INTEGRATED FIGURE OF MERIT OF PUBLIC SECTOR RESEARCH EVALUATION

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An approach for evaluation of research is described that integrates output indicators of four stages downstream the innovation process: immediate, intermediate, pre-ultimate and ultimate outputs. Indexes of leading output indicators are constructed. The indexes are integrated cumulatively to form an overall index of key output indicators, which is the integrated figure of merit (IFM). Data for the indicators are obtained from records and key informants, and the indicators are grouped by normalized weights. The paper also discusses the limitations and the methodological, conceptual and political/organizational issues of such an approach to research evaluation.

Introduction

The measurement and evaluation of research in general, and publicly-generated research in particular, have traditionally been confined to the immediate outputs and impacts of the research activity.\(^1\) Few exceptions have extended the measurement of impacts to other beneficiaries and impactees downstream the innovation process.\(^2\) Notably, the usual evaluation concentrated in two major streams. First, evaluation of research programs by peer review, complemented by counts of publications and citations.\(^3\) These bibliometric approaches specifically assessed the immediate or proximal outputs of the research activity. Further down the innovation process there were attempts to assess federal research programs by count of patents for given areas of technology.\(^4\)

Yet, the interest in the impact and the value of research beyond the mere count of selected output categories has also been extended to economic evaluations. These may be largely grouped under the categories of input-output or cost-benefit techniques. Mansfield (1991), in a marginal cost-benefit analysis of the impacts of academic research on industrial innovation, calculated total inputs or expenditures on academic research, and then compared it with its impact on industrial innovation.\(^5\) Thus, the
returns from academic research are calculated by the cost industrial companies would have incurred in developing new products, without the inputs from academia.\textsuperscript{6}

This paper advances the approach and the technique of an integrated figure of merit (IFM) of public sector research evaluation as a feasible and highly promising assessment method. The purpose of this paper is threefold. First, to describe the technique, its framework and its components; secondly, to describe and report some initial empirical work in which this technique was utilized; and thirdly, to discuss some of the problems and issues related to the approach of the integrated figure of merit, and to offer some conclusions and suggestions for further use. This paper is not an attempt to present the state-of-the-art in the highly dynamic area of research evaluation. Rather, this paper concentrates on addressing the design and the feasibility of the integrated figure of merit approach, particularly as it applies to public sector research programs.

**Public sector research**

Research conducted by public organizations has become a considerable economic activity in the past half a century. In the data published by the National Science Board, the federal government funded $13.3 billion of basic research in 1993 (63\% of the total expended that year for basic research in the US). The federal government also performed (in its own laboratories) basic research costing $2.3 billion (11\% of the total expended that year in the US).\textsuperscript{7}

Federal expenditures for applied research in 1993 amounted to $17.5 billion, of which the government itself performed about $4 billion (32\%).\textsuperscript{7} Thus, the 1993 total federal expenditures for research (basic and applied) were $25.8 billion, of which the government performed $6.3 billion (24.4\%). In this paper, research is defined to include both basic and applied research, so that the term will be referred to in the following pages simply as "research."

In times of tight budgets and prioritization of public expenses, research programs are natural candidates for increased scrutiny and for attempts at parsimonious allocation of resources. By the mere fact that the outcomes from research are both long term and difficult to measure, government research programs fall into an ambiguous territory of justifiable expenditures and investments of public monies.\textsuperscript{8} In the search for justification, public research organizations are currently confronted with two converging phenomena. First, they are faced with the increasingly focussed pressures to "commercialize."\textsuperscript{9} This phenomenon is characterized by the pervasive view in government circles that the role of publicly supported research should include (perhaps