SIDEBAR

New Definition of KTI Industries

Previous editions of this chapter defined knowledge- and technology-intensive (KTI) industries based on two categories of industries formerly classified by the Organisation for Economic Co-operation and Development (OECD). Five high-technology manufacturing industries—aircraft and spacecraft; pharmaceuticals; computers and office machinery; semiconductors and communications equipment; and measuring, medical, navigation, optical, and testing instruments—spend a high proportion of their revenues on research and development (Table 6-1).* Five knowledge-intensive services industries—business, education, financial, health care, and information—incorporate high technology either in these services or in the delivery of these services (Table 6-1).† While output data are based on industry categories, trade data are based on products and not industry categories. The National Center for Science and Engineering Statistics classifies trade of KTI products and services by selecting products and services that closely correspond to KTI industries.

Trade of KTI products and services was previously defined as three categories of knowledge-intensive services—telecommunications, computer, and information; finance; and other business—and six categories of high-technology goods—aerospace; communications; computers; pharmaceuticals; semiconductors; and testing, measuring, and control instruments.‡

For this 2018 edition of *Science and Engineering Indicators*, we have expanded our definition of KTI industries to include five medium-high-technology industries in addition to the existing two categories of KTI services and high-technology manufacturing industries (Table 6-1). The five medium-high-technology industries are motor vehicles and parts, chemicals excluding pharmaceuticals, electrical machinery and appliances, machinery and equipment, and railroad and other transportation equipment. These industries as formerly classified by the OECD spend a relatively large proportion of their revenues on R&D and make products to incorporate advanced technologies.* Although they spend a lower proportion of their revenue on R&D compared to high-technology manufacturing industries, medium-high-technology manufacturing industries produce many products that incorporate advanced and science-based technologies. For example, cars and trucks contain sophisticated sensors and software using sensing, measurement, and information and communications technologies to prevent accidents, optimize engine performance, and maximize fuel economy.

Consequently, the definition of KTI products and services has been expanded to make trade data consistent with the new definition of KTI industries. Chemicals excluding pharmaceuticals, motor vehicles and parts, machinery and equipment, electrical machinery and appliances, and railroad and other transportation equipment have been added to the existing three categories of knowledge-intensive services and six categories of medium-high-technology goods.

* In designating these high-technology and medium-high technology manufacturing industries, the OECD estimated the degree to which different industries used R&D expenditures made directly by firms in these industries and R&D embedded in purchased inputs (indirect R&D) for 13 countries: the United States, Japan, Germany, France, the United Kingdom, Canada, Italy, Spain, Sweden, Denmark, Finland, Norway, and Ireland. Direct R&D intensities were calculated as the ratio of total R&D expenditure to output (production) in 22 industrial sectors. Each sector was weighted according to its share of the total output among the 13 countries, using purchasing power parities as exchange rates. Indirect intensities were calculated using the technical coefficients of industries on the basis of input-output matrices. The OECD then assumed that, for a given type of input and for all groups of products, the proportions of R&D expenditure embodied in value added remained constant. The input-output coefficients were then multiplied by the direct R&D intensities. For further details concerning the methodology used, see OECD (2001) and Godin (2004).

† See OECD (2001) for a discussion of classifying economic activities according to their degree of "knowledge intensity." Like all classification schemes, the OECD classification has shortcomings. For example, KTI industries produce some goods or services that are neither knowledge intensive nor technologically advanced. In addition, multiproduct companies that produce a mix of goods and services, only some of which are KTI, are assigned to their largest business segment. Nevertheless, data based on the OECD classification allow researchers and analysts to trace, in broad outline, worldwide trends toward greater interdependence in science and technology and the development of KTI sectors in many of the world's economies.

‡ Other business services include trade-related services, operational leasing (rentals), and miscellaneous business, professional, and technical services. These include legal, accounting, management consulting, public relations services, advertising, market research and public opinion polling, research and development services, architectural, engineering, and other technical services, agricultural, mining, and on-site processing (WTO 2016:83).