# Science and Management Techniques

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The thoughts presented here had their origin in an insightful remark made by a drain maintenance specialist in our laboratory. He noted that research scientists spend much of their time in the library just reading magazines.

It is our public duty as scientists to see that for every research dollar spent, the public receives a dollar's worth of results. Hence the widely accepted conclusion that the management of our affairs needs much more careful scrutiny and control than in the past. Since scientists engaged in research are, as a group, somewhat less responsive to newer management techniques than other citizens appear to be, it might be well for the scientific community to ponder and profit from the management successes that have occurred in other creative fields. I am deeply indebted to the Office of Management Resources for permission to share with the reader portions of a recent study, OMR-CY 54-8-095, which earned a commendation at the Secretaries level for thoroughness and originality. Its lessons should be the subject of introspection for all of us.

Briefly, the problem that gave rise to the report was this: The symphony orchestra of one of our largest cities was found to be non–cost effective. Since 37 different agencies contributed in various ways to the support of this organization, the duties and responsibilities of the government were clear, and a 38th agency was assigned to investigate the case. With remarkable sensitivity to the nuances of such a difficult problem, and with due respect to the rights of minority groups, it was decided to appoint a member of a group not previously given sufficient recognition—the totally deaf. The investigator appointed was therefore less subject to bothersome auditory distractions. His study is remarkable for its insight and clarity, and I can do no better than to quote from it directly.

"It took only the most casual observation to discover that, while musicians are paid in full for their time, they do not play all of the time. The fault is partly in the choice of music. Using a simple computer program, it was possible to score musical programs for degree of involvement for each player and to choose programs on this basis. This has resulted in a Musician Participation Improvement Program that should be more widely adopted. It will be administered through the newly created Office of Participation Improvement, which has a skeleton staff of 148.

"Closer analysis of musical scores, however, revealed that many composers considered a full orchestra unnecessary and therefore obviously wasteful. By selecting works scored for smaller groups, very large savings are possible. While there has been disagreement concerning what should be retained, clearly some reduction in staff is in order.

"There appears to be little evidence of modern technology and of modern management principles in our orchestras. The piccolo clearly needs to be redesigned, and no attempts appear to have been made to improve violin design since the last century. However, the most immediate improvements are to be had by applying modern management expertise to orchestral direction. As is well known in military command circles, no one can direct 100 people effectively except through subordinates. On the average, one man can interact effectively with only five or six people. Clearly, subdirectors are required, and at least one should be appointed in each section to stand and receive instructions from the conductor and pass them on through the command chain to the performers. In this way responsibilities can be more clearly fixed and goals and tasks assigned.

"I have also found that communication within the orchestra is deficient. Some portion of each performance should therefore be set aside for discussion to improve the flow of organizational information and to allow subdirectors, through probing questions, to see if instructions and goals are understood. Much improvement is also to be made through standardization. For example, different conductors take different lengths of time to perform the same works. In addition, there is much repetition, and I can find no useful purpose for it whatsoever.

"However, the most glaring defect is in the reporting system. It is astounding to discover that *no* reports are written—weekly, monthly, triannually, semiannually, or annually. It is my own view that this is clearly the heart of the problem. All sorts of advance notice, programs of intent, and so forth are given, but there is little evidence on file of solid performance. Continued government support should not be provided in its absence.

"The matter of training and education has also been examined. There simply are not enough positions available to justify musical education on the scale now practiced. Only four or five replacements per year are needed, yet most orchestra members train literally dozens of students. The wastes here are staggering, and training should clearly be restricted. Further, little attention is given to the balance between instruments taught and requirements. Most instruction is in piano—an instrument often omitted from concerts entirely. And when one is used, it is almost always played by an outsider who busies himself serving many different orchestras. This policy of manpower sharing should be more widely adopted, especially as regards performers needed only occasionally, such as harpists.

"There is one specialty that appears to be in short supply, however, and that therefore demands a high salary, which contributes greatly to cost. This specialty is conducting. Of all performers, the conductor is the most vigorous, and he is the only one who performs constantly. The basic reason that there are few conductors is that there are no good texts on this vocation. Training programs should therefore be encouraged and should teach the essentials in this field once they have been catalogued. That will take some time, however. For the present, we need new and innovative solutions such as the one I propose here. Time-motion and eye-movement studies confirm my observation that conductors are able to fix visually different performers

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at precisely defined times and then make sweeping gestures in their direction. In a previous study, I found that successful quarterbacks do the same thing, singling one player out of many after a precise number of counts and, with a precise overhand motion, projecting a score object in that player's direction. Since plots of quarterback and conductor ages show little overlap, it is evident that one could quite successfully become the other. This concept, called Sequential Career Commonality Utilization, is now being applied in many other fields, and the Sequential Career Commonality Utilization Branch is slated to achieve bureau status in a few years. The greatest breakthrough achieved by this branch was the finding of politician–night watchman commonalities, such as random walking, peering into darkness, and lack of a requirement for intelligent conversation, suggesting that either could serve as the other.

"Modesty forbids that I dwell too long on my final point, but I cannot omit mentioning the question most often asked me: 'What accounts for your unbroken string of successes and innovations?' My success is, I believe, due to my advantage of the broader view, of seeing how it all fits together, of knowing, if you will, the grand design. Knowing the game plan keeps one from reinventing the wheel, lets one leave the sinking ship, and lets one hit a home run without dropping the whole ball of wax, no matter how the cookie crumbles at any point in time. That's really the secret. The narrow, non–management trained specialist should be on tap, but never on top."

It is my deep pleasure to be able to share these insights with the readership of *Science*. It is easy to see how well this type of analysis and management skill applies to research management. I am, again, indebted to the Office of Management Resources for permission to reprint the above quotation.

**NEWS AND COMMENT**

# Congress: A Big Agenda—Can They Cope with It All?

When the 93rd Congress convened a year ago, President Nixon was riding the crest of his reelection wave and Congress was in disarray. The principal point of conflict then was the Administration's impoundment of funds voted by Congress in excess of the President's requests. The year of Watergate has changed all that, and now the major issue is not impoundment, but impeachment.

Congress, however, gives the impression of continuing in disarray, if for different reasons. Impeachment is not an issue on which a congressman can get much guidance by consulting the Gallup or Harris polls, or even by tapping the grassroots back in his district; many of the congressional rank and file are in the painful position of mistrusting the political instincts which serve as an inertial guidance system for most legislators.

Congress is beset not only by the dilemma of impeachment, but by an agenda jammed with new and old business. The energy shortage and the Arab oil boycott have raised a series of issues that, at least in peacetime, are probably unprecedented in their complexity and impact on the public. Furthermore, Watergate has put Congress on its mettle to set its own far-from-tidy house in order. With respect to self-improvement, Congress is busy on three fronts: (i) "budget control" machinery is being created in both houses for the purpose of regaining a share of the budget-making power that has been lost to the Executive, (ii) overhaul of the committee system in the House is gaining momentum, with action rationalizing committee jurisdictions likely in this session, and (iii) tighter regulation of campaign financing is in the works in both the Senate and the House. To top it all off, this is an election year.

Symptomatic of the situation in Congress is the status of the emergency energy bill. Since well before Christmas the bill has caused serious overloads of congressional circuits. Yet another failure to achieve a compromise on the measure on 7 February apparently means delay of a Senate vote at least until 19 February, when Congress comes back from its Lincoln's birthday recess.

The measure (S. 2589) contains a number of controversial provisions, notably those which provide for taxation of windfall oil profits, and empower the President to postpone the requirements of the Clean Air Act. The latest hitch developed when the Senate on 29 January voted to recommit a version of the bill agreed to by a House–Senate conference. The majority on the 57–37 vote was made up of an unusual consort of a dozen Northern liberal Democrats, 13 Southern Democrats, and 32 Republicans. Some of these odd bedfellows voted to recommit to defend the Clean Air Act, others to protect the oil companies from the windfall profits tax, and still others to back the Administration, which opposed the bill. President Nixon had expressed disapproval of the bill, asking that action on taxes, provisions to deal with unemployment, and creation of a Federal Energy Administration (FEA) be separated from the emergency legislation.

The issue of the organization of FEA seems particularly vexatious to critics on the Hill, who are charging that the Administration doesn't know what it wants. The word had been that the White House wanted a temporary FEA which would have power to allocate oil supplies and set prices, and an Energy Research and Development Agency (ERDA), which would do what the name implies. Now, federal energy chief William Simon is said to be rethinking the matter and to like the idea of a permanent agency combining the FEA and ERDA functions. Confusion on the issue has, therefore, been compounded.

In the sector of congressional self-reform, some early progress can be reported. Consensus on the Hill is clearest on the lines that budget control reform should follow. A Budget Control and Impoundment Act (H.R. 7130) passed the House on 5 December; the Senate Government Operations