About Science and Engineering Indicators

Science and Engineering Indicators (SEI) is first and foremost a volume of record comprising the major high quality quantitative data on the U.S. and international science and engineering enterprise. SEI is factual and policy-neutral. It does not offer policy options and it does not make policy recommendations. SEI employs a variety of presentational styles—tables, figures, narrative text, bulleted text, web-based links, highlights, introductions, conclusions, reference lists—to make the data accessible to readers with different information needs and different information processing preferences.

The data are "indicators." Indicators are quantitative representations that might reasonably be thought to provide summary information bearing on the scope, quality, and vitality of the science and engineering enterprise. The indicators reported in SEI are intended to contribute to an understanding of the current environment and inform the development of future policies. SEI does not model the dynamics of the enterprise, and it avoids strong claims about the significance of the indicators it reports. SEI is used by readers who hold a variety of views about which indicators are most significant for different purposes.

SEI is prepared by the National Science Foundation's Division of Science Resources Statistics (SRS) on behalf of the National Science Board. It is subject to extensive review by outside experts, interested federal agencies, NSB members, and SRS internal reviewers for accuracy, coverage, and balance.

SEI includes more information about measurement than many readers unaccustomed to analyzing social and economic data may find easy to absorb. This information is included because readers need a good understanding of what the reported measures mean and how the data were collected in order to use the data appropriately. SEI's data analyses, however, are relatively accessible. The data can be examined in various ways, and SEI generally emphasizes neutral, factual description and avoids unconventional or controversial analysis. As a result, SEI almost exclusively uses simple statistical tools that should be familiar and accessible to most readers. Readers comfortable with numbers and percentages and equipped with a general conceptual understanding of terms such as "statistical significance" and "margin of error" will readily understand the statistical material in SEI.

SEI's Different Parts

SEI consists of seven chapters that follow a generally consistent pattern; an eighth chapter, on state indicators, presented in a unique format; and an overview that precedes these eight chapters. The chapter topics are

- Elementary and Secondary Education
- Higher Education in Science and Engineering
- Science and Engineering Labor Force
- Research and Development: Funds and Technology Linkages
- Academic Research and Development
- Industry, Technology, and the Global Marketplace
- Science and Technology: Public Attitudes and Understanding
- State Indicators

An appendix volume contains tables keyed to the first seven chapters. SEI is available on the NSF website (http://www.nsf.gov/statistics/seind06/), and the paper volume is accompanied by a CD-ROM version and pocket size Information Cards. The web version includes presentation graphics. A policy-oriented "companion piece," authored by the National Science Board (NSB) and providing NSB analyses and recommendations, often accompanies SEI and draws on its data.

The Seven Core Chapters

Each chapter consists of front matter (table of contents and lists of sidebars, text tables, and figures), highlights, an introduction (chapter overview and chapter organization), a narrative synthesis of data and related contextual information, a conclusion, notes, a glossary, and references.

Highlights. The highlights provide an outline of major dimensions of a chapter topic. They are intended to be suitable as the basis for a presentation that would capture the essential facts about a chapter topic. As such, they are prepared for a knowledgeable generalist who seeks an organized generic presentation on a topic and does not wish to develop a distinctive perspective on the topic, though s/he may wish to flavor a standard presentation with some distinctive insights. They also provide a brief version of the "meat" of the chapter.

Introduction. The chapter overview provides a brief explanation of why the topic of the chapter is important. It situates the topic in the context of major concepts, terms, and developments relevant to the data that the chapter reports. The introduction includes a brief narrative account of the logical flow of topics within the chapter.

Narrative. The chapter narrative is a descriptive synthesis that brings together significant findings. It is also a balanced presentation of contextual information that is useful for interpreting the findings. As a descriptive synthesis, the narrative aims to (1) enable the reader to comfortably assimilate a large amount of information by putting it in an order that facilitates comprehension and retention and (2) order the

material so that major points readily come to the reader's attention. As a balanced presentation, the narrative aims to include appropriate caveats and context information such that (3) a non-expert reader will understand what uses of the data may or may not be appropriate, and (4) an expert reader will be satisfied that the presentation reflects a good understanding of the policy and fact context in which the data are interpreted by users with a range of science policy views.

Figures. Figures provide visually compelling representations of major findings discussed in the text. Figures also enable readers to test narrative interpretations offered in the text by examining the data themselves.

Text Tables. Text tables help illustrate points made in the text.

Sidebars. Sidebars discuss interesting recent developments in the field, more speculative information than is presented in the regular chapter text, or other special topics. Sidebars can also present definitions or highlight crosscutting themes.

Appendix Tables. Appendix tables, which appear in Volume 2 of SEI, provide the most complete and neutral presentation of quantitative data, without contextual information or interpretive aids. According to past surveys of SEI users, even experienced expert readers find it helpful to consult the chapter text in conjunction with the appendix tables.

Conclusion. The conclusion summarizes important findings. It offers a perspective on important trends, but stops short of definitive pronouncements about either likely futures or policy implications. Conclusions tend to avoid factual syntheses that suggest a distinctive or controversial viewpoint.

References. SEI includes references to data sources cited in the text, stressing national or internationally comparable data. SEI does not review the analytic literature on a topic or summarize the social science or policy perspectives that might be brought to bear on it. References to that literature are included only where they are necessary to explain the basis for statements in the text. SEI does not reference many suggestive analyses of national and international patterns and trends that use more limited or less reliable data sources than those in SEI.

The State Indicators Chapter

This chapter consists of data that can be used by people involved in state-level policy-making, including journalists and interested citizens, to assess trends in S&T-related activities in their states. Indicators are drawn from a range of variables, most of which are part of the subject matter of the seven core chapters. The text explains the meaning of each indicator and provides important caveats about how to interpret it. Approximately 3 to 5 bullets highlight significant findings. The presentation is overwhelmingly graphic and tabular. It is dominated by a United States map that color codes states into quartiles and a table with state by state data.

There is no interpretive narrative to synthesize overall patterns and trends. SEI includes state level indicators to call attention to state performance in S&T and foster consideration of state level activities in this area.

Overview

The overview is a selective interpretive synthesis that brings together patterns and trends that unite data in several of the substantive chapters. The overview helps readers synthesize the findings in SEI as a whole and draws connections among separately prepared chapters that deal with related topics. It is intended to serve readers with varying levels of expertise. Because the overview relies heavily on figures, it is well adapted for use in developing presentations, and presentation graphics for the figures in the overview are available on the Web.

Like the core chapters, the overview strives for a descriptive synthesis and a balanced tone, and it does not take or suggest policy positions. But, whereas the priority for the core chapters is a comprehensive and neutral presentation of data, even at the cost of some internal coherence, the overview strives for greater coherence and permits more selectivity.

Presentation

SEI is released in printed and electronic formats. The printed version is published in 2 volumes: Volume 1 provides the main text content and Volume 2 provides the detailed tabular data. The complete content of the printed volumes is posted on the NSF website in html and pdf formats, with tables available in spreadsheet (MS Excel) format and source data associated with every figure. In addition, selected figures are also available in presentation format in MS PowerPoint and JPEG formats. Source data are also included.

The printed version of SEI includes a CD-ROM in PDF format and a packaged set of Information Cards in a pocket attached to the inside back cover. The CD-ROM is a complete version of SEI. As with the online version, appendix tables are presented in MS Excel format and the set of presentation graphics is included. The Information Cards highlight important patterns and trends. Each card presents a selection of figures with captions stating the major point the figure is meant to illustrate. A mini-CD-ROM containing the full volume is included with each card set.

SEI includes a list of abbreviations/acronyms and an index.