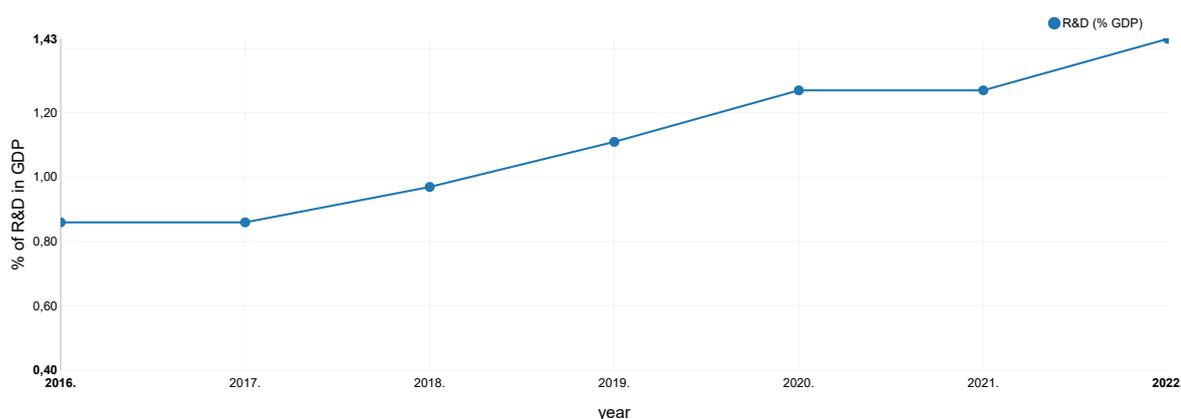




## RESEARCH AND DEVELOPMENT, 2022

The share of research and development (R&D) expenditures in GDP in 2022 was 1.43%

### G-1 SHARE OF RESEARCH AND DEVELOPMENT EXPENDITURES IN GDP



In 2022, a total of 7.2 billion kuna was spent on R&D activity in the Republic of Croatia, which was an increase of 32.4% compared to the previous year. Of the total funds intended for R&D, the largest amount of funds was spent in the business enterprise sector, i.e. 54.3%. It was followed by higher education with 27.8%, while the smallest amount of funds was spent in the government and private non-profit sector, i.e. 17.9%.

The largest share of expenditure on R&D was accounted for by labour costs, 56.7%. Other current costs accounted for 28.5% of total expenditure, while capital expenditure accounted for only 14.8%.

Observing the sources of funds for R&D for total sectors, the largest amount was funded by units with internal funds, 43.3%, followed by the central and local government with 28.8%. A detailed analysis by sectors shows that enterprises mostly finance R&D with internal funds (71.5%), while the government and private non-profit sector (58.5%) and higher education (62.9%) are mostly financed by the central and local government.

The total R&D personnel in 2022 amounted to 28 230, which was 2.9% more than in the previous year. Of the total R&D personnel, 13 448 (47.6%) were women.

The employees of units performing the R&D were mostly engaged in the R&D activity, 94.8% of them, while 5.2% of the total R&D personnel were hired under contractual agreement or author's contract. The share of researchers in the total R&D personnel was 61.7% (out of which 48.4% were women). Among the researchers, there were 63.6% of doctors of science (the share of women among the researchers with a doctoral degree was 49.5%).

The R&D work may be the employees' main activity or their additional activity in part-time employment. In order to present the actual engagement of R&D employees, a full-time equivalent (FTE) is used in line with the standards of international statistics. The FTE is considered a main indicator of R&D personnel for the purpose of international comparison.

Expressed as a full-time equivalent, there were a total of 17 191.7 person-years employed in R&D in 2022 (i.e. persons in full-time employment in R&D), out of which 45.7% were women. There were 9 913.0 researchers expressed as FTE.

Regarding the sectoral distribution, 405 out of 569 observation units belonged to the business enterprise sector, 68 to the government and private non-profit sector and 96 to the higher education.

## 1 MAIN R&D INDICATORS, 2022

	Gross domestic expenditure, thousand kuna	Total R&D personnel (headcount)	Of that			Total R&D personnel (FTE)	Of that			Number of performing units
			Women	Researchers	Doctors of science		Women	Researchers	Doctors of science	
Sectors – total	7 228 846	28 230	13 448	17 421	11 085	17 191,7	7 848,3	9 913,0	5 543,1	569
Business enterprise sector	3 922 824	9 938	3 270	3 667	467	7 931,8	2 723,6	3 098,7	379,4	405
Government and private non-profit sector	1 293 129	4 839	2 848	3 221	2 679	3 286,1	1 933,4	2 166,5	1 807,7	68
Higher education	2 012 893	13 453	7 330	10 533	7 939	5 973,8	3 191,3	4 647,8	3 356,0	96

## 2 GROSS DOMESTIC EXPENDITURE ON R&D, BY SECTORS AND TYPES OF EXPENDITURES, 2022

Thousand kuna

	Gross domestic expenditure	Capital expenditures	Current expenditures		
			Total	Labour costs	Other current costs
Sectors – total	7 228 846	1 072 233	6 156 613	4 099 733	2 056 880
Business enterprise sector	3 922 824	387 042	3 535 782	2 036 660	1 499 122
Government and private non-profit sector	1 293 129	364 670	928 459	678 888	249 571
Higher education	2 012 893	320 521	1 692 372	1 384 185	308 187

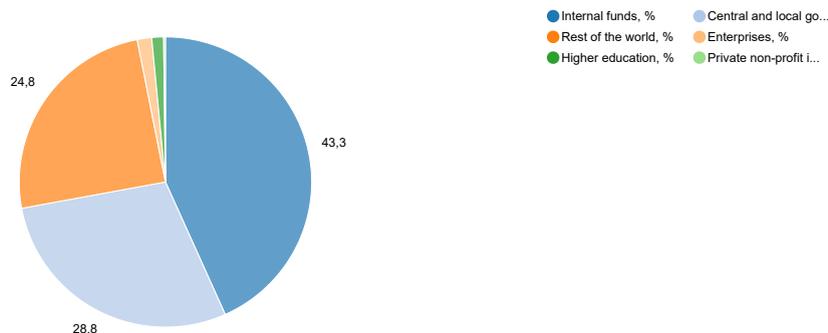
## 3 EXPENDITURE ON R&D IN BUSINESS ENTERPRISE SECTOR, TOTAL R&D PERSONNEL AND RESEARCHERS IN FULL-TIME EQUIVALENT, BY ENTERPRISE SIZE, 2022

	Expenditure on R&D, thousand kuna	Total R&D personnel	Researchers
Business enterprise sector — total	3 922 824	7 931,8	3 098,7
Up to 9	152 192	251,7	132,5
10 – 49	386 826	1 025,9	405,7
50 – 249	1 394 075	2 925,8	1 115,8
250 – 499	596 078	954,8	536,1
500 and more	1 393 653	2 773,6	908,6

## 4 SOURCES OF FUNDS FOR R&D, 2022

Thousand kuna

	Total	Internal funds	Central and local government	Enterprises	Higher education	Private non-profit institutions	Rest of the world
Sectors – total	7 228 846	3 131 058	2 080 998	112 570	91 245	16 830	1 796 145
Percentage	100,0	43,3	28,8	1,6	1,3	0,2	24,8
Business enterprise sector	3 922 824	2 804 483	58 303	26 879	866	12 747	1 019 546
Percentage	100,0	71,5	1,5	0,7	0,0	0,3	26,0
Government and private non-profit sector	1 293 129	135 836	756 473	28 979	48 942	3 127	319 772
Percentage	100,0	10,5	58,5	2,2	3,8	0,2	24,7
Higher education	2 012 893	190 739	1 266 222	56 712	41 437	956	456 827
Percentage	100,0	9,5	62,9	2,8	2,1	0,0	22,7

**G-2 SOURCES OF FUNDS FOR R&D, 2022**

**5 R&D PERSONNEL, BY TYPE OF EMPLOYMENT, SECTORS, OCCUPATION IN R&D AND SEX, 2022**

	Total		Researchers		Expert associates		Technicians		Other supporting staff	
	All	Women	All	Women	All	Women	All	Women	All	Women
<b>Headcount</b>										
Total R&D personnel	28 230	13 448	17 421	8 439	5 380	2 158	2 750	1 078	2 679	1 773
Business enterprise sector	9 938	3 270	3 667	1 186	3 583	1 166	1 767	508	921	410
Government and private non-profit sector	4 839	2 848	3 221	1 833	740	454	385	210	493	351
Higher education	13 453	7 330	10 533	5 420	1 057	538	598	360	1 265	1 012
Persons working on employment contract basis	26 752	12 738	16 418	7 969	5 130	2 030	2 620	1 031	2 584	1 708
Business enterprise sector	9 713	3 201	3 595	1 167	3 530	1 150	1 685	482	903	402
Government and private non-profit sector	4 310	2 568	2 897	1 679	626	388	362	200	425	301
Higher education	12 729	6 969	9 926	5 123	974	492	573	349	1 256	1 005
Persons hired under contractual agreement or author's contract	1 478	710	1 003	470	250	128	130	47	95	65
Business enterprise sector	225	69	72	19	53	16	82	26	18	8
Government and private non-profit sector	529	280	324	154	114	66	23	10	68	50
Higher education	724	361	607	297	83	46	25	11	9	7
<b>Full-time equivalent (FTE)</b>										
Total R&D personnel	17 191,7	7 848,3	9 913,0	4 692,3	4 150,7	1 552,6	1 753,3	692,9	1 374,7	910,5
Business enterprise sector	7 931,8	2 723,6	3 098,7	1 044,1	3 089,9	1 032,9	1 221,5	390,5	521,7	256,1
Government and private non-profit sector	3 286,1	1 933,4	2 166,5	1 261,3	480,2	275,9	264,9	132,0	374,5	264,2
Higher education	5 973,8	3 191,3	4 647,8	2 386,9	580,6	243,8	266,9	170,4	478,5	390,2
Persons working on employment contract basis	16 719,4	7 635,2	9 574,4	4 538,8	4 080,7	1 527,0	1 724,2	682,2	1 340,1	887,2
Business enterprise sector	7 856,6	2 705,2	3 067,9	1 038,3	3 062,3	1 027,9	1 209,3	386,3	517,1	252,7
Government and private non-profit sector	3 101,1	1 838,0	2 037,7	1 197,3	460,8	265,7	256,2	129,1	346,4	245,9
Higher education	5 761,7	3 092,0	4 468,8	2 303,2	557,6	233,4	258,7	166,8	476,6	388,6
Persons hired under contractual agreement or author's contract	472,3	213,1	338,6	153,5	70,0	25,6	29,1	10,7	34,6	23,3
Business enterprise sector	75,2	18,4	30,8	5,8	27,6	5,0	12,2	4,2	4,6	3,4
Government and private non-profit sector	185,0	95,4	128,8	64,0	19,4	10,2	8,7	2,9	28,1	18,3
Higher education	212,1	99,3	179,0	83,7	23,0	10,4	8,2	3,6	1,9	1,6

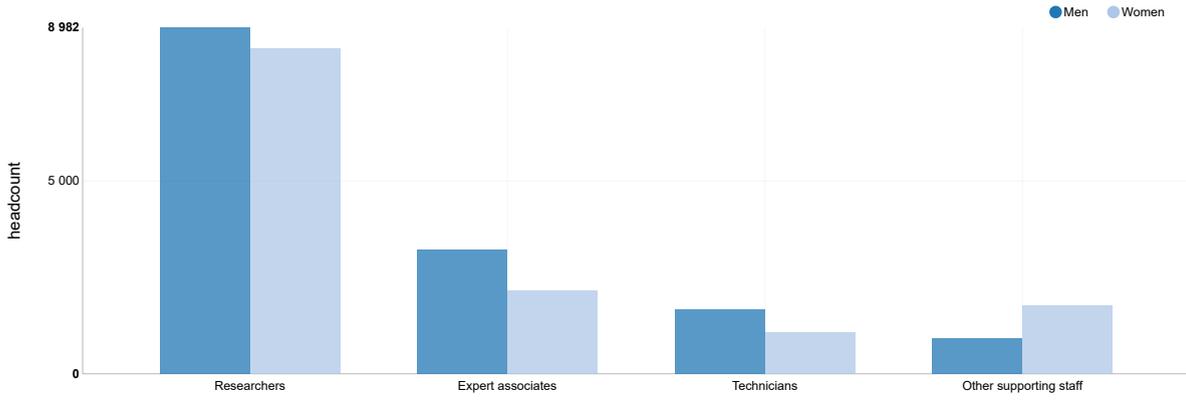
## 6 RESEARCHERS, BY TYPE OF EMPLOYMENT, SECTORS, EDUCATIONAL ATTAINMENT AND SEX, 2022

	Total		Researchers by educational attainment							
			Doctoral or equivalent level		Master's or equivalent level		Bachelor's or equivalent level		Short cycle tertiary education	
	All	Women	All	Women	All	Women	All	Women	All	Women
<b>Headcount</b>										
Researchers – total	17 421	8 439	10 756	5 490	5 850	2 686	676	246	139	17
Business enterprise sector	3 667	1 186	424	177	2 744	921	360	71	139	17
Government and private non-profit sector	3 221	1 833	2 542	1 383	471	310	208	140	-	-
Higher education	10 533	5 420	7 790	3 930	2 635	1 455	108	35	-	-
Persons working on employment contract basis	16 418	7 969	10 071	5 173	5 540	2 536	670	243	137	17
Business enterprise sector	3 595	1 167	384	167	2 720	915	354	68	137	17
Government and private non-profit sector	2 897	1 679	2 295	1 264	394	275	208	140	-	-
Higher education	9 926	5 123	7 392	3 742	2 426	1 346	108	35	-	-
Persons hired under contractual agreement or author's contract	1 003	470	685	317	310	150	6	3	2	-
Business enterprise sector	72	19	40	10	24	6	6	3	2	-
Government and private non-profit sector	324	154	247	119	77	35	-	-	-	-
Higher education	607	297	398	188	209	109	-	-	-	-
<b>Full-time equivalent (FTE)</b>										
Researchers – total	9 913,0	4 692,3	5 351,1	2 780,7	3 924,5	1 691,2	537,1	205,6	100,3	14,8
Business enterprise sector	3 098,7	1 044,1	351,5	161,7	2 353,3	810,5	293,6	57,1	100,3	14,8
Government and private non-profit sector	2 166,5	1 261,3	1 719,6	959,1	254,2	169,2	192,7	133,0	-	-
Higher education	4 647,8	2 386,9	3 280,0	1 659,9	1 317,0	711,5	50,8	15,5	-	-
Persons working on employment contract basis	9 574,4	4 538,8	5 128,3	2 675,1	3 813,2	1 644,3	533,6	204,6	99,3	14,8
Business enterprise sector	3 067,9	1 038,3	342,4	160,1	2 336,1	807,3	290,1	56,1	99,3	14,8
Government and private non-profit sector	2 037,7	1 197,3	1 611,2	903,2	233,8	161,1	192,7	133,0	-	-
Higher education	4 468,8	2 303,2	3 174,7	1 611,8	1 243,3	675,9	50,8	15,5	-	-
Persons hired under contractual agreement or author's contract	338,6	153,5	222,8	105,6	111,3	46,9	3,5	1,0	1,0	-
Business enterprise sector	30,8	5,8	9,1	1,6	17,2	3,2	3,5	1,0	1,0	-
Government and private non-profit sector	128,8	64,0	108,4	55,9	20,4	8,1	-	-	-	-
Higher education	179,0	83,7	105,3	48,1	73,7	35,6	-	-	-	-

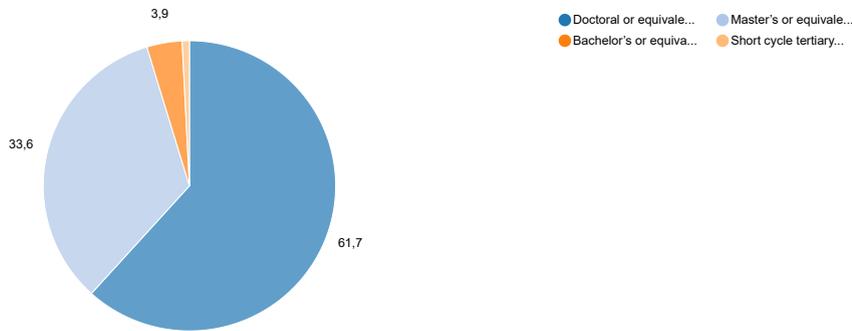
## 7 R&D PERFORMING UNITS, BY SECTORS AND FIELDS OF SCIENCE, 2022

	Total	Business enterprise sector	Government and private non-profit sector	Higher education
Total	569	405	68	96
Natural sciences	56	34	12	10
Engineering	295	265	3	27
Biomedicine and health	53	21	22	10
Biotechnical sciences	67	53	6	8
Social sciences	62	25	10	27
Humanities	24	1	15	8
Interdisciplinary fields of science	7	3	-	4
Artistic fields	5	3	-	2

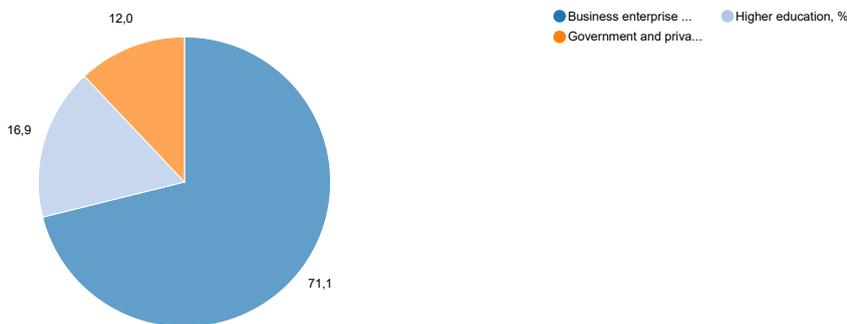
G-3 R&D PERSONNEL, BY OCCUPATION IN R&D AND SEX, HEADCOUNT, 2022



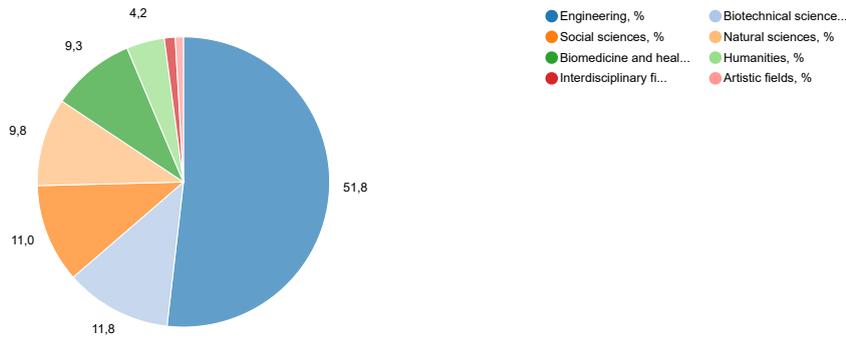
G-4 RESEARCHERS, BY EDUCATIONAL ATTAINMENT, HEADCOUNT, 2022



G-5 R&D PERFORMING UNITS, BY SECTORS, 2022



## G-6 R&D PERFORMING UNITS, BY FIELDS OF SCIENCE, 2022



## NOTES ON METHODOLOGY

### Purpose of the survey

The purpose of the Research and Development survey is to monitor the R&D activity in the Republic of Croatia. The survey is conducted every year with the aim of collecting and publishing data on R&D personnel, expenditure and sources of funds for R&D, as well as the results of the R&D activity. The survey results enable the measurement of research and development activities in the Republic of Croatia and represent a part of the basis for adopting national policy on research and development activity and monitoring its implementation. They also represent official data on the research and development activity in the Republic of Croatia that are published in national and international publications and databases. In addition to continuous monitoring of research and development activities, the survey is important for the calculation of GDP.

The survey is conducted on the basis of the Official Statistics Act (NN, No. 25/20). The legal basis of the European Union for the implementation of the survey is Regulation (EU) 2019/2152 of the European Parliament and of the Council of 27 November 2019 on European business statistics, repealing 10 legal acts in the field of business statistics (Text with EEA relevance).

### Sources and methods of data collection

Data are the result of statistical processing of annual reports collected from legal units dealing with the R&D in the Republic of Croatia in the 2022 calendar year, from business sector on the Annual Report on R&D for Enterprises (IR-1 form), from government and private non-profit sector on the Annual Report on R&D for Government and Private Non-Profit Sector (IR-2 form) and from institutions of higher education on the Annual Report on R&D for Higher Education (IR-3 form). The forms were sent to the reporting units via electronic mail, along with general instructions and attachments required to fill out the forms. The reporting units returned the filled forms in the same way.

The reference period to which data on R&D personnel and expenditure refer is the entire 2022.

Pursuant to the Official Statistics Act (NN, No. 25/20), the confidentiality of all data provided by the reporting units in the form is guaranteed. The data collected are used solely for statistical purposes and are published in aggregate form.

### Coverage and comparability

The statistical survey entitled Research and Development in 2022 covers legal units on the territory of the Republic of Croatia that are known or assumed to be engaged in the R&D activity. Due to the importance of research and development (R&D), which is seen as an initiator of economic growth and innovations, various data sources have been analysed in order to improve the survey coverage and to identify hitherto unknown legal units engaged in R&D. The following sources have been used: Register of Scientific Organisations of the Ministry of Science and Education, Survey on Innovation Activities in Croatian Enterprises (enterprises that indicated that they are engaged in R&D activities), Statistical Business Register of the Croatian Bureau of Statistics, previous Research and Development surveys and the project database within the programme Horizon Europe for the Republic of Croatia for data on funds allocated by applicants (EU\_CORDIS base), information on awarded grants to enterprises from the European Structural and Investment Funds, a list of scientific institutions of the Croatian Scientific Bibliography (CROSBIB), a list of funded HAMAG-BICRO projects as well as a list of legal entities that have reported investments in R&D in the Annual Report on Gross Investment in Fixed Assets (INV-P form) for 2021. The analysis of the mentioned sources resulted in the basic list of 1 386 reporting units, to which a form was sent.

The completed form was submitted by 569 units, 662 units responded that they were not engaged in the R&D activity and 155 units did not respond in any way. Data in this First Release present aggregate results for 569 units engaged in the R&D activity.

The 2022 data published in this First Release are comparable with data for the previous five years. Data for 2016 are not fully comparable with data from previous years due to the improvement of a number of statistical production processes and the break in time series.

Until 1996, the statistics on scientific research was compiled by means of the Annual Report for Legal Entities Engaged in Science and Research and Legal Entities Engaged in Research and Development (NIRO form), which covered all legal entities engaged in science and research as well as research units within enterprises and institutions, and all institutions of higher education that were recorded with the Register of the Ministry of Science and Technology of the Republic of Croatia in the referent year.

Since 1997, the sector approach has been introduced, based on the international methodology – the Frascati Manual 2002 – and aimed at the expansion of the business enterprise sector as the principal domain of research and development in the world. Data for the period from 1997 to 2003 were collected from business enterprises employing more than a hundred persons, the 2004 data were collected from business enterprises employing more than ten persons and, since 2005, enterprises with less than ten employees as well as private non-profit sector have been covered. Since 2013, the private non-profit sector has been presented together with the government sector due to the small number of units.

### Definitions and explanations

Definitions of the R&D field are based on the international methodology – the Frascati Manual 2015 (*Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*, publisher: Organisation for Economic Co-operation and Development – OECD, Paris, 2015).

**Research and development (R&D)** comprise systematic creative work aimed at increasing knowledge about man, culture and society and its application in practice. For an activity to be an R&D activity, it must satisfy five criteria. The activity must be novel, creative, uncertain, systematic and transferable and/or reproducible. There are three types of research and development: basic research, applied research and experimental development.

**Basic research** is a theoretical or experimental work, which mainly aims at attaining to new knowledge about basics of phenomena and facts with no practical application.

**Applied research** is a theoretical or experimental work, which mainly aims at attaining to new knowledge and which is primarily focused on achieving practical objectives.

**Experimental research** is a systematic work based on the results of scientific research and practical experience, aimed at creating new materials, products and systems as well as at introducing new or improving existing processes.

**Business enterprise sector** comprises enterprises and institutions the main activity of which is production of goods and services intended for market at commercial price. The business enterprise sector includes public enterprises, as well as non-profit institutions that are market producers of goods or services.

**Government sector** comprises all units of central and local government, including social security funds, except institutions of higher education, as well as all non-profit institutions that are controlled by government units, and that are not themselves part of the Higher education sector.

**Private non-profit sector** comprises non-market, non-profit institutions serving households (that is, the general public), except those mainly controlled and financed by government, their main characteristic being that they should not be the source of revenue or profit to the institutions controlling them.

**Higher education** includes all institutions providing formal tertiary education programmes, whatever their source of finance or legal status, and all research institutes and centres that have their R&D activities under the direct control of, or administered by, tertiary education institutions.

**Gross domestic expenditure on R&D** (GERD) is the total intramural expenditure on R&D performed in the national territory during the reporting calendar year. GERD includes domestically performed R&D that is financed from abroad but excludes funding for R&D performed abroad. Intramural R&D expenditures are all current expenditures and gross fixed capital expenditures for R&D performed within reporting unit, irrespective of the source of funds.

**Current expenditures** comprise labour costs and other current costs used in R&D.

**Labour costs** include compensations of employees (wages and salaries and social contributions paid by an employer), vocational training costs and other labour costs.

**Other current costs** comprise material costs, costs of persons hired under contractual agreement of author's contract, acquiring services to support intramural R&D and other costs (costs of indirect services).

**Capital expenditures** are the annual gross amount paid for the acquisition of fixed assets that are used repeatedly or continuously in the performance of R&D for more than one year. They comprise investing in land and buildings, machinery and equipment, computer software and patents, licences, studies and projects.

**Total R&D personnel** include all persons engaged directly in R&D, whether employed by the reporting unit or external contributors (persons hired under contractual agreement or author's contract) fully integrated into the unit's R&D activities, as well as those providing direct services for the R&D activities (such as R&D managers, administrators, technicians). According to the recommendations of the Frascati Manual 2015, persons who work less than 10% of full-time hours are not included.

**Researchers** are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods.

**Technicians and equivalent staff** are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities and the arts. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers.

**Expert associates** are persons with higher education employed to perform expert jobs (librarians, IT professionals, information specialists, etc.), who participate in the scientific and research and R&D work, but are not the managers of R&D projects.

**Other supporting staff** are employees who perform all the activities that directly contribute to the R&D performance, which are not performed by researchers or technicians and expert associates. These activities include secretarial and other administrative tasks, the management of materials or equipment required for the R&D project implementation, supporting activities related to R&D such as planning, information and financial support, legal services, assistance in the assembly, adjustment, maintenance and repair of scientific equipment and instruments. Managerial and administrative staff who mainly deal with financial and personnel issues and general administration also perform the aforementioned activities if their activities are directly related to R&D projects.

**Full-time equivalent** (FTE) is expressed in person-years and presents time as a share of full working time in which persons in employment are engaged in the work related to R&D (for example, if a person was engaged in works related to R&D for six months in full working time, it is expressed as 0.5 full-time equivalent – 0.5 FTE).

## Abbreviations

EU	European Union
GDP	gross domestic product
HAMAG-BICRO	Croatian Agency for SMEs, Innovations and Investments
NN	Narodne novine, official gazette of the Republic of Croatia
OECD	Organisation for Economic Co-operation and Development

## Symbols

-	no occurrence
0,0	value not zero but less than 0.05 of the unit of measure used

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