

Science, Technology and Innovation

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Methodological notes - Selected Indicators

Research and Development (R&D)

Research and development is acquirement of new knowledge, techniques and regularities applying scientific methods and procedures. R&D activities include:

- **Basic research** - systematic activity which priority aim is to extend knowledge about a studied subject and its deepen understanding regardless of practical applications of acquired knowledge;
- **Applied research** - systematic activity oriented upon the practical application of knowledge and the revealing of new scientific knowledge with the aim of application in economic and social spheres;
- **Development** - systematic utilization of scientific knowledge oriented towards production of utility goods, devices, systems, methods, and processes including design and development of prototypes.

The statistical R&D survey covers R&D organizations and R&D working places, i.e. legal and physical entities whose:

- principal activity is research and development (according to the Statistical classification of economic activities SK NACE Rev.2);
- principal activity differs from R&D, but their research and development potential represents, recalculated by the full time equivalent (FTE), at least one man-year.

R&D organizations and working places are broken down according to the Frascati manual methodology into following sectors:

- **Business enterprise sector**; firms, organizations, and institutions whose main activity is focused on the production of goods and services for market in order to attain profit; profit R&D institutions, non-profit institutions mainly serving the business enterprise sector;
- **Government sector**; institutions and bodies rendering public services which, due to economic reasons, cannot be rendered by other organizations administered by the government, and non-profit institutions administered and financed mainly by the government, i.e. budgetary organizations;
- **Higher education sector**; universities, university hospitals and other organizations of the post-secondary educational level regardless their source of funds and legal status (including all institutions administered by universities or linked to them).
- **Private non-profit sector**; non-market, non-profit institutions and non-profit private persons;

According to change in the methodology given in the Frascati manual 2015 since 2016 the

indicator R&D employees (including doctorate students) was replaced by the indicator R&D personnel.

R&D personnel includes persons employed directly in the field of R&D as well as persons providing direct services to R&D. In extent of conducted R&D activity and providing direct services to R&D the number of R&D personnel includes R&D employees, pedagogical staff at universities and colleges, health employees, employees in prototypes, employees accepted to educational stay, working proprietors and unpaid family workers, external personnel and doctoral students.

- **Researchers**; this category includes employed persons with decisive importance for production and social use of the scientific knowledge;
- **Technicians and equivalent personnel**; here are included employed persons participating in R&D projects by performing scientific and technical tasks usually under the supervision of researchers;
- **Supporting staff**; here are included qualified and nonqualified workers, secretaries and other employed persons participating in the work on R&D projects. There are also included other managers and administrative employees dealing with personal and financial matters whose activities are qualified as a direct service supporting research.

R&D expenditures include total expenditures on R&D activities within the organization, i.e. domestic expenditures. They include capital and current expenditures. From expenditures being spent outside the organization, only those which serve as a support to the internal research and development are included (e.g. purchase of equipment for R&D). The depreciation of buildings, machinery equipment, and equipment is excluded.

Capital expenditures are funds for acquisition of tangible and intangible assets. They are divided into land and buildings, instruments and equipment. Current expenditures include operating and financial costs related to R & D activities. They are divided into labour costs and other current costs.

Innovations

Innovations include technological and non-technological innovations. Technological innovation represent **product innovation**, i.e. new or significantly improved product (good, service) introduced into the market or **process innovation**, i.e. new or significantly improved process introduced within the enterprise. Non-technological innovations include **organizational innovations** and **marketing innovations**.

Product innovation is the market introduction of a new or significantly improved product (good or service) with characteristics or intended uses that differ significantly from previous products produced by the enterprise. This includes new or significantly improved technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

Process innovation is introduction of new or improved production methods; logistics, delivery

and distribution systems, and 'back office' activities, such as maintenance, purchasing, and accounting operations. They include significant changes in specific techniques, equipment and/or software, intended to improve the quality, efficiency or flexibility of a production or supply activity, or a reduction in environmental and safety hazard.

Organizational innovation is implementation of a significant change in business practices, the organisation of work responsibilities and decision making, which includes training or education to increase skills and responsibilities; and the organisation of external relationships with other enterprises or public institutions. They are intended to improve the enterprise's innovative capacity or performance characteristics, such as the quality or efficiency of work flows. Organisational innovations usually involve changes to more than one part of the enterprise's supply chain and are less technology dependent than process innovations.

Marketing innovation covers significant changes in how an enterprise markets its goods and services, including changes to design and packaging. Many of them must be the first use by the enterprise. For example, the first use of product placement on the internet for one product line is an innovation, but the second use of internet product placement for a different product line or for a different geographical market is not an innovation.

Enterprises with innovation activity are those that had at least one type of innovation activity during the surveyed period, i.e. introduced new or significantly improved product or process or had on-going or abandoned innovation activity related to a product or process or implemented organizational or marketing innovation.

Successful innovators are those that introduced product innovation or process innovation.

Innovation intensity is defined as the total innovation expenditure expressed as percentage of turnover.

High-tech statistics

High-tech statistics is based on the definition of technological sectors (sectoral approach) and on the definition of the high-tech products (product approach) that take into consideration intensity of research and development in the given economic activity (group of products) expressed by the share of R&D expenditure in value added (in the case of sectoral approach) and in total sales (in the case of product approach).

Definition of high-technology industries (high-tech industries, i.e. high-tech sector) comprises economic activities with high intensity of research and development specified according to the Statistical classification of economic activities - NACE Rev.2 as follows:

High-tech manufacturing:

- 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations
- 26 Manufacture of computer, electronic and optical products
- 30.3 Manufacture of air and spacecraft and related machinery

High-tech services (knowledge-intensive high-technology services):

- 59 Motion picture, video and television programme production, sound recording and music publishing activities
- 60 Programming and broadcasting activities
- 61 Telecommunications
- 62 Computer programming, consultancy and related activities
- 63 Information service activities
- 72 Scientific research and development

Definition of high-tech products was developed on the basis of the Standard International Trade Classification - SITC Rev.4 and contains technical products of which the manufacturing involved a high intensity of research and development. Definition allows extraction of internationally comparable data on external trade with high-tech products by the following basic groups of products:

- Aerospace (codes SITC Rev.4: 792.1, 792.2, 792.3, 792.4, 792.5, 792.91, 792.93, 714-714.89-714.99, 874.11)
- Computers - office machines (codes SITC Rev.4: 751.1, 751.94, 751.95, 751.96, 751.97, 752.2, 752.3, 752.6, 752.7, 759.8, 759.97)
- Electronics, telecommunications (codes SITC Rev.4: 761.3, 761.4, 761.5, 763.8, 763.31, 763.39, 764-764.93-764.99, 772.2, 772.61, 773.18, 776.25, 776.27, 776.3, 776.4, 776.8, 898.4)
- Pharmacy (codes SITC Rev.4: 541.3, 541.5, 541.6, 542.1, 542.2)
- Scientific instruments (codes SITC Rev.4: 774, 871, 872.11, 874-874.11-874.2, 881.11, 881.21, 884.11, 884.19, 899.61, 899.63, 899.66, 899.67)
- Electrical machinery (codes SITC Rev.4: 778.62, 778.63, 778.64, 778.65, 778.67, 778.68, 778.7, 778.84)
- Chemistry (codes SITC Rev.4: 522.22, 522.23, 522.29, 522.69, 525, 531, 574.33, 591)
- Non-electrical machinery (codes SITC Rev.4: 714.89, 714.99, 718.7, 728.47, 731.1, 731.31, 731.35, 731.42, 731.44, 731.51, 731.53, 731.6-731.62-731.66-731.67-731.69, 733.12, 733.14, 733.16, 735.9, 737.33, 737.35).