

HRST stocks

Scope covered

Data examine the existing labour market stocks of HRST at national and regional levels. Unless stated otherwise, data is compiled in line with the recommendations laid down in the Canberra Manual.

HRST statistics cover the total population usually residing in Member States at age group 15-74 years .

Why collect data on HRST?

A rapidly changing economic environment and a growing emphasis on the knowledge-based economy have seen mounting interest in the role and measurement of skills. Meeting the demands of the new economy is a fundamental policy issue and has a strong bearing on the social, environmental and economic well-being of the population.

Data on Human Resources in Science and Technology (HRST) can improve our understanding of both the demand for and supply of science and technology personnel — an important facet of the new economy. As a result, this domain focuses on two main aspects: stocks and flows. The former serves to show the needs of the labour force and the latter indicates to what degree this demand is likely to be met in the future. Within this assemblage, particular attention should be paid to the subset of scientists and engineers (S&E), quite often the innovators at the nucleus of the technology-led development.

What is HRST?

HRST is defined according to the Canberra Manual as a person fulfilling at least one of the following conditions:

- Successfully completed education at the third level in a S&T field of study (HRSTE)
- Not formally qualified as above, but employed in a S&T occupation where the above qualifications are normally required (HRSTO).

The conditions of the above educational or occupational requirements are considered according to internationally harmonised standards: the International Standard Classification of Education (ISCED); the International Standard Classification of Occupation (ISCO).

The use of ISCED and ISCO for HRST analysis is briefly considered below.

Annex 1 – HRST stocks

Even though the official definition of HRST as shown in the Canberra Manual contains the term “S&T”, **this term does not restrict the definition: HRSTE covers all fields of study, i.e. anybody who successfully completed third level education (owing at the minimum the potential for S&T)**; HRSTO refers to two specific major ISCO classes that are broader than what one might expect from scientific and technological activities in a stricter sense.

HRST and sub-categories of HRST can be more easily understood by looking at Table 1.

Table 1: (Sub-) Categories of HRST

			HRSTE (Education)	
			Tertiary education	Lower than tertiary education
HRSTO (Occupation)	ISCO 2 ISCO 3	Professionals Technicians	HRSTC (Core)	HRST without tertiary education
	ISCO 1 ISCO 4-9	Managers All other occupations	HRST non-core	NON-HRST employed
		Unemployed	HRSTU (Unemployed)	NON-HRSTU (Unemployed)
		Inactive	HRST inactive	NON-HRST inactive

Some examples of different types of HRST are given below:

Qualified and employed as HRST:

- computer system designer with a degree in computer science;
- university professor with a PhD in economics;

Qualified as HRST but not so employed:

- unemployed marine biologist;
- engineer staying at home to raise his/her children;

Employed as HRST but not so qualified:

- computer programmer who did not complete second-level education;
- language teacher with second-level education;

HRST by level of education (HRSTE)**HRSTE: Persons with tertiary education (ISCED)**

Those people who have successfully completed education at the third level.

Annex 1 – HRST stocks

In order to minimise cultural differences in education systems and to increase cross-country comparability, HRST data use the International Standard Classification of Education (ISCED) developed by UNESCO. Due to an increasing demand for internationally comparable indicators on education and a mounting complexity in the educational programmes on offer in different countries, the original standard, developed in 1976, was revised and updated in 1997. Another revision of ISCED classification took place in 2011.

HRST data in this Eurobase domain are still displayed according to ISCED1997.

Prior to 1998, HRST consisted of those persons that belong to ISCED categories 5, 6 and 7. Under the ISCED1997 classification, HRST consists of those persons that belong to categories 5b, 5a and 6. The content of the ISCED1997 levels 5a, 5b and 6 is presented below:

The International Standard Classification of Education (ISCED 1997)

ISCED level 5A: programmes that are largely theoretically based and are intended to provide sufficient qualifications for gaining entry into advanced research programmes and professions with high skill requirements;

ISCED level 5B: programmes that are generally more practical/technical/occupationally specific than ISCED 5A programmes;

ISCED level 6: this level is reserved for tertiary programmes that lead to the award of an advanced research qualification. The programmes are devoted to advanced study and original research.

S&T fields of study

The Canberra Manual recommends that, for the macro-measurement of HRST, ISCED fields of study shall be grouped into the following seven broad fields of study. In fact any kind of study leading to a qualification of the above mentioned ISCED1997 levels 5a, 5b and 6 falls under this definition and therefore all HRST belong to the “S&T field of study” in the broad sense of the Canberra Manual. However, using the term S&T in a more specific sense, it is clear that the two first groups (S&E = natural sciences, medical science & engineering and technology) are more directly relevant to S&T activities than humanities or other fields:

- natural sciences
- engineering and technology
- medical sciences
- agricultural sciences
- social science
- humanities
- other fields.

In order to approach the Canberra concept of S&T field of study, two positions in the list of fields of study according to ISCED1997 are selected and considered as core of ‘Science and Technology’ fields:

- 4 Sciences, Mathematics and Computing
- 5 Engineering, Manufacturing and Construction.

HRST by occupation (HRSTO)

HRSTO: Persons employed in science and technology

Those people who are employed in an S&T occupation.

Occupations are classified according to the International Standard Classification of Occupation (ISCO), developed by the International Labour Organisation (ILO) and adapted for the EU to implement ISCO for census and several survey coding purposes.

Recommendations in the Canberra Manual identify certain occupation groups as HRSTO, namely:

- ISCO major group 2 (Professionals) - occupations whose main tasks require a high level of professional knowledge and experience in the fields of physical and life sciences, or social sciences and humanities.
- ISCO major group 3 (Technicians and associate professionals) - occupations whose main tasks require technical knowledge and experience in one or more fields of physical and life sciences, or social sciences and humanities.

These types of occupations typically require a formal education qualification equivalent to the one defined above. However, whether the person actually has this formal education qualification or not is irrelevant as people with those occupations are automatically considered as belonging to HRST(O).

Due to an increasing demand for internationally comparable indicators on occupations, the original standard developed in 1988 was revised and updated in 2008.

As a result, HRST data in Eurobase domain up to and including 2010 are built up based on the original classification - ISCO-88. From 2011, ISCO-08 is employed.

The International Standard Classification of Occupation (ISCO-88)

Professionals are sub-divided into four sub-major groups — physical, mathematical and engineering science professionals; life science and health professionals; teaching professionals; and other professionals — the first two making up the sub-set of scientists and engineers (S&E).

Technicians and associate professionals are sub-divided in four sub-major groups – physical and engineering science associate professionals; life science and health associate professionals; teaching associate professionals; and other associate professionals

The user should note that this definition constitutes a certain deviation from the recommendations laid down in the Canberra Manual. In addition to ISCO major groups 2 and 3, the Canberra Manual proposes to also consider the following groups as HRST: production and operations managers, other specialist managers, managers of small enterprises (ISCO 122, 123 and 131). These groups may work in the field of S&T but are not included in HRST as used here (but they are included in HRSTE if they have successfully completed third level education). The limitation applied here is, however, justified as a pilot survey conducted in 1995 tested the validity of the original definitions for HRST and the results indicated that, for the EU, including these certain managerial occupations distorted the results significantly due to variations between countries in the treatment and classification of managers.

The International Standard Classification of Occupation (ISCO-08)

Professionals are sub-divided into six sub-major groups – science and engineering professionals; health professionals; teaching professionals; business and administration professionals; information and communications technology professionals; and legal, social and cultural professionals.

Technicians and associate professionals are sub-divided in five sub-major groups – science and engineering associate professionals; health associate professionals; business and administration associate professionals; legal, social, cultural and related associate professionals; and information and communications technicians.

The ISCO changeover

In general, 1-to-1 correspondence does not exist between ISCO-08 and ISCO-88. Consequently, the overall comparison between the two versions is difficult. The revision of the ISCO has an impact on the HRSTO populations, even if the precise magnitude is complicated to be measured. As the data are only available at 3-digits, this impact is not quantifiable, except for the transfer of one category in ISCO-88 to one single category in ISCO-08, at the level of 3 digits. This is case for the HRST population which could impact as much as 10% of the population in the Czech Republic, for example. For the other countries, the distribution of reallocation from ISCO-88 to ISCO-08 between the other categories is not known and this makes the estimation of the impact on HRST not possible. Consequently, for all the HRST categories using the ISCO classification, there was a break in series in 2011.

Other terminology related to HRST

HRSTC: Persons with tertiary education (ISCED) and employed in science and technology — Core

Those people :

- who have successfully completed education at the third level (HRSTE) – ISCED1997 levels 5 and 6

and

- are employed in a S&T occupation (HRSTO) – ISCO major groups: 2 (professionals) and 3 (technicians)

S&E — Scientists and Engineers

Prior to 2011, Scientists and Engineers are those people who work in:

- 21 physical, mathematical and engineering occupations;
- 22 life science and health occupations.

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With the new ISCO-08 classification, S&E are those people who work in:

- 21 science and engineering professionals;
- 22 health professionals;
- 25 information and communications technology professionals.

HRSTU: Unemployed persons with tertiary education

Those people who have successfully completed education at the third level and are unemployed.

NON_HRSTU: Unemployed persons with non-tertiary education

Those people who have not fulfilled the HRST requirements and are unemployed (unemployed non tertiary educated).

HRST labour force

The HRST labour force comprises persons who fulfil the requirements of HRST and are either employed or unemployed, but not inactive. The definitions for employed, unemployed and inactive are provided in the website of EU-LFS. ([EU labour force survey](#))

Employed HRST

The employed HRST comprises persons who fulfil the requirements of HRST and are employed. The definitions for employed, unemployed and inactive are provided in the website of EU-LFS. ([EU labour force survey](#))

Non-HRST Labour Force

The non-HRST labour force comprises persons who do not fulfil the requirements of HRST and are either employed or unemployed, but not inactive. The definitions for employed, unemployed and inactive are provided in the website of EU-LFS. ([EU labour force survey](#))

HRST / population ratios

HRST / population ratios correspond to HRST as a proportion of the total population of the age group considered. Note that for total HRST as a proportion of the population, anyone below the age of 15 is excluded from the figure for population. This is because no one below the age of 15 can fulfil either of the requirements for being classified as HRST and so the denominator is adjusted accordingly.

HRST / labour force ratios

HRST / labour force ratios correspond to HRST as a proportion of the total labour force of the age group considered. Only active (employed and unemployed) HRST categories are taken into account and divided by the total labour force.

HRST/ employment ratios

HRST employment ratios correspond to the number of HRSTO which by definition are employed divided by the total employed population of the age group considered.

HRST rate of unemployment

The HRST unemployment rate corresponds to the number of unemployed HRST divided by the total active HRST population. Unemployed HRST restricts to the tertiary educated unemployed population.

Non-HRST rate of unemployment

The non-HRST unemployment rate corresponds to the number of unemployed non-HRST divided by the total active non-HRST population.. Unemployed non-HRST correspond to non-tertiary educated unemployed persons.