



RESEARCH AND DEVELOPMENT, 2021

The share of research and development (R&D) expenditures in GDP in 2021 was 1.27%

In 2021, a total of 5.5 billion kuna was spent on R&D activity in the Republic of Croatia, which was an increase of 15.5% 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. 46.5%. It was followed by higher education with 32.3%, while the smallest amount of funds was spent in the government and private non-profit sector, i.e. 21.1%.

The largest share of expenditure on R&D was accounted for by labour costs, 62.5%. Other current costs accounted for 22.8% of total expenditure, while capital expenditure accounted for only 14.7%.

Observing the sources of funds for R&D for total sectors, the largest amount was funded by units with internal funds, 42.9%, followed by the central and local government with 33.1%. A detailed analysis by sectors shows that enterprises mostly finance R&D with internal funds (77.4%), while the government and private non-profit sector (58.0%) and higher education (62.0%) are mostly financed by the central and local government.

The total R&D personnel in 2021 amounted to 27 424, which was 8.8% more than in the previous year. Of the total R&D personnel, 13 247 (48.3%) were women.

The employees of units performing the R&D were mostly engaged in the R&D activity, 93.2% of them, while 6.8% 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 61.5% (out of which 48.8% were women). Among the researchers, there were 64.1% of doctors of science (the share of women among the researchers with a doctoral degree was 49.2%).

The R&D work may be the employees' main activity or their additional activity in part-time employment. In order to present 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 16 528.2 person-years employed in R&D in 2021 (i.e. persons in full-time employment in R&D), out of which 47.2% were women. There were 9 507.7 researchers expressed as FTE.

Regarding the sectoral distribution, 371 out of 529 observation units belonged to the business enterprise sector, 64 to the government and private non-profit sector and 94 to the higher education.

1 MAIN R&D INDICATORS, 2021

	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	5 459 426	27 424	13 247	16 879	10 814	16 528,2	7 800,4	9 507,7	5 552,4	529
Business enterprise sector	2 539 681	8 637	2 726	3 119	432	6 614,7	2 221,6	2 508,9	349,6	371
Government and private non-profit sector	1 154 291	4 646	2 741	2 949	2 509	3 531,3	2 117,6	2 136,2	1 837,9	64
Higher education	1 765 454	14 141	7 780	10 811	7 873	6 382,2	3 461,2	4 862,6	3 364,9	94

2 GROSS DOMESTIC EXPENDITURE ON R&D, BY SECTORS AND TYPES OF EXPENDITURES, 2021

Thousand kuna

	Gross domestic expenditure	Capital expenditures	Current expenditures		
			Total	Labour costs	Other current costs
Sectors – total	5 459 426	801 412	4 658 014	3 412 286	1 245 728
Business enterprise sector	2 539 681	263 656	2 276 025	1 502 822	773 203
Government and private non-profit sector	1 154 291	254 350	899 941	899 941	228 549
Higher education	1 765 454	283 406	1 482 048	1 238 072	243 976

3 EXPENDITURE ON R&D IN BUSINESS ENTERPRISE SECTOR, TOTAL R&D PERSONNEL AND RESEARCHERS IN FULL-TIME EQUIVALENT, BY ENTERPRISE SIZE, 2021

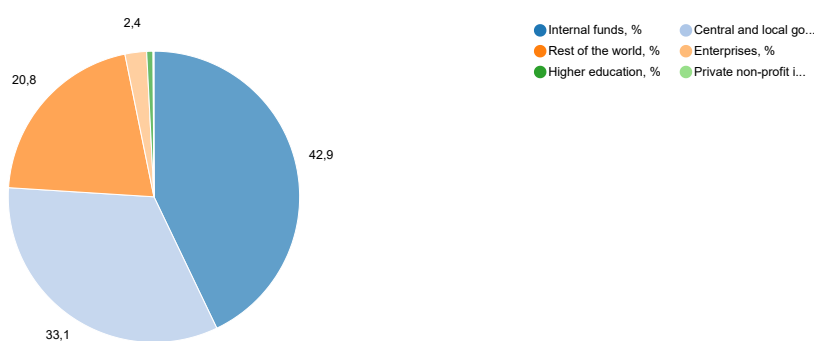
	Expenditure on R&D, thousand kuna	Total R&D personnel	Researchers
Business enterprise sector — total	2 539 681	6 614,7	2 508,9
Up to 9	57 975	197,7	88,5
10 – 49	233 852	769,4	306,5
50 – 249	864 242	2 618,6	1 169,4
250 – 499	205 326	298,4	157,4
500 and more	1 178 286	2 730,6	787,1

4 SOURCES OF FUNDS FOR R&D, 2021

Thousand kuna

	Total	Internal funds	Central and local government	Enterprises	Higher education	Private non-profit institutions	Rest of the world
Sectors - total	5 459 426	2 342 529	1 810 256	132 423	35 808	4 036	1 134 374
Percentage	100,0	42,9	33,1	2,4	0,7	0,1	20,8
Business enterprise sector	2 539 681	1 966 067	46 731	17 101	1 069	-	508 713
Percentage	100,0	77,4	1,9	0,7	0,0	-	20,0
Government and private non-profit sector	1 154 291	152 491	669 704	65 086	11 003	3 685	252 322
Percentage	100,0	13,2	58,0	5,6	1,0	0,3	21,9
Higher education	1 765 454	223 971	1 093 821	50 236	23 736	351	373 339
Percentage	100,0	12,7	62,0	2,8	1,3	0,0	21,2

G-1 SOURCES OF FUNDS FOR R&D, 2021



5 R&D PERSONNEL, BY TYPE OF EMPLOYMENT, SECTORS, OCCUPATION IN R&D AND SEX, 2021

	Total		Researchers		Expert associates		Technicians		Other supporting staff	
	All	Women	All	Women	All	Women	All	Women	All	Women
Headcount										
Total R&D personnel	27 424	13 247	16 879	8 230	5 430	2 291	2 794	1 193	2 321	1 533
Business enterprise sector	8 637	2 726	3 119	952	3 171	993	1 694	512	653	269
Government and private non-profit sector	4 646	2 741	2 949	1 675	797	484	415	247	485	335
Higher education	14 141	7 780	10 811	5 603	1 462	814	685	434	1 183	929
Persons working on employment contract basis	25 558	12 280	15 673	7 612	4 921	2 006	2 697	1 168	2 267	1 494
Business enterprise sector	8 428	2 676	3 041	932	3 109	978	1 631	500	647	266
Government and private non-profit sector	4 269	2 561	2 704	1 558	708	448	407	245	450	310
Higher education	12 861	7 043	9 928	5 122	1 104	580	659	423	1 170	918
Persons hired under contractual agreement or author's contract	1 866	967	1 206	618	509	285	97	25	54	39
Business enterprise sector	209	50	78	20	62	15	63	12	6	3
Government and private non-profit sector	377	180	245	117	89	36	8	2	35	25
Higher education	1 280	737	883	481	358	234	26	11	13	11
Full-time equivalent (FTE)										
Total R&D personnel	16 528,2	7 800,4	9 507,7	4 589,7	3 988,8	1 558,7	1 739,2	808,0	1 292,5	844,0
Business enterprise sector	6 614,7	2 221,6	2 508,9	812,0	2 673,1	865,6	1 066,6	387,2	366,1	156,8
Government and private non-profit sector	3 373,3	2 032,0	2 028,4	1 179,7	579,5	356,4	362,5	216,8	402,9	279,1
Higher education	5 986,5	3 237,9	4 585,9	2 387,2	606,5	262,1	296,8	197,9	497,3	390,7
Persons working on employment contract basis	15 884,5	7 474,0	9 089,7	4 372,3	3 818,5	1 476,1	1 711,4	799,9	1 264,9	825,7
Business enterprise sector	6 524,7	2 204,1	2 475,4	805,4	2 632,5	857,6	1 052,1	385,2	364,7	155,9
Government and private non-profit sector	3 373,3	2 032,0	2 028,4	1 179,7	579,5	356,4	362,5	216,8	402,9	279,1
Higher education	5 986,5	3 237,9	4 585,9	2 387,2	606,5	262,1	296,8	197,9	497,3	390,7
Persons hired under contractual agreement or author's contract	643,7	326,4	418,0	217,4	170,3	82,6	27,8	8,1	27,6	18,3
Business enterprise sector	90,0	17,5	33,5	6,6	40,6	8,0	14,5	2,0	1,4	0,9
Government and private non-profit sector	158,0	85,6	107,8	59,0	19,8	9,1	6,3	2,0	24,1	15,5
Higher education	395,7	223,3	276,7	151,8	109,9	65,5	7,0	4,1	2,1	1,9

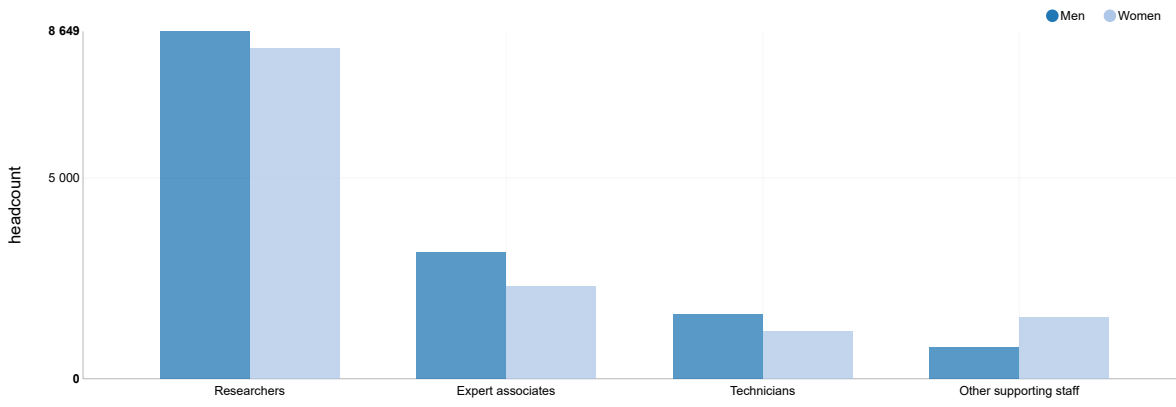
6 RESEARCHERS, BY TYPE OF EMPLOYMENT, SECTORS, EDUCATIONAL ATTAINMENT AND SEX, 2021

	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
Headcount										
Researchers – total	16 879	8 230	10 454	5 320	5 547	2 668	754	227	124	15
Business enterprise sector	3 119	952	380	137	2 084	720	532	80	123	15
Government and private non-profit sector	2 949	1 675	2 335	1 274	392	255	221	146	1	-
Higher education	10 811	5 603	7 739	3 909	3 071	1 693	1	1	-	-
Persons working on employment contract basis	15 673	7 612	9 639	4 923	5 160	2 447	751	227	123	15
Business enterprise sector	3 041	932	345	133	2 044	704	529	80	123	15
Government and private non-profit sector	2 704	1 558	2 114	1 165	369	247	221	146	-	-
Higher education	9 928	5 122	7 180	3 625	2 747	1 496	1	1	-	-
Persons hired under contractual agreement or author's contract	1 206	618	815	397	387	221	3	-	1	-
Business enterprise sector	78	20	35	4	40	16	3	-	-	-
Government and private non-profit sector	245	117	221	109	23	8	-	-	1	-
Higher education	883	481	559	284	324	197	-	-	-	-
Full-time equivalent (FTE)										
Researchers – total	9 507,7	4 589,7	5 309,2	2 759,8	3 453,2	1 619,5	646,8	196,9	98,5	13,5
Business enterprise sector	2 508,9	812,0	317,0	124,2	1 641,4	603,7	452,2	70,6	98,3	13,5
Government and private non-profit sector	2 136,2	1 238,7	1 701,7	954,2	240,2	158,7	194,1	125,8	0,2	-
Higher education	4 862,6	2 539,0	3 290,5	1 681,4	1 571,6	857,1	0,5	0,5	-	-
Persons working on employment contract basis	9 089,7	4 372,3	5 039,3	2 628,3	3 306,7	1 533,6	645,4	196,9	98,3	13,5
Business enterprise sector	2 475,4	805,4	300,9	122,9	1 625,4	598,4	450,8	70,6	98,3	13,5
Government and private non-profit sector	2 028,4	1 179,7	1 599,6	898,1	234,7	155,8	194,1	125,8	-	-
Higher education	4 585,9	2 387,2	3 138,8	1 607,3	1 446,6	779,4	0,5	0,5	-	-
Persons hired under contractual agreement or author's contract	418,0	217,4	269,9	131,5	146,5	85,9	1,4	-	0,2	-
Business enterprise sector	33,5	6,6	16,1	1,3	16,0	5,3	1,4	-	-	-
Government and private non-profit sector	107,8	59,0	102,1	56,1	5,5	2,9	-	-	0,2	-
Higher education	276,7	151,8	151,7	74,1	125,0	77,7	-	-	-	-

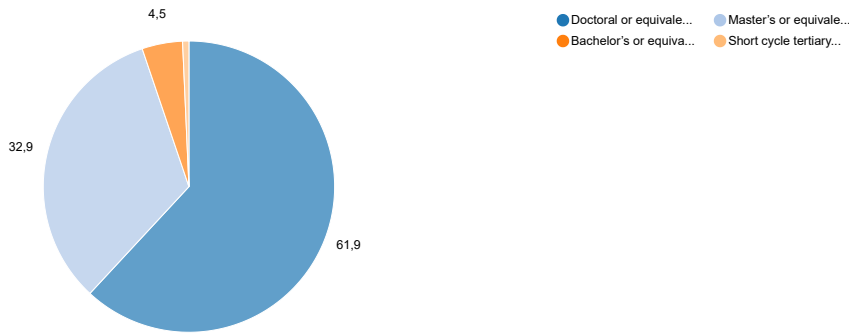
7 R&D PERFORMING UNITS, BY SECTORS AND FIELDS OF SCIENCE, 2021

	Total	Business enterprise sector	Government and private non-profit sector	Higher education
Total	529	371	64	94
Natural sciences	48	26	12	10
Engineering	277	247	3	27
Biomedicine and health	44	16	19	9
Biotechnical sciences	59	46	6	7
Social sciences	62	25	11	26
Humanities	22	4	12	6
Artistic field	3	-	-	3
Interdisciplinary fields of science	14	7	1	6

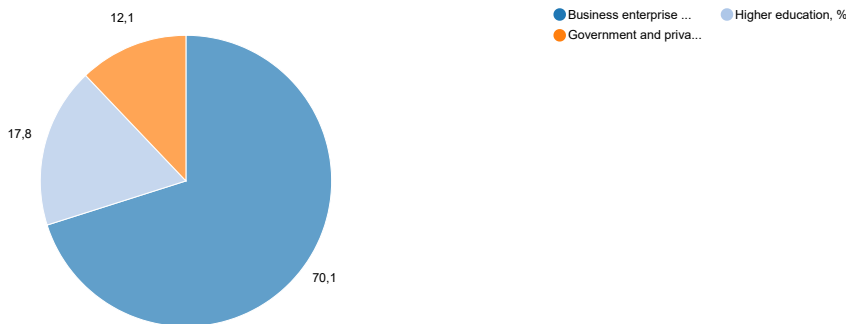
G-2 R&D PERSONNEL, BY OCCUPATION IN R&D AND SEX, HEADCOUNT, 2021



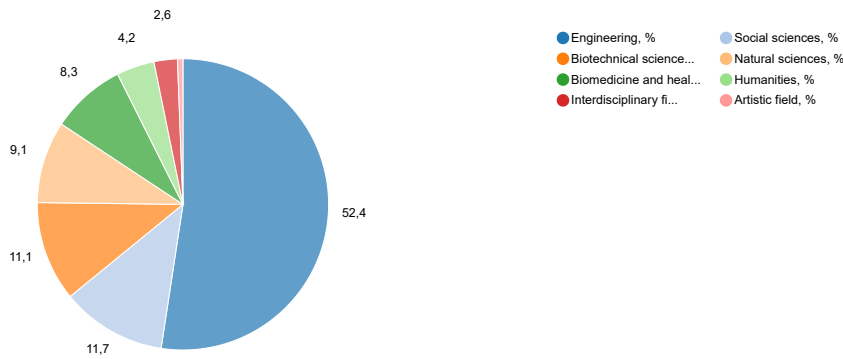
G-3 RESEARCHERS, BY EDUCATIONAL ATTAINMENT, HEADCOUNT, 2021



G-4 R&D PERFORMING UNITS, BY SECTORS, 2021



G-5 R&D PERFORMING UNITS, BY FIELDS OF SCIENCE, 2021



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 Decision No. 1608/2003/EC of the European Parliament and of the Council of 22 July 2003 concerning the production and development of Community statistics on science and technology and Commission Implementing Regulation (EU) No. 995/2012 of 26 October 2012 laying down detailed rules for the implementation of Decision No. 1608/2003/EC.

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 2021 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 2021.

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 aggregated form.

Coverage and comparability

The statistical survey entitled Research and Development in 2021 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 Horizon 2020 programme 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 (CROSBI), 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 2019. The analysis of the mentioned sources resulted in the basic list of 1 457 reporting units, to which a form was sent.

The completed form was submitted by 529 units, 736 units responded that they were not engaged in the R&D activity and 192 units did not respond in any way. Data in this First Release present aggregate results for 529 units engaged in the R&D activity.

The 2021 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 interruption 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 development 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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