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Guest Editorial

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Wicked Problems

Professor Horst Rittel of the University of California Architecture Department has suggested in a recent seminar that the term "wicked problem" refer to that class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing. The adjective "wicked" is supposed to describe the mischievous and even evil quality of these problems, where proposed "solutions" often turn out to be worse than the symptoms.

Just how extensive are the wicked problems, he did not tell us, but one was led to conclude from the discussion that the membership in the class of non-wicked problems is restricted to the arena of play: nursery school, academia and the like.

Rittel suggested that there are various attempts to "tame" these wicked problems, among which must be counted the efforts of operations research and management science. Sometimes the taming consists of trying to generate an aura of good feeling or consensus. Sometimes, as in OR, it consists of "carving off" a piece of the problem and finding a rational and feasible solution to this piece. In the latter case, it is up to someone else (presumably a manager) to handle the untamed part.

A better way of describing the OR solution might be to say that it tames the growl of the wicked problem: the wicked problem no longer shows its teeth before it bites.

Such a remark naturally hints at deception: the taming of the growl may de-

ceive the innocent into believing that the wicked problem is completely tamed. Deception, in turn, suggests morality: the morality of deceiving people into thinking something is so when it is not. Deception becomes an especially strong moral issue when one deceives people into thinking that something is safe when it is highly dangerous.

The moral principle is this: whoever attempts to tame a part of a wicked problem, but not the whole, is morally wrong.

Such a moral principle would appear to be ridiculous to many a management scientist, who has been brought up to believe that he should only tackle "feasible" problems. For him to tame the whole of a wicked problem is not feasible, and hence the moral principle tells him to do something that his teachers told him was wrong. Of course, none of his teachers was ever able to tell him what "feasible" means, because *that's* a wicked problem; but nevertheless, the student of management science usually develops his own idea in a short span of experience.

For those who believe they can identify the feasible, there is the saving moral principle of honesty. If I tell you honestly what I have done, so goes the story, then you need not be deceived. So the management scientist, being honest, says to the manager: "Look, I've not tamed the whole problem, just the growl; the beast is still as wicked as ever."

This is how morality aids morality in the arena of right and wrong. But there is a sneaking suspicion that the answer is a weak one. It takes more than a verbal caveat to *inform* the manager that the OR solution is incomplete. The model, or the large computer program, plus expensive months of data collection and analysis, must give the impression that most of the wicked problem has been tamed. Dishonesty, as any con-man knows, can be created in the environment of complete, outspoken frankness and honesty.

What seems to emerge is not a moral reprimand of the management scientist, but rather a moral problem of the profession, a wicked moral problem. To what extent are we morally responsible to inform the manager in what respect our "solutions" have failed to tame his wicked problems? Does "inform" merely mean that we clear ourselves legally, or does it mean that we attempt to enter into a deep, mutual understanding of the untamed aspects of the problem?

To date, operations research and management science have been largely indifferent to the morality of the profession, perhaps because the profession has not yet taken itself seriously. That the profession has a moral problem, nonetheless, there can be no doubt. It might make us look more mature if we began to discuss it.

C. West Churchman
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Letters to the Editor

To the Editor:

The transfer of scientific knowledge in usable form to the industrial complex can be a starting point to emphasize the impact of communications as a source of national economic growth.

During the last fifty years, the Gross National Product has consistently grown faster than the labor force and capital goods investment. The "unexplained" increase in economic growth can be attributed to some of the sources of growth which are mainly education, training and economies of scale.

But contemporary economic investigation attributes the rate of growth to the impact of new technology. There has been a declining importance played by increases in number of workers or sheer dollar value of capital. Many economists feel that there is a new phase in the industrial organization where productivity reflects the application of scientific knowledge. The increasing importance of the "intangibles" of education and technology rather than mere mechanical strength and power brings out the impact of communications as a source of national economic advancement.

Efficient communications can provide the road for potential economic growth by integrating the state-of-the-art. Communications must be used to pre-assess rather than historically assess economic progress which is brought on by science and technology. Communication aspects are chosen because they are an important implication in economic progress through the transfer of knowledge to productive output. The greatest deterrent in the use of knowledge is poor communications.

Innovation, some economists feel, comes about periodically. As the economy becomes more refined and advanced, it brings a lack of flexibility and a decline in rugged individualism that will hinder the new innovation needed for economic growth. Thus, channels of technical information such as "Aerospace Research," must be made applicable to commercial use. The Federal Government and the National Aeronautics and Space Administration's Technology Utilization Program is an experimental effort in communicating aerospace technology to non-aerospace industry.

Many experts feel that an effort by university and research organizations would be the strongest mechanism for the transfer of science and technology innovations to future commercial use. The question is however, "Under what media does one transfer the information to the desired resting place?" The need arises for the concept of transferring today's technology to today's industrial management.

Communication of technical data information by professional societies through their informal activities (such as symposiums, meetings, etc.) imposes a structural device that is short of optimum.

There has been a steady improvement, such as the growth of independent technical periodicals and journals. Time reduction improvements in the availability of technology have been made through super-structured techniques of abstracting. These are new or novel or in their formative stages and are not yet efficient methods.

There is a need for a unique structural device to improve transfer of communications in terms of time. The potential application of nationwide audio-visual communications merits investigation. This could provide an increased efficiency in the transferring of technology to the desired sources. Direct closed circuit television broadcasts could prove to be the most economically feasible. This

presents several questions. Can literal benefits be derived from direct communications in science and technology? Is the cost of converting the industrial transformation of science to commercial application feasible? Can the approach of private closed circuit television audio-visual method be a successful means of transferring information to those unaware of such technology? The answer to these questions must be oriented to the economics of establishing a media to transform technological information to the desired or needed business sectors for promoting commercial applications.

Another problem of technical knowledge transferrence is the reliance necessary on a basic workable communications of language to fit all scientific environments. The problem is multifold and can lead to adjacent research areas such as copyrights, legal implications, up-grading of teaching and methodology.

"Knowledge" and technology can flourish and remain effective only if they are interacted and unified with all branches of sciences. Ideas and knowledge are the substance of science and technology, yet because of the tremendous growth of the literature, there is a danger of fragmentation into masses of repetitive findings and conflicting specialties. This is, in essence, the "crisis" in scientific and technological information.

The Federal Government, as the largest manager of research and development, supports approximately three-fourths of all science and technology. The magnitude of need and costs gives it a strong reason to maintain effective communications. It has the responsibility to prevent redundancies and contradictions between the specialized communities.

The problem is not only the Federal Government's. Good communications are also a necessary tool of business management. Science and technology has become the business of industry, professional technical societies and the university. Each group has developed its own methods to overcome communications problems. But their methods are isolated. Too often they tend to further the already disjointed scientific structure.

The objective of today's research is to find information and knowledge that can be assessed and used quickly. Programs must be established to determine costs of a feasible method for disseminating information in a rapid and clear manner. Government programs could be established to determine costs of a feasible method of disseminating information via closed circuit television or communications satellites.

The feasibility of economic costs can be researched in establishing possibilities such as:

1. Nationwide science and technology television channels;
2. A nationwide technology communications effort by the Federal Government in massive cooperation with professional societies and business management;
3. A continuing series of nationwide science and technology telecasts, on a repeat cycle dictated by the demand for new information;
4. Technology survey films or video tapes available for multiple reuse in a broad continuing educational program;

5. Television receivers in all scientific and engineering facilities for usage by engineers, scientists and non-technical management.

A nationwide communications effort by the Federal Government in cooperation with professional and business management associations may be the answer.

A. M. Agapos
Ohio University

To the Editor:

Management Science readers may be interested in some of the findings of a new Diebold Research Program Survey on the Cost Effectiveness of Software and Hardware. The survey indicates that the uses to which million dollar computers are applied are determined primarily by technicians rather than by company management.

Seventy-three percent of 2,700 executives responding to the survey stated that recommendations for new uses of computers in their company come from sources other than senior management. Sixty-one percent said that the suggestions for new uses *were* coming from data processing personnel themselves or from management science staffs—people skilled in implementing applications rather than in determining the real needs of their companies.

The conclusion drawn from these facts by Diebold Group, Inc. staff is that this senior management abdication to technicians is one of the prime reasons that companies often do not realize the true potential from their data processing investment.

These findings come from the most extensive survey ever conducted of computer users in this country. Companies responding indicated they were spending an average of just under $1-million per year for data processing activities—117 companies (4.3%) reported spending over $5-million per year. Small users were included too—17.6% reported an annual ADP budget of under $100,000.

In commenting on the survey, John Diebold, President of The Diebold Group, Inc., noted that "the survey verifies the first hand observations of our own professional experience—that there is still a real communication problem between those who run the computers and those who run the companies. Increased specialization within the ADP activity appears to adversely affect success in communicating ideas, instructions and directions."

To discover top management's involvement in the data processing activity, respondents were asked to report on the frequency of their own reporting to management with the result that only 11% report on a regular quarterly or semiannual basis, documenting return on investment, cost reduction and operating improvement while 52% report only informally on an annual basis, providing a general overview, and 31% are just initiating procedures for reporting. Among the other findings cited were these:

A majority of respondents said that data processing staff and middle management have not been successful in bridging the communications gap in implementing new applications. Only 38% (1,036 responses) reported that they are usually successful, while 29% (770) went so far as to

state that they considered this "one of the most important problems relating to data processing."

Fully 79% of respondents (2,144) said that skill in motivating and communicating—not technical knowledge—was most important to them in fulfilling their responsibilities in data processing. Only 499 ranked technical knowledge highest (19%).

Recommendations for future applications of data processing emanated from:

52% (1,393 responses) from data processing management;
31% (831 responses) from line management;
27% (722 responses) from top management;
9% (236 responses) from management science staff advisors;
(Note: This totals more than 100% due to the fact that some respondents checked more than one source.)

Additional findings of the survey showed that:

More than one-half of the respondents indicate that top management is either not responsible for guiding the growth of the ADP activity within the organization, or is responsible but carries this responsibility without the assistance of the senior data processing executive as a part of the corporate strategy group.

45% (1,158 responses) reported *both* that top management is responsible and that the senior ADP executive is included in corporate strategy planning.
23% (572 responses) reported that *neither* is the case.
31% (779 responses) reported that top management is *not* responsible for guiding the growth of the ADP activity.
46% (1,178 responses) reported that the senior ADP executive *is not* part of the corporate strategy planning group.

Companies with larger data processing budgets report more of a communication problem than those spending less on computers and related activities. When asked whether motivation and communication abilities of data processing managers were more important than technical knowledge, 83% of the respondents with the highest budgets said "yes" as opposed to 66% of those with the smallest budgets.

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The "Free for All" column is dedicated to the uninhibited exchange of relevant opinion. Letters should be addressed to Editor, Free for All, Graduate School of Business, 401 Uris Hall, Columbia University, New York, New York 10027.