

Technology Assessment, Citation Analysis, and Invisible Radiations.

June 14, 1972

Technology assessment is a major preoccupation of scientists and laymen of late. According to Kash1 technology assessment connotes not merely technological forecasting but rather careful study of its ethological (cultural-behavioral) and ecological impact. Whereas the futuristic game players were content to discuss specific technologic and scientific advances during the coming decades, and even speculated on some of their social implications--technology assessment demands that such information be uncovered even before scientific and technological "advances" are accomplished. This basic distrust of technology has crystallized in two bills now before the U.S. Congress. One of the bills is sponsored by John W. Davis, Chairman of the House Subcommittee on Science Research and Development; the other, by Senators Warren G. Magnusson and Philip Hart. The Davis Bill is similar to one introduced in 1966 by former Rep. Emilio Daddario that would have established an Office of Technology Assessment as an arm of the Congress. The Magnusson-Hart Bill would create a 15-man Technology Assessment Commission, operating independently of established branches and agencies of the government.

How does one go about the task of predicting the adverse or positive effects of new technological developments?

Could someone have predicted in 1900 that the automobile would one day poison the biosphere? I am told that some pessimist of that era predicted that replacement of the horse by the internal combustion engine would mean the end of the urban English sparrow. The sparrow's progeny seem to be doing fine! But we descendants of that pessimistic ur-ecologist prognosticator are apparently in big trouble.

Technology assessment involves the process of discovering unanticipated significances or consequences of discoveries or inventions that ordinarily are not immediately apparent either to inventors, researchers, or their sponsors. technology assessment Fortunately, may often simply require the posing of rather elementary questions and the subsequent application of well-known phenomena or simple mathematics. As I believe J.R. Oppenheimer, among others, once calculated, if the scientific literature were to continue to double every ten years the paper required to print it would completely inundate the planet. Exponential growth can only be tolerated for so long. And why such elementary mathematics should not be understood by those who oppose birth control is difficult to comprehend. But surely technology assessment is not really necessary for such problems.

I am often asked if information science or a specific aspect of it (citation analysis) can contribute to the field of technology assessment. Stated in different terms one can ask, "How predictive can we make information analysis?" About one thing I am certain, information retrieval through citation indexing does produce results which help the investigator uncover significances and relationships that he had not originally perceived. That is why I called it a posteriori as opposed to a priori indexing.2 We also know that the use of citation analysis can describe, sometimes in an elegant way, the history of scientific fields. By the display of these "paradigms" one may gain some insight into the future. We also know from certain case studies, as I once did long ago during the Thalidomide tragedy, creative literature analysis may in fact provide clues that less precise individuals might call predictive. There was in fact evidence in the literature that would cause many serious investigators to ponder the possible teratological effects of that drug.

As another example I might mention my own long-standing concern with the long-term effects of electromagnetic

radiation, about which we seem to know so little. Somehow invisible phenomena have always been a source of concern. Communication satellites presumably are innocuous sources of radiation, despite their increasing number. A colleague at the FCC assures me that the power which reaches the earth from an INTELSAT satellite is about 10-30 of the exposure limit recommended by the American Standards Institute.3 Nevertheless, electromagnetic pollution is a much more downto-earth business. The potentially harmful effects of radar stations and other high-powered communication transmitters are far from trivial, especially where their power is, in effect, multiplied by large antennas. My friend also assures me that "problems resulting from such transmissions have long been recognized by both government and industry groups and both are working on them." Ironically, my original interest in the effects of "invisible" radiations stems from some interesting studies concerning the effects of electromagnetic phenomena on patients in mental hospitals!4 It is somewhat reassuring to learn that someone is doing technology assessment even before Congress

Kash, D.E. & White, I.L. Technology assessment: harnessing genius. C&E News p. 36-41, November 29, 1971.

^{2.} Garfield, E. Citation indexes for science. Science 122:108-111, 1955.

^{3.} Ende, A.H. Personal communication, March 8, 1972.

Friedman, H., Becker, R.O., and Bachman, C.H. Psychiatric ward behaviour and geophysical parameters. Nature 205:1050, 1965.