James D. Thompson

On Building an Administrative Science

The unique contribution of science lies in its combination of deductive and inductive methods for the development of reliable knowledge. The methodological problems of the basic sciences are shared by the applied fields. Administrative science will demand a focus on relationships, the use of abstract concepts, and the development of operational definitions. Applied sciences have the further need for criteria of measurement and evaluation. Present abstract concepts of administrative processes must be operationalized and new ones developed or borrowed from the basic social sciences. Available knowledge in scattered sources needs to be assembled and analyzed. Research must go beyond description and must be reflected against theory. It must study the obvious as well as the unknown. The pressure for immediately applicable results must be reduced.

The author is a member of the faculty of the Graduate School of Business and Public Administration, Cornell University.[1]

THE issue of science versus art for administration seems to be vanishing with the realization that one approach does not rule out the other. The art of the surgeon, to take a parallel case, is supported by the medical sciences; the art of the engineer by the physical sciences. It is widely recognized that there is an element

[1]The author is indebted to William J. McEwen of the same faculty for helpful comments.

of art in administration; the possibility of a science of administration is only now coming to be taken seriously. Nevertheless, the sole assumption required for the application of scientific methods to the subject of administration is now generally accepted. That assumption—that regularities can be identified in the phenomena under consideration—is the basis of every attempt to train people for administrative roles.

If every administrative action, and every outcome of such action, is entirely unique, then there can be no transferable knowledge or understanding of administration. If, on the other hand, knowledge of at least some aspects of administrative processes is transferable, then those methods which have proved most useful in gaining reliable knowledge in other areas would also seem to be appropriate for adding to our knowledge of administration.

It is no longer a ridiculous idea that regularities can be found in human behavior. Previous impressions to that effect stemmed more from inability to perceive regularities than from their absence. Those who assert that human behavior cannot be studied scientifically often speak of such regularities as staff-and-line conflict. There is now every reason to believe that an administrative science can be built, although the building will not be easy.

An administrative science will be an applied science, standing approximately in relation to the basic social sciences as engineering stands with respect to the physical sciences, or as medicine to the biological.[2] There is an element of art in the practice of medicine and engineering, but in both instances the development of supporting sciences has reduced the element of luck or chance by providing tested bases for judgment. The less gifted practitioners of medicine and engineering are more effective than their counterparts a generation ago precisely because there is a greater store of scientific knowledge for them to draw upon. For the same reason the more creative physicians and engineers are able to accomplish things which their creative forerunners would consider miracles. The dividing line between "art" and "science" is not a fixed one but is constantly changing. The art of the engineer, the physician

[2]This is, of course, an oversimplification. Medical practitioners, for example, have incorporated knowledge from the physical as well as from the biological sciences, and more recently, they have paid increasing attention to the social sciences.

or surgeon, or the administrator, gradually improves, that is, it becomes more effective in terms of his aim, as the sciences behind him find new relationships and explore their ramifications.

If the term "science" is not merely a synonym for "knowledge," the distinction lies in the methods by which scientific knowledge is amassed. The distinguishing contribution of the sciences seems to lie not in measurement, not in quantification or statistics, not even in laboratory experimentation, but in the combination of both deductive and inductive techniques for the development of logical, abstract, tested systems of thought. Achievements in the physical and biological sciences, and in their sister applied sciences, have demonstrated most convincingly the practical value of theory —theory which is repeatedly tested against experience and modified accordingly. A science of administration will be distinguished from administrative lore by the methods used to build that knowledge of administration.

The methodological problems found in the basic sciences are shared by the applied fields. Several schools of thought are embraced by the discipline known as philosophy of science, and it would be presumptuous here to try to describe completely the methods of science. But several characteristics of the methods of science are well established and carry implications for the direction of effort for students of administration.

The major achievement of science—the successful blending of inductive and deductive, or theoretical and empirical approaches—is accomplished under the following minimum set of circumstances:

First, a *focus on relationships.* While description and measurement are basic techniques in science, their importance lies in obtaining greater precision in the statement of relationships among phenomena under stated conditions. The biologist views an organism as a system or a set of related and interdependent parts, and the astronomer understands the solar system as a set of celestial bodies in relationship to one another. Scientific theories are simplified models of relationships, which appear to account for experience.

A second important characteristic of the scientific approach is *the use of abstract concepts.* Science involves deliberate attempts to simplify understanding of relationships through use of abstract

concepts which permit generalization. An important indication of success in science is the number and range of "concrete" events which one set of concepts can "explain." Moving away from the concreteness of specific cases permits discovery of relationships which hold in numerous cases and is thus an important step in generalizing. This was a major advantage of Einstein's famous formula, $E = mc^2$. The scientific method requires the discarding of concepts limited to particular geographical areas or particular times and their replacement by others.

The development of operational definitions is another major characteristic of the scientific approach. If concepts are not to remain sterile or forever debatable, they must be bridged to "raw experience." Science requires that concepts be defined by a series of operations which permit the sensory perception and identification of the phenomena referred to by those concepts. Operational definitions make possible independent repetition of observations by scientists in many places and at many times.

How does the field of administration measure up against these requirements?

Much of our literature is lore, spelling out how a procedure or technique is carried out in current practice or proclaiming that "this is the way" to do it. This material contains rather bold and often implicit assumptions about the relationships between the procedure or technique under consideration and other things which take place within the organization. This type of literature frequently asserts that a certain device is proper, i.e., gets desired results, on the grounds that "General Motors has it" or that the one hundred "best-managed" companies use it. But a particular budgeting procedure, for example, may be appropriate for General Motors and not for Company X, and it may be appropriate for General Motors in 1956 but less appropriate in 1960. Any particular item, that is, may show a high correlation with "success" when imbedded in one context but show a low correlation in a different context. A particular budgeting procedure thus may be effective when accompanied by a particular communication system, a particular style of leadership, a particular structure of authority and responsibility, and so on. It is the configuration of these items—the relationships between them—which produces a desirable result.

With respect to concepts, the literature of administration ranges from the very abstract to the extremely concrete, but seldom are the two related. Despite the many discussions, for example, of the works of Chester Barnard, Henri Fayol, Mary Parker Follet, Herbert Simon, Lyndall Urwick, and others, their concepts and propositions have been little tested in research. On the other hand, much research into administrative problems has been organized around *ad hoc* hypotheses with little attention being given the place, if any, of these concepts in more general theory. Many of our concepts are appropriate to one cultural setting but not to others, to one type of administrative enterprise but not to others, to one hierarchical level but not to others.

Scientific talents, like administrative talents, are scarce; there are great economies to be gained through the use of concepts which can be applied to administration wherever administration occurs. The development of an administrative science will be hobbled until we find concepts applicable to a variety of administrative levels so that, for example, scientific knowledge of phenomena at supervisory levels can feed into understanding of events at higher levels, and vice versa, or until we develop concepts which will permit confirmation in, say, the hospital setting, of relationships observed in a business or military organization.

Concepts appropriate for these purposes must be rather abstract, although they may well be accompanied by less abstract concepts which serve as a bridge to concrete "reality" in specific settings. For example, a focus on profit as a major objective of the administrator immediately separates profit-making organizations from other types, unless at the same time we move upward in abstraction —perhaps to think of the administrator as employing resources in pursuit of objectives, with profit as a specific manifestation of objectives in one type of organization, and with healed patients as a specific type of objective in another type of organization.

The more abstract scheme permits the simultaneous gathering, in many kinds of organizations, of data about the use of resources in the pursuit of objectives. It therefore encompasses a much larger number of people who may make valuable contributions.

Because administrative research has been relatively divorced from administrative theory, few of our abstract concepts have been

operationalized, while those concepts which have been used in research seldom permit generalization. Empirical observations are thus difficult to reflect against theoretical systems, and we are not able to design research projects out of those systems. Administrative science cannot progress very far until we have convertibility of "symbolic currency."

The above are some of the problems which face any science, basic or applied. But in the applied fields one problem stands out as particularly important and universally bothersome. This is the question of criteria or indexes for objective measurement and for selection of alternatives.[3] How are we to determine the effects of a particular relationship among a set of variables? Moreover, how are we to determine that one relationship yields a more "desirable" net effect than another relationship?

In their purest forms, the basic sciences can be as well served by a negative finding as by a positive one. Their models or theories approach neutrality, and all findings are welcomed. But the models of the applied sciences, implicitly or by design, are focused on achievement, utility, or service values. The medical sciences, for example, focus on preserving the human organism and maintaining its "proper" functioning. The engineering sciences have other pragmatic values for application. Because the values employed in those fields are also so widely held by others in our society, we tend to forget that they are value criteria. But the issue is pointed up in medicine occasionally by, for example, the question of "mercy deaths"; the engineer runs into a similar issue when he attempts to apply his science in areas where religious or other values are held in higher esteem than are the pragmatic values of engineering.

The basic scientist may open a new direction for research and theory if he finds that a certain relationship between *A* and *B* leads to *C*. The same discovery may also open up a new area for the applied scientist—but not necessarily the same area. For application it is not enough to know that *A* and *B*, in a specific relationship, lead to *C*. We must determine, in addition, two things:

[3]Distinctions between basic and applied sciences are distinctions of degree rather than kind, and this discussion necessarily is oversimplified. The problems found in one area of science appear also in other areas of science, but the emphases may be different.

(1) What *else* does this relationship between *A* and *B* bring about? It is not enough to know that penicillin fights bacteria in the human organism, for in some organisms the introduction of penicillin may also have harmful aftereffects. The same sales or profit targets may be achieved under either a "divisional" or "functional" type of organization, but one may have higher "costs" in the long run through, for example, higher labor turnover. An executive incentive system may bring about increased effort, but this may also glue executives' attention to the short run at the expense of next year's operations.

(2) What else leads to *C*? The *AB* relationship brings about *C* at some "costs," and there may be other ways of arriving at *C* with less expense. Until the array of alternative means and their "costs" is known, selection from among possibilities is difficult.

The criterion problem is a tough one for any applied science, for the relationships involved in "real life" usually are quite complex and are not subject to the same high degree of control which can be maintained in the laboratory. The laboratory scientist, and the abstract theory builder, can work with "other things being equal." But when a vaccine, for example, is taken out of the laboratory and used on human beings who have had virus as well as those who have not, on children who have runny noses and those who have not, on some who are anemic or have already been exposed to a disease, and so on—here the applied scientist is not as certain as he was in the laboratory. He no longer has "other things equal."

Because of this complexity in our phenomena, adequate measurement is difficult. How, for example, can we learn to measure the effects—or even the major effects—of the introduction of a new organization chart, or a particular committee arrangement?

The development of criteria will be difficult, requiring considerable research time and money, but it does not appear impossible. Important contributions have been made during the last decade, particularly in research supported by the military establishment, and more will undoubtedly be forthcoming from other sources. But because of the difficulty of establishing criteria and the consequent research required, it is extremely important that theories be developed which predict the consequences of various admin-

istrative actions. Generally speaking, the more advanced the theory, the less the research effort required to determine the major relationships. This is one sense in which theory is a most practical matter.

If these observations have validity, what directions do they point to for the development of an administrative science?

Of immediate importance is the area of concepts. The abstract concepts already at hand must be operationalized where possible, or revised and then made operational. New concepts will have to be developed or they may need to be incorporated from related sciences. The basic social sciences have been wrestling with concepts for some time and have been operationally defining them. While they offer jargon they also offer concepts which promise to be highly useful in the study of administration.[4]

To the extent that useful ideas have been developed in these related fields, it would be folly to ignore them. At the same time, however, administrative science will have to develop some of its own concepts and refine those it borrows. This will not be accomplished quickly, and it will require the presence of abstract thinkers or conceptualizers, as well as research-oriented scientists. We have perhaps been more successful in developing people who *use* abstract notions (i.e., "competition brings better service, lower prices") than we have in developing people who *think* at highly abstract levels. Moreover, systems of logic for relating these abstract concepts are as urgently needed as the concepts themselves. In the physical sciences the service of mathematics for this purpose is obvious. Mathematics has not yet demonstrated equal power in the social science area, although new forms of mathematics may be developed for this purpose in the future. In any event, one or more systems of logic must be developed before administrative science can mature. How much confidence can we have in it? How far can we generalize from it? Current knowledge of administration is not sufficiently organized. This is due in part to the need to develop more comprehensive theory.

[4]The high incidence of jargon in these fields, incidentally, probably springs largely from the fact that social scientists have been wrestling with conceptual problems for some time. It would seem that this is a stage any science must go through. The biological and physical sciences have this behind them for the most part.

At the same time, we need to explore the empirical findings in the social sciences which may be pertinent and, when necessary, to translate these into administrative situations, at least hypothetically. Basic discoveries in the biological and physical sciences are incorporated at applied levels with impressive speed. Effective channels have been built for funneling new knowledge into medicine and engineering. By contrast, administration is relatively isolated from the basic social sciences.

A third major need is redirection and renewed emphasis on research. Too much of our research effort has gone into the compilation of incidents or examples which support particular points of view, and far too little effort has been directed toward testing such points of view. It is vital that we seek out those incidents or cases which do *not* fit, for this is the only sure way of finding those points at which theory needs revision.

A trend toward empirical research is encouraging, but we must not rest with pure description. Description is necessary but it is only one step in building a science. Nor is the testing of "free-floating" hypotheses an economical way to approach our problems. Testable hypotheses which will link abstract notions with empirical data are urgently needed.

The pressure for immediately applicable research results must be removed from a large part of our research. It is this pressure which, in part, leads to the formulation of common-sense hypotheses framed at low levels of abstraction, without regard for general theory. The focus of attention on results with immediate utility limits thought and perception and thereby reduces the ultimate contributions of the research to administrative science. Moreover, the search for the immediately useful often leads to the application of ideas whose unintended and unrecognized costs may be greater than their positive contributions. Research not carried out under pressure for immediate results is more likely to seek out all major consequences of an idea or practice.

Research for an administrative science must be directed at the "obvious" as well as at the "unknown." Attention tends to be caught by those items of our experience which are not usual, expected, or obvious. Those activities or procedures within administrative practices which "work perfectly well" are seldom noticed.

Yet if they are analyzed and described in abstract, theoretical terms, they may well form the backbone of a comprehensive theory which will help immensely in discovering other, currently unknown, relationships. It was through understanding of the known elements that the construction of the periodic table was possible, and this in turn permitted chemists to predict the existence of unknown elements, some of which are only now being found. An administrative science must explain the obvious as well as the rare or difficult relationships.

Surveys showing "how things are done" have their place in an administrative science, but much more needs to be done along the lines of "what happens if." All possible combinations and permutations need to be explored, and the current "best practice" must be examined *critically*. This kind of research is not easily or quickly done. An administrative science must attract talented people and provide them with resources. Sponsors with patience as well as funds must be found. The quality of patience is also of much advantage to those actively engaged in the building of an administrative science. Answers to questions of administration are more likely to come by increment than by the master stroke of one research project, and this requires a research sequence with each piece building on the knowledge gained before.