, having
> been thrown out of the door, they fly in through the window!
> (Lenin, *Selected Works*, Vol VIII:353, quoted in [Abrahamsson
> 1977:41-42]).

Another important aspect concerning the motivations of bureaucrats to
hold onto their positions was brought out by Trotsky, again based on observa-
tions of the Soviet governmental bureaucracy:

> Bureaucracy owns neither shares nor state bonds. It is
> recruited, replenished, and renewed as an administrative
> hierarchy, independently of property relationships. The indi-
> vidual bureaucrat cannot transfer the right to exploit the
> state apparatus to his heirs. Bureaucracy enjoys its
> privileges in the form of power abuse (Trotsky, *The Revolution
> Betrayed*, pp. 179-180; quoted in Abrahamsson, 1977:46).

This last observation is interesting in light of the remarks by Weber earlier.
Weber views the process of bureaucratization as tending towards operations
based on impartial rules and procedures rather than personalities and personal

motives.

But, as the Trotksy quote suggests, one of the pathologies of mature bureaucracies is practically the reverse. Because bureaucrats become so wedded to their roles, they not only depend on them psychologically but also tend to re-interpret them to satisfy their own personal ends. Portugal, a situation I know to some degree personally, is another example of a large government bureaucracy which survived a national revolution. There the above mentioned pathology of bureaucracy even has a name: "cunha" ('coon-ya'). Cunha is the informal system for getting things done in the bureaucracy based on who you know, trading of favors, etc. In Portugal, and I suspect elsewhere, it is amazingly well developed and in many cases effectively invalidates the formal rule structure.

I am sure similar informal systems exist in other large bureaucracies to a greater or lesser degree.

I point this out because such "cunha" systems may in certain cases be the real barrier to improvement of the bureaucracy. The fundamental difficulty of this is that because it consists for the most part of quasi- or illegal actions on the part of its participants— hence a source of potential embarrassment—it is generally kept secret.

INFORMATION TECHNOLOGY IN BUREAUCRACIES

Bureaucrats are no longer the only active force in bureaucracies. Whereas a bureaucrat is trained and socialized to follow prescribed procedures, a computer can likewise be programmed to follow many of these same procedures.

Indeed, the computerization of a bureaucratic process is the ultimate form of organizational rationalization. The computer is the archetype of Weber's

dictum to eliminate "love, hatred and all purely personal, irrational and emotional elements" from the organization's procedures.

Yet while computers presumably help remove the undesirable caprice of bureaucrats themselves, they nonetheless have become symbols of pathological bureaucratic rigidity. We are all acquainted with the agonies of trying to rectify a computer based billing error, etc.

But is this really because the computerization of such process actually makes them less adaptive, or is it rather that computers provide a convenient scapegoat for organizational incompetence? Systems analysts will often argue that the latter is the case. While I think this is to some extent true, it is as well true that computerization, at least in its most prevalent forms, does add to inflexibility. This stems from two interrelated problems.

The first is one of organizational responsibility: The people that use the computer programs are very seldom the ones that write them. Thus the people that are close to the problem and able to recognize needed modifications as they arise, must request the assistance of a programmer, who typically resides in a different (data processing) department. This problem has been widely recognized and is often cited as a motivation for localized (microprocessor) computing and associated high level languages that the functional departments themselves can control; see e.g., Fick (1980).

However, this is likely to be only a partial solution, applicable only to those procedures that are modular and separable to individual departments. The problem still would remain as to the management of procedures that pervade large segments of the organization, especially where these are complex and interdependent.

The second source of inflexibility arising from computerization arises, I contend, from the character of the computer languages used to describe these

procedures. The basic problem is that current programming practice forces logical designs whose pieces are highly interdependent.

Winograd (1979) for instance observes:

> Using current programming techniques, systems often reach a point at which the accretion of changes makes their structure so baroque and opaque that further changes are impossible, and the performance of the system is irreversibly degraded.

The resistance of computer based information systems to subsequent modification is one aspect of the current "software crisis" gaining increased attention in the computer science literature.

One way of viewing this problem is as a trade-off between "procedural" vs "declarative" representations of knowledge (see Lee 1980, for more detail). Briefly, procedural design makes use of a rigidly controlled sequence of steps, each of which defines a narrow context of focus and therefore can make use of specialized rules of interpretation. Declarative representations, on the other hand, attempt to avoid such sequential dependence and seek to develop general rules of interpretation. This latter approach is conceptually much more difficult but, once achieved, offers much greater flexibility for further modifications.

Another advantage of this type of software architecture is that it allows the specification of so-called "heuristics," i.e., rules that may not work in all cases. Thus, for instance, a computer program confronted with a particular problem may try to resolve it using one set of heuristic rules; if those do not work, other rules are tried, etc.

Example applications of programs of this sort have been chess playing programs, programs to find mathematical proofs, etc.

In such systems, there may in fact be multiple ways to solve a given problem (or none at all); and it is the job of the program to find a satisfactory solu-

tion as quickly as possible. Because the program must search through a number of potentially feasible alternatives for each problem, rather than having a single solution technique pre-selected, these systems are considerably less efficient, though correspondingly more flexible in dealing with highly varied situations.

The trade-off between procedural vs. declarative designs for programming languages is as yet still an issue for research, and it will be some time before computer languages supporting declarative rule representations come into commercial use.

Beyond these technical issues, however, the similarity between the resistance to change in large computer systems and large scale bureaucracies is, in itself provocative. What I want to suggest is that not only do computers offer a new *medium* for representing bureaucratic rules and procedures, but also as mechanical systems based on rules and procedures, the issues in programming language architecture offer a useful *model* for considering the problems of bureaucracies. That is, the issues currently under study for the design of computer programs might offer a new interpretation of the problems in designing bureaucratic rules and procedures, quite apart from computer implementations.

The suggestion here is that an analogous procedural/declarative trade-off exists for the design of bureaucratic procedures. The organization becomes more efficient, the more its operations become proceduralized. However, to be flexible, these rules must be in a form that they may be easily examined and modified without affecting other aspects of the bureaucracy's operations. Furthermore, the flexibility of a given bureaucratic policy might be enhanced by regarding it as a sort of heuristics for accomplishing a certain goal, rather than as a single deterministic rule. This is implicit in the so-called "management by

objectives'' approach to administration: instructions to subordinates are given in the form of goals to be attained rather than procedures. The employees are then given the freedom to devise their own mans for reaching these ends.

The value of computer language representations as a model for the study of bureaucracies is at this stage only conjectural. The comparison does however help to isolate one important facet of bureaucratic design, namely the structure of the bureaucracy's rule system. This aspect is generally submerged amidst the many inter-personal and political factors that operate in bureaucracies.

SUMMARY

Bureaucracies were viewed as large organizations lacking competitive pressures and performance incentives. They are economically one-sided with measurable inputs and largely non-measurable outputs. They have a tendency towards increased rationalization and formalization of their operations that is seldom if ever reversed by shocks from the market place.

Bureaucrats are employees bred into these organizations. They have become socialized into its rules and procedures and have a personal interest in its continued stability. This is a major factor contributing to the reluctance and inability of bureaucracies to adapt to new circumstances.

Information technology, as currently applied, tends to further re-inforce the tendency to stability, indeed, rigidity of the bureaucratic rule system.

Bureaucracies, then, have multiple factors contributing to their stable continuance and resistance to change. Sometimes, when a bureaucracy's service becomes so outmoded as to have doubtful social benefit, it is successfully abolished or reduced by a budget cut. The more serious problem is, however, with bureaucracies that control an obviously necessary social function (e.g., postal

service, army), but fail to improve or adapt their services to changing needs. They continue on as before, often despite efforts by elected leaders to change them. (Witness how many campaigning politicians promise to trim the bureaucratic fat, and how few actually succeed.)

The central research issue is whether an alternative design for bureaucracies can be found which does not lead to irreversible rigidity. The suggestion here was that certain representation issues in the design of computer languages may provide new insights. In particular was the possibility of representing the bureaucracy's policy in the form of independent, declarative rules which can be analyzed and modified gradually, rather than requiring a complete reorganization.

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