8 Public budget and expenditures in educational R&D: towards a new generation of international indicators?

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Research and Experimental Development (R&D) is a key driver of innovation in all sectors of society. This chapter presents international statistics about countries' public investment in educational research and experimental development, showing that public educational R&D is one of the least funded socio-economic objectives. The chapter also highlights the limitations of available data proposes strategies to improve them.

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Introduction

In most sectors, public and private research and experimental development (R&D) expenditures constitute a good indicator of the intensity of product and process innovation. Thus, a key measure in innovation policy is to fund and stimulate public research, partly in alignment with governmental priorities, partly leaving researchers identify strategic research areas, generally by means of a tax policy to encourage private investment in R&D and by funding university researchers and government research agencies (OECD, 2015[1]; OECD, 2023[2]). Additionally, political and administrative entities increasingly require scientific knowledge as a basis for effective decision making. Increasing demand for usable knowledge, from policy makers and practitioners, has further developed national frameworks of educational R&D and constitutes an additional source of innovation in education (OECD, 2022[3]; OECD, 2007[4]).

The size, structure and characteristics of such national educational R&D systems remain largely obscure, as few comparative studies have approached the subject systematically. Data on staff and on R&D expenditure in education in eight OECD countries were published in *Education at a Glance 1995* (OECD, 1995[5]). At the time, educational R&D seemed to be a minor activity compared to the size of educational systems as a whole and R&D activities in other fields of science. The impact of educational R&D was deemed insignificant, and the International Indicators of Education Systems project (INES) resolved not to include the R&D indicators in posterior editions of Education at a Glance (McKenzie, 2007[6]). This is still the case in 2023.

This chapter presents and discusses measures of public educational R&D through the analysis of existing data collections within OECD and partner countries. Collected and compiled at the OECD by the Working Party of National Experts on Science and Technology Indicators (NESTI), these data collections follow the guidelines established in the different editions of the Frascati Manual (OECD, 2015[7]; OECD, 2002[8]), and focus on the inputs of research and development processes. The chapter presents the latest educational R&D indicators for 35 countries, presents some data collections that were discontinued at the international level, and discusses the limitations of available data. It ends by proposing strategies to collect more reliable comparative data on educational R&D.

Public budget for educational R&D

The government budget allocation to research and development (also known as GBARD) is currently the most widely available indicator of educational R&D funding in OECD countries. This is the public budget allocated to R&D. This indicator essentially "seeks to ascertain government intentions or objectives when committing money to R&D" (OECD, 2002[8]). The government budget allocations are derived from national budgets.

Their allocation between different fields is earmarked following the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS), more commonly referred to as socio-economic objectives. They thus enable to compare the public research budgets allocated to different purposes. The 2007 modification of the NABS classification system elevated "education" to the status of main socio-economic objective. Since then, a measure of R&D funding oriented towards education has been reported yearly by most OECD countries.

In 2020 nearly all countries reported their public R&D budget, and 34 countries earmarked its education share. This is the main information available to assess countries' public educational research budget.

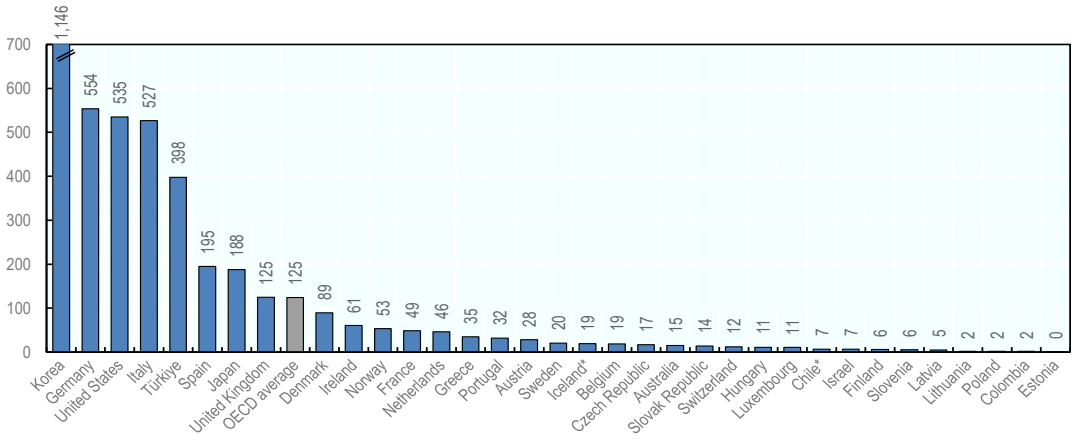
Public budget allocated to educational R&D

Figure 8.1 shows the educational research budget allocation in millions of US dollars (in purchasing power parities to make the values comparable across countries). In 2020, an OECD country allocated on average

USD 125 million to educational R&D (and the cumulative amount for all countries for which information is available amounted to USD 4.4 billion). Korea had the greatest public research budget for education, allocating more than 1 100 million, exceeding by far the next largest allocations: Germany (554), United States (at the federal level) (535), Italy (527) and Türkiye (398). Most countries allocate less than the country average – with a median at USD 19 million.

Figure 8.1. Public research budget for education, 2020

GBARD for education - Million PPP US dollars - 2015 Constant prices



Note: * 2019 instead of 2020

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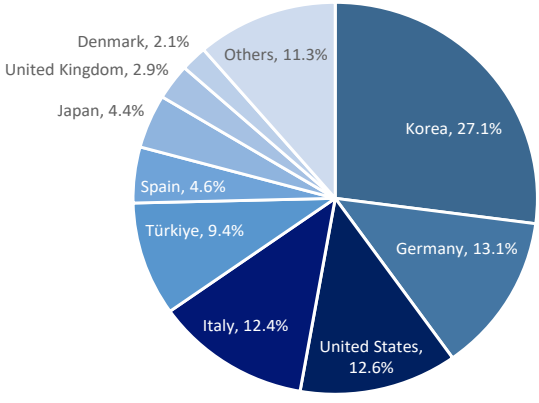
Figure 8.2. Distribution of public educational R&D budget across OECD countries

Percentage of total budget allocation for educational R&D in the OECD area



Note: Read: The budget for public educational research in Korea represents 27.1% of the total public R&D budget for education in the OECD area.

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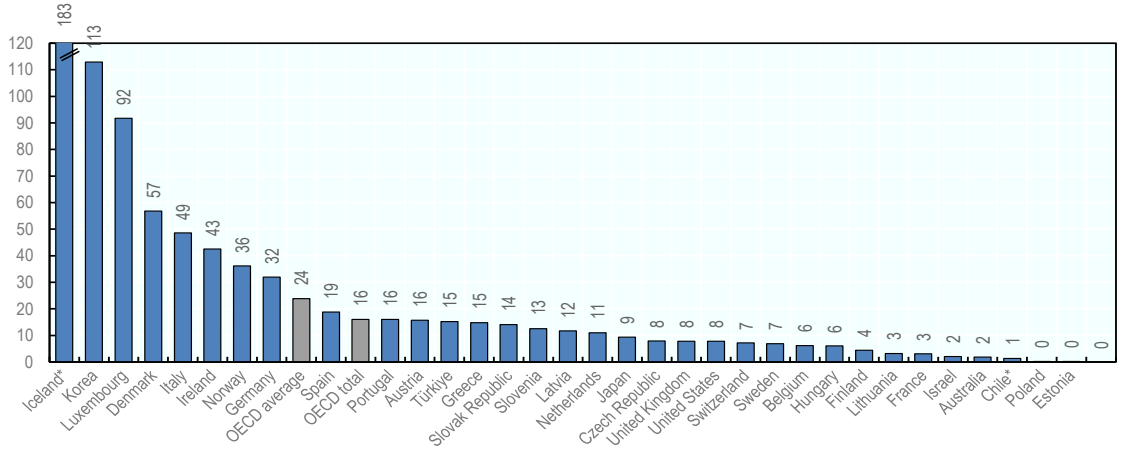
Figure 8.2 presents how the total educational R&D funding is distributed across countries. The budget for educational research in the OECD area is concentrated in a small number of countries. Korea, Germany and the United States account for over 50% of the budget.

Figure 8.3 presents the public educational research budget per student (calculated using 2020 enrolments at all levels of education). It offers a relative measure that accounts for the size of the countries' educational systems. This analysis not only flattens out the difference between the greatest and lowest public research allocations to education, but also highlights a distinct group of top funding countries. In 2020, Iceland allocated the largest relative educational research budget per student with USD 183, followed by Korea (113) and Luxembourg (92). The country mean stood at USD 24 per student and the median at USD 11, thus leaving Korea, Germany and Italy as the only countries above average in both absolute and relative terms.

Figure 8.3. Public educational R&D budget per student, 2020

GBARD for education per student (all levels of education) - PPP US dollars, 2015 constant prices



Note: * 2019 instead of 2020. Read: In Spain, the public budget for educational R&D corresponds to USD 19 per student in formal education.

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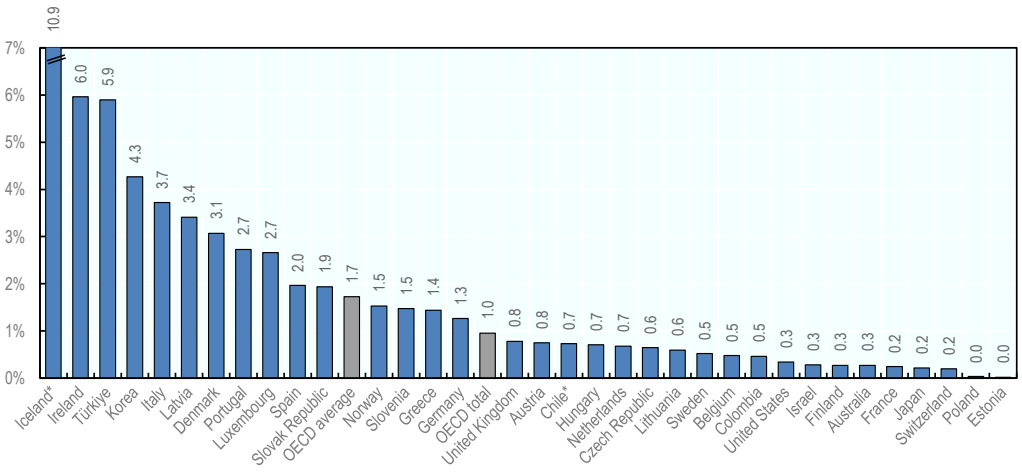
Share of public R&D allocated to educational R&D

In 2020, an OECD country allocated on average 1.7% of its public research budget on educational research. This appears to be relatively small given that an OECD country spent on average 5.8% of its GDP on education in 2019. There are large differences across countries, with a majority of countries (19) allocating less than 1% to educational R&D, eight between 1 and 3%, and seven over 3%. In total, taking into account the actual amount of the budget allocations, 1% of the total OECD budget for public R&D was allocated to educational R&D.

In the past decade, public educational research budgets have increased though. In 2010, a country allocated 1.1% of its public research budget to education (against 1.5% for countries for which data are available in 2010 and 2020). Figure 8.4 shows that on average the amounts allocated to public educational research (in constant prices) have increased by 5% a year and increased in almost all countries, and that the share of educational research in the total public research has also increased, albeit at a lower pace of 2%.

Figure 8.4. Share of the public research budget allocated to educational R&D, 2020

Share of GBARD for education in total GBARD



Note: * 2019 instead of 2020

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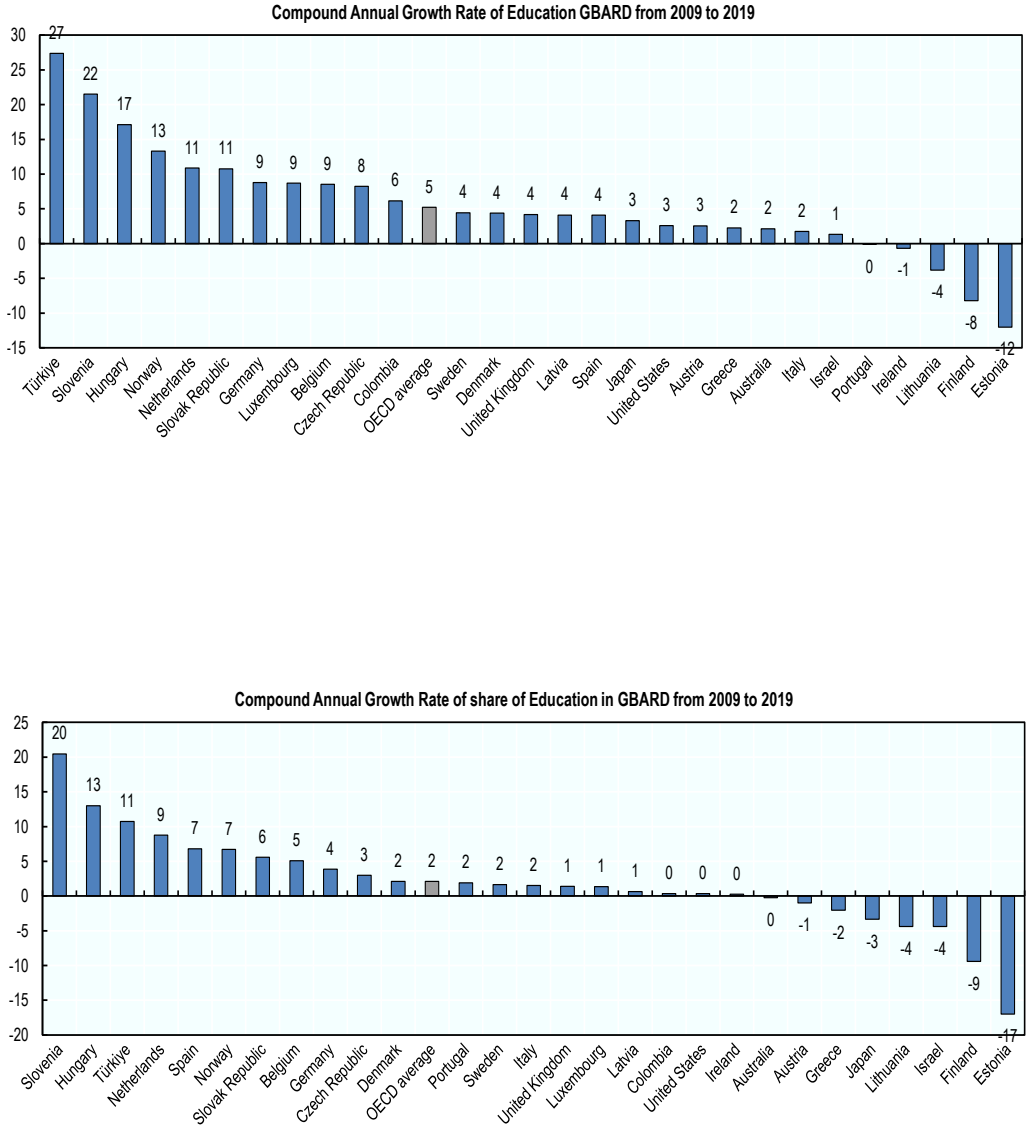
Figure 8.5 presents this evolution in a combined way, showing more clearly that most countries have tried to boost educational research compared to other sectors. From 2009 and 2019, the share of educational R&D in the total public R&D increased by 48% and the budget of educational R&D more than doubled (with a 124% increase). In most of countries, both measures move in same direction, increasing sometimes a lot, like in Hungary, the Netherlands, Slovenia and Türkiye where there were multiplied by more than two. At the opposite side, there are some countries such as Estonia and Finland in which both education GBARD and share of education were divided by two.

Figure 8.5. Growth rate of public educational R&D budget from 2009 to 2019, in value and as a share of the total public research budget

3-year centred moving averages, based on 2015 constant prices for budget amounts



Note: On average, the public budget for educational R&D grew by 5% per year in an OECD country (in constant prices and purchasing power parities) and the growth rate of public educational R&D in the share of total public R&D amounted to 2%. A negative growth rate denotes a decrease while a positive one an increase.

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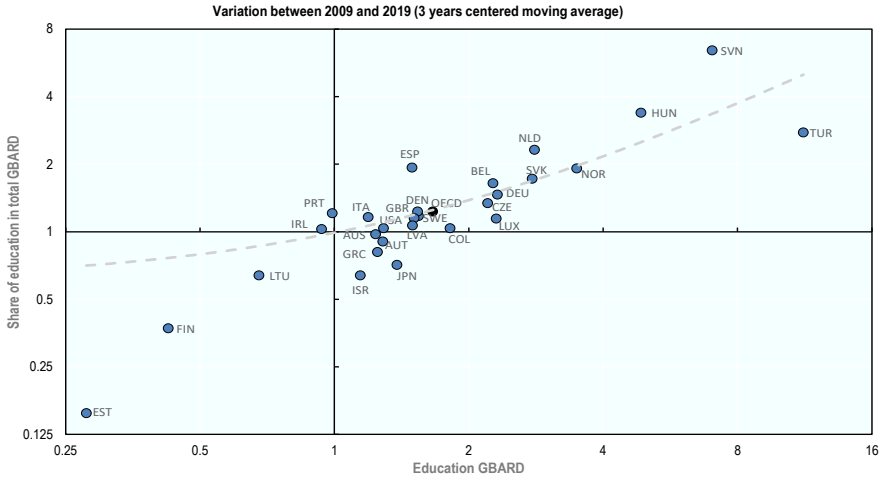
Figure 8.6. Combined annual growth of public educational R&D and of share of education in public R&D budget, 2009-2019

3-year centred moving averages, based on national currencies for budget amounts



Note: The two axes denote stability between 2009 and 2019. 1 means that the public educational R&D budget (GBARD) was identical in 2009 and 2019 in constant prices or that the share of education in the total public R&D budget remained the same. 0.5 means that it was halved, and 2 that it was doubled. The top right quadrant shows countries where both the amount and share of educational research have increased. The bottom left quadrant, where they have both decreased. The top left quadrant means that the amount of public research budget for education has decreased but that its share in the total public research has increased (meaning that the total amount of public research budget has decreased). The bottom right quadrant means that the amount of publica educational research has increased, but at a lower pace than what was allocated to other socio-economic objectives.

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Educational R&D compared to other socio-economic objectives

Comparing the public budget devoted to educational R&D to that of other sectors of society and the economy provides another perspective on governments' investment in educational R&D. Table 8.1 presents the distribution of the public R&D budget to different socio-economic objectives. The OECD average shows what a country spends on average for each domain, while the OECD total shows how much budget is allocated to each socio-economic budget for the whole OECD area. For example, while an OECD country allocates 4% to defence R&D, the defence budget within the OECD represents 19% of all public R&D expenditures given the allocations to defence R&D in some countries.

A feature, common to all OECD countries, emerges when comparing education to other socio-economic objectives. On average, education receives the second smallest share of the public research budget compared to all other socio-economic objectives (Table 8.1) – after culture, recreation, religion and mass media. In nine countries (out of 34 for which data are available) it was the least funded socio-economic objective (Australia, Colombia, Czech Republic, Estonia, Finland, Germany, Greece, Poland, United Kingdom) and, in 22 countries, one of the three least funded objectives in the public R&D budget. The average share allocated to educational research compares to other socio-economic objectives like "culture, recreation, religion and mass media" (1.3%), "political and social systems, structures and processes" (2.3%), "exploration and exploitation of the earth" (2.3%), "transport, telecommunication and other infrastructures" (2.5%) "environment" (2.6%), "exploration and exploitation of space" (2.6%), and "energy" (3.1%). A second group of socio-economic objectives which on average receive close to 4-5% of total allocations comprise "defence" (4%) and "agriculture" (5.1%). The socio-economic objectives of "health" and "industrial production

and technology" received on average large public research allocations: 9.3% and 12% of the total public research budget, respectively.

When looking at the allocation of budget at the OECD (rather than country) level, educational R&D remains the second last public research budget after culture, at 1% of the total public research budget – almost halved compared to the country average. Defence (19.7%) trumps general university funds for the general advancement of knowledge (17.3%), health (15.9%) and industrial production and technology (12.1%). In terms of overall public research budget, educational R&D (1%) compares with public R&D on culture, recreation and religion (0.5%), political and social systems, structures and processes (1.1%), exploration and exploitation of the Earth (1.4%) and environment (1.7%).

Figure 8.7 presents the relative size of educational research compared to some other fields of research: each panel showcases countries' public R&D (GBARD) allocations to agriculture, defence and health objectives as a factor of their public educational R&D budget. Agriculture is an interesting sector for education as it successfully managed its transition to a more "evidence-based" sector. Health is important as another social sector, while defence imports as a sector for which governmental R&D will mainly come from, for obvious reasons.

On average an OECD country assigned three times as much public budget for R&D to agriculture as to education. Only in Luxembourg, Iceland, Italy, Portugal and Türkiye was the budget allocation in the opposite direction.

As regards defence, the United States stands out: its absolute public education R&D budget allocation is the third largest among all OECD countries, but educational R&D represents 0.7% of its public budget for military and defence-related research (and 0.3% of its overall federal governmental R&D budget). Eleven OECD countries reported public educational R&D budgets larger than their public defence R&D budget (Austria, Denmark, Hungary, Ireland, Iceland, Israel, Italy, Latvia, Luxembourg, Portugal, Spain). Still, an OECD countries assigned on average about 2.3 times as much resources to defence as to education research (1.5 times as much, excluding the United States). And 20.5 as much to defence as to education in terms of overall OECD R&D budget appropriation.

Health research also receives significantly more public funding than education. On average, OECD countries assigned five times as much resources to health research as to education. The United States, Australia and France allocate respectively as much as 83, 69 and 50 times as much funds to public R&D on health as to educational R&D. Among OECD countries, only Iceland and Türkiye assigns more R&D funds to education than to health. In absolute terms, the public OECD budget for health R&D is 16-fold the public budget for educational R&D.

Table 8.1. Percentage of public R&D budget allocations by socio-economic objective, 2020

	Agriculture	Culture, recreation, religion and mass media	Defence	Education	Energy	Environment	Exploration and exploitation of space	Exploration and exploitation of the Earth	GAK: R&D financed from General University Funds (GUF)	GAK: R&D financed from sources other than GUF	Health	Industrial production and technology	Political and social systems, structures and processes	Transport, telecommunication and other infrastructures
Australia	8.5%	0.5%	6.2%	0.3%	4.2%	3.3%	0.4%	5.6%	34.4%	8.0%	18.7%	6.6%	1.4%	2.1%
Austria	1.2%	0.5%	0.1%	0.8%	3.5%	2.7%	0.7%	1.4%	56.6%	12.6%	4.6%	13.0%	1.1%	1.2%
Belgium		1.4%	0.7%	0.5%	1.7%	0.6%	8.4%	2.5%	17.5%	23.7%	2.3%	36.1%	4.0%	0.5%
Chile*	14.4%	0.1%	0.0%	0.7%	1.9%	1.3%	0.0%	4.6%	9.0%	59.3%	3.0%	3.3%	1.5%	0.7%
Colombia	23.7%	1.3%	0.9%	0.5%	1.0%	15.6%	0.0%	19.4%	NA	4.1%	16.7%	10.6%	5.0%	1.2%
Czech Republic	4.1%	0.7%	1.0%	0.6%	4.4%	2.1%	1.8%	1.9%	23.6%	34.4%	7.1%	11.7%	2.1%	4.5%
Denmark	3.0%	1.5%	0.3%	3.1%	3.6%	1.2%	1.1%	0.4%	46.2%	14.3%	14.8%	8.3%	2.1%	0.1%
Estonia	5.3%	0.7%	2.4%	0.0%	0.1%	1.3%	1.6%	1.1%	18.7%	61.5%	1.8%	1.3%	3.9%	0.1%
Finland	2.6%	0.4%	2.0%	0.3%	2.8%	3.0%	1.2%	0.7%	30.2%	27.6%	2.8%	21.4%	3.4%	1.6%
France	2.2%	0.8%	8.6%	0.2%	7.3%	1.8%	14.2%	0.8%	24.1%	22.4%	12.3%	0.9%	0.1%	4.3%
Germany	2.8%	1.1%	4.2%	1.3%	5.7%	2.7%	4.4%	1.4%	37.3%	14.5%	7.5%	13.4%	1.9%	1.9%
Greece	3.0%	10.2 %	1.6%	1.4%	2.2%	4.2%	1.7%	1.9%	31.4%	3.9%	10.8%	15.7%	5.8%	6.3%
Hungary	7.1%	1.8%	0.3%	0.7%	2.6%	4.3%	5.0%	2.0%	2.1%	19.1%	19.7%	29.9%	2.2%	3.2%
Iceland*	3.1%	0.0%	0.0%	10.9%	0.4%	0.0%	0.0%	0.7%	44.4%	24.4%	1.4%	14.4%	0.3%	0.0%
Ireland	10.7%	0.4%	0.0%	6.0%	0.9%	1.9%	2.7%	1.3%	17.0%	32.3%	6.8%	19.0%	0.6%	0.3%
Israel	4.9%	0.6%		0.3%	0.4%	0.7%	0.5%	1.0%	49.7%	3.5%	0.6%	33.6%	1.4%	2.7%
Italy	2.7%	0.6%	0.5%	3.7%	3.3%	2.9%	13.9%	5.5%	38.2%	1.7%	12.4%	10.0%	3.1%	1.5%
Japan	2.8%	0.0%	1.5%	0.2%	5.6%	2.7%	3.8%	0.6%	18.7%	14.7%	7.7%	33.7%	0.4%	7.6%
Korea	4.6%		16.6%	4.3%	5.3%	3.2%	1.7%	0.9%	NA	21.0%	8.3%	28.4%	2.3%	3.5%

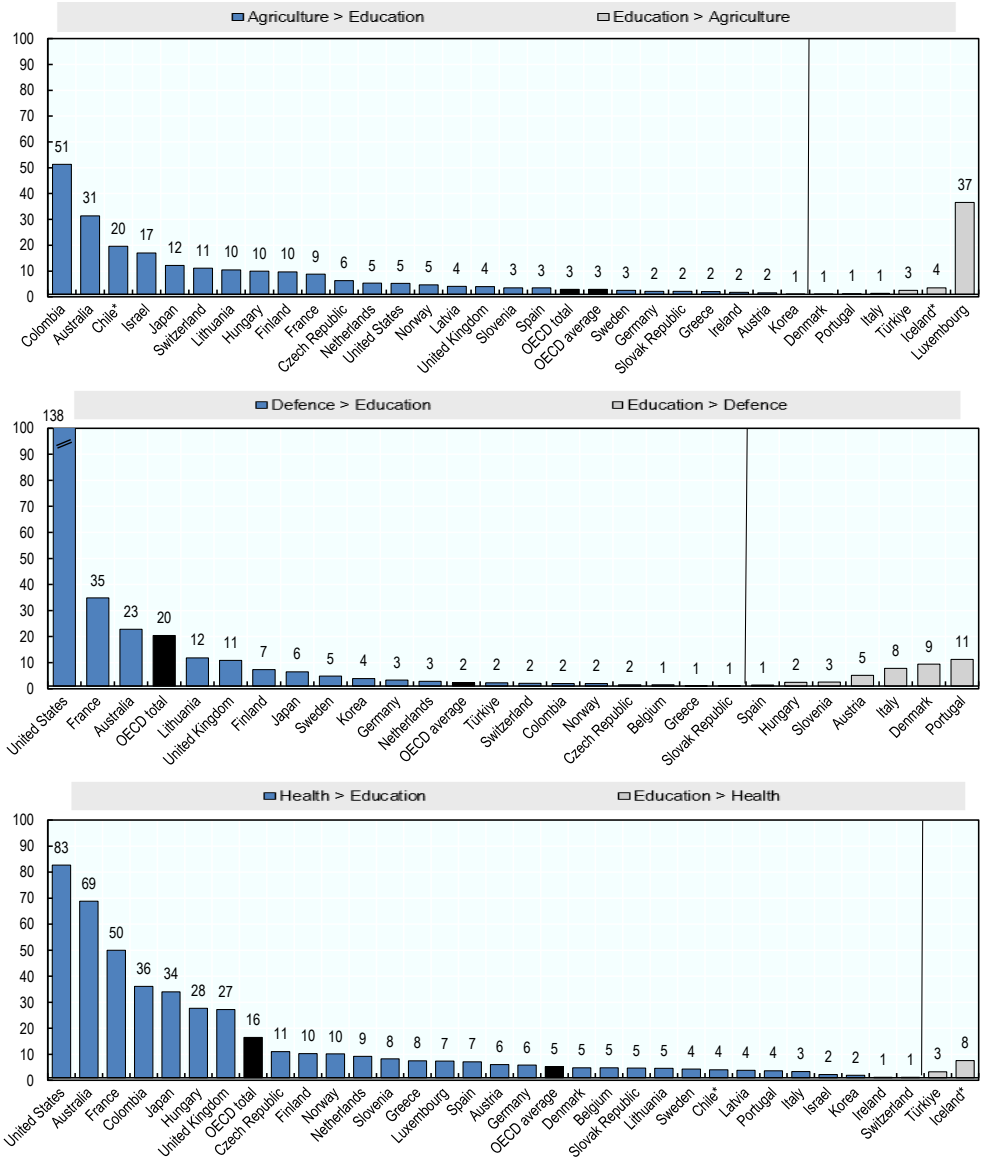
	Agriculture	Culture, recreation, religion and mass media	Defence	Education	Energy	Environment	Exploration and exploitation of space	Exploration and exploitation of the Earth	GAK: R&D financed from General University Funds (GUF)	GAK: R&D financed from sources other than GUF	Health	Industrial production and technology	Political and social systems, structures and processes	Transport, telecommunication and other infrastructures
Latvia	14.0%	3.0%		3.5%	2.4%	6.1%		0.3%	8.2%	29.5%	13.5%	8.4%	2.7%	8.4%
Lithuania	6.2%	2.8%	7.0%	0.6%	3.3%	0.3%	0.0%	3.0%	51.6%	11.9%	2.7%	8.1%	2.3%	0.0%
Luxembourg	0.1%	0.1%	0.0%	2.7%	0.2%	2.0%	0.0%	0.0%	34.9%	24.4%	19.7%	11.0%	5.0%	0.1%
Mexico	3.8%	0.3%	0.2%		15.0%	1.2%	0.1%	4.8%	39.1%	16.8%	6.9%	8.4%	3.1%	0.3%
Netherlands	3.6%	0.3%	1.9%	0.7%	2.0%	0.7%	2.9%	0.9%	55.4%	17.6%	6.2%	4.9%	1.5%	1.4%
Norway	7.1%	1.1%	2.9%	1.5%	2.5%	3.1%	2.3%	1.2%	34.0%	13.3%	15.5%	8.9%	4.8%	1.7%
Poland	6.3%	5.8%	3.5%	0.0%	0.9%	1.2%	0.5%	0.8%	46.4%	29.7%	2.3%	0.9%	0.1%	1.5%
Portugal	2.3%	1.6%	0.2%	2.7%	2.1%	4.3%	0.6%	1.3%	56.7%	8.6%	10.0%	5.1%	1.7%	2.7%
Slovak Republic	4.1%	3.4%	2.0%	1.9%	2.2%	2.9%	1.2%	2.0%	43.0%	16.9%	9.0%	7.7%	2.1%	1.5%
Slovenia	5.1%	2.3%	0.6%	1.5%	4.3%	5.3%	0.2%	2.8%	0.3%	47.3%	12.1%	12.1%	3.1%	3.0%
Spain	6.8%	1.0%	1.4%	2.0%	2.6%	3.1%	5.9%	2.4%	32.9%	14.8%	14.0%	9.3%	1.2%	2.6%
Sweden	1.3%	0.2%	2.5%	0.5%	4.5%	1.8%	1.1%	1.2%	50.6%	22.6%	2.3%	4.3%	2.5%	4.6%
Switzerland	2.2%	0.0%	0.4%	0.2%	0.6%	0.4%	2.6%	0.2%	61.2%	26.6%	0.2%	2.9%	2.4%	0.1%
Türkiye	2.3%	0.0%	13.4%	5.9%	1.3%	0.8%	1.3%	1.4%	48.8%	5.7%	1.8%	10.2%	0.4%	6.7%
United Kingdom	3.1%	1.3%	8.4%	0.8%	4.3%	1.8%	1.4%	3.9%	23.4%	13.3%	21.2%	6.0%	3.2%	7.9%
United States	1.8%	0.0%	47.1%	0.3%	2.7%	0.3%	8.4%	1.0%	NA	8.0%	28.3%	0.5%	0.4%	1.1%
OECD average	5.1%	1.3%	4.0%	1.7%	3.1%	2.6%	2.6%	2.3%	31.0%	20.3%	9.3%	12.0%	2.3%	2.5%
OECD total	*2.8%*	*0.5%*	*19.7%*	*1.0%*	*4.0%*	*1.7%*	*5.8%*	*1.4%*	*17.8%*	*13.1%*	*15.9%*	*12.1%*	*1.1%*	*3.2%*

Note: * 2019 instead of 2020. GAK = General Advancement of Knowledge.

Read: 0.3% of Australia's public R&D budget was allocated to education in 2020, 8.5% to agriculture, etc. The OECD average represents the share of a country's public research budget allocated on average to a specific economic objective. The OECD total presents the share that the OECD area allocates to each socio-economic objective (regardless of where the budget is located).

Figure 8.7. Public R&D budget for agriculture, defence and health relative to education, 2020

Positive or negative factor between the public research budget allocated to education within countries and the OECD



Note: Read: On average, in 2020, an OECD country allocated 3 times more governmental R&D budget to agriculture than education; 2 times more to defence; and 5 times more to health (OECD average). In the OECD area, public R&D for agriculture, defence and health represented 3, 16 and 20 fold the budget of public R&D about education (OECD total).

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The aforementioned categories of socio-economic objectives constitute a breakdown of applied or earmarked research only. Government appropriations and outlays are also assigned to non-earmarked research under the categories of General Advancement of Knowledge (GAK). This budget represents 51% on average of the public R&D budget, over 80% in Estonia and Switzerland and over 70% in the Netherlands, Poland and Sweden (Table 8.1).

In most countries, a significant share of this non-earmarked R&D corresponds to the share of public funding that governments allocate to universities through "general university funds". In most countries, these "general university funds" come as part of the public funding of universities (and/or academics). In a few countries such as the United States, Colombia or Korea, the public budget allocations for universities is deemed to be used exclusively for the education mission of universities, and research is funded separately. This is why this category appears as "not applicable" in Table 8.1.

Typically, universities (and other research agencies working on basic or multi-objective research) will perform educational research as part of the general advancement of knowledge (as well as research and development on the other socio-economic objectives). While it is reasonable to presume that at least some funding allocated to the general advancement of knowledge is devoted to educational research, further break down of this category is not collected by socio-economic objectives – although some countries collect a breakdown by field of science.

Assuming that the public budget for R&D for the general advancement of knowledge follows the same priorities as the other sectors, one could provide an estimation of those allocations taking these large public R&D budgets into account. In that hypothetical case, countries would allocate 4% on average of their public R&D budget to education (rather than the 1.7% with no such assumption) – and the OECD area, 1.4% of its public research budget (instead of 1%). The message would not be so different: education would remain the second least funded socio-economic objective on average and in total, and in eight countries educational R&D would remain the least funded socio-economic objective, and in 22 countries one of the three least funded.

This is an important caveat of the public R&D budget data by socio-economic objective, and thus to estimate public investment in educational research and experimental development.

Other educational R&D indicators

This section presents briefly other data that used to be collected by countries' statistical offices. Their collection at the international level has been discontinued, but they may still be available at the country level in some countries. The two other categories relate to countries' gross expenditure on R&D, which used to be reported by socio-economic objective, and the research personnel.

Gross Expenditure on R&D

The Gross Expenditure on R&D (also referred to as GERD) is collected by means of especially designed surveys targeted at performers of research and development. The institutions performing R&D are classified according to their main sector, that is, business enterprise, government, higher education or private non-profit. This information is still published by the OECD every year. Its advantage compared to the public budget is that it tries to capture actual rather than planned expenditures and covers other sectors than the government one. It is thus a strong measure of actual performance of R&D and an indicator of who performs it (regardless of the source of funding).

Until 2016, R&D expenditures information on educational expenditures were available by socio-economic objective, including education, in a few countries. (The difficulty to collect the information in enough countries for all socio-economic objectives led to the gradual abandonment of this data collection at the international level).

Table 8.2 presents the latest available distribution of the gross domestic expenditures on R&D by socio-economic objective (for 2014). It covers virtually all sectors of performance for the selected countries. The expenditures on education amounted to 3.2% on average in the OECD countries that collected this information. With the absence of the United States and several other large European countries, the average

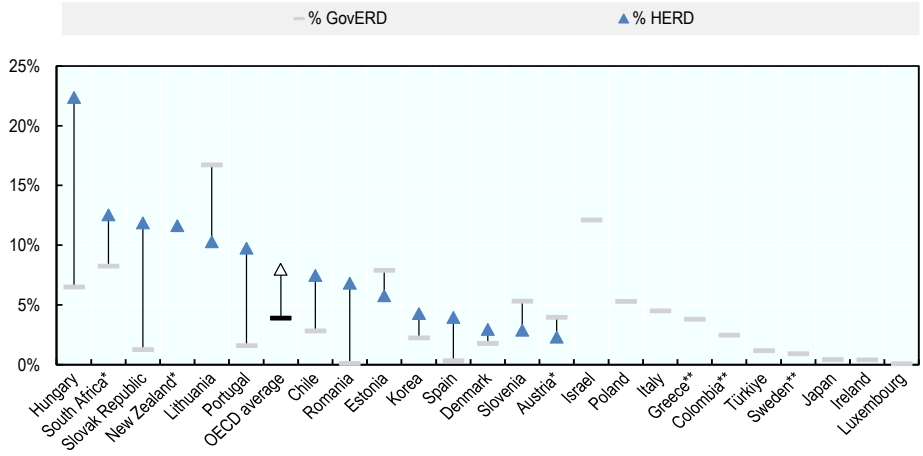
share of expenditure on defence or the exploration of space become relatively small. But once this is taken into account, expenditures on educational R&D appeared as small.

As the information about business expenditures and the non-profit sectors' expenditures on education were often missing, we focus on the two sectors for which information used to be available: gross expenditures on R&D by the higher education (HERD) and government (GovERD) sectors. It should be noted that this indicator cannot be compared in a straightforward way with the public R&D budget (GBARD). The public budget could indeed be spent by any sector in principle, here both the government and higher education sectors.

Figure 8.8 presents the share of intramural expenditure on R&D in education by government and higher education in 2014, the latest year for which enough information in education. On average, a country spent 3.9% of educational R&D in the government sector and 8% in higher education. In countries for which both indicators were available, countries used to spend a greater share of their R&D expenditures on education in higher education than in the government (except in Austria, Estonia, Lithuania and Slovenia). Hungary had the largest share of education R&D in higher education (22%), almost twice as much as any other country. It is likely that higher education institutions still spend (perform) more educational R&D than the government sector.

Figure 8.8. Share of education in total government and higher education R&D expenditures (2014)

Intramural expenditure on R&D in education by government (GovERD) and higher education (HERD)



Note: * 2013 instead of 2014 for Austria, New Zealand and South Africa; ** 2015 instead of 2014 for Colombia, Greece and Sweden
Source: OECD MSTI

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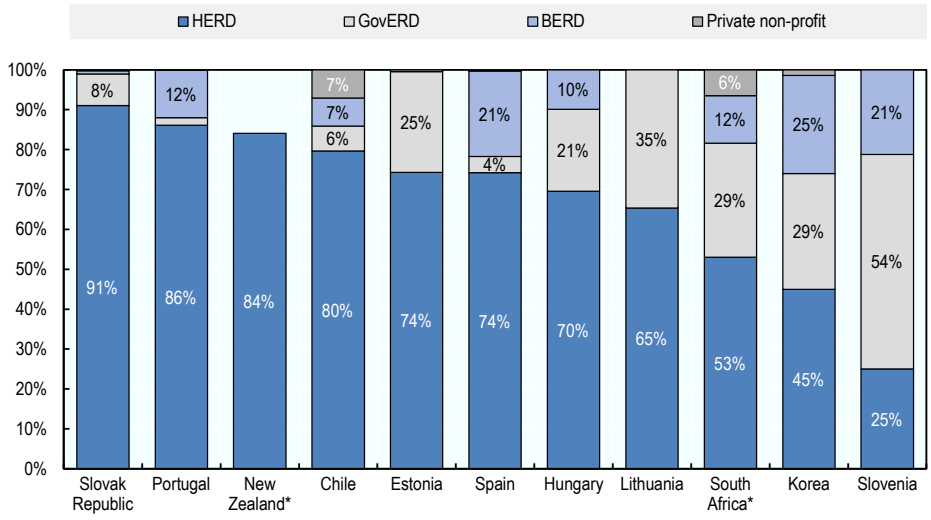
Table 8.2 Percentage of total Gross Domestic Expenditures on R&D by socio-economic objective, 2014

Gross Domestic Expenditures

	Agriculture	Culture, recreation, religion and mass media	Defence	Education	Energy	Environment	Exploration and exploitation of space	Exploration and exploitation of the Earth	General advancement of knowledge	Health	Industrial production and technology	Political and social systems, structures and processes	Transport, telecommunication and other infrastructures
Chile	13.3%	0.5%	0.3%	3.6%	2.7%	6.6%	13.0%	8.8%	20.5%	8.4%	17.1%	3.1%	2.1%
Estonia	5.0%	3.0%	0.8%	3.4%	5.9%	4.1%	0.8%	0.5%	30.4%	8.3%	13.2%	8.1%	16.6%
Hungary	6.9%	1.0%	0.4%	4.4%	1.7%	2.3%	0.2%	1.3%	6.4%	20.9%	40.5%	2.1%	11.9%
Korea	2.3%	1.2%	3.8%	0.9%	6.2%	3.1%	0.9%	1.0%	2.4%	6.6%	62.9%	1.1%	7.7%
New Zealand*	15.2%	7.2%	1.6%	4.2%	4.2%	10.4%		1.4%	7.2%	11.2%	18.7%	2.6%	16.1%
Portugal	4.1%	2.4%	0.8%	5.2%	4.6%	5.3%	1.0%	1.8%	15.7%	16.9%	25.9%	3.5%	12.8%
Slovak Republic	5.7%	1.4%	0.4%	4.5%	1.9%	2.0%	0.5%	4.6%	36.1%	8.0%	27.1%	0.6%	7.1%
Slovenia	1.8%	0.3%	0.0%	1.2%	5.0%	2.6%	0.1%	1.0%	25.4%	11.3%	45.7%	0.5%	4.9%
Spain	5.7%	2.2%	2.6%	1.5%	6.3%	4.6%	2.4%	3.6%	9.8%	19.7%	24.6%	2.7%	14.3%
OECD average	6.6%	2.1%	1.2%	3.2%	4.3%	4.6%	2.4%	2.7%	17.1%	12.3%	30.5%	2.7%	10.4%
South Africa*	9.9%		5.4%	6.7%	3.3%	3.4%	0.4%	9.2%	18.2%	11.1%	26.3%		6.1%

A few countries had a more comprehensive picture of the sectors that perform educational R&D. Figure 8.9 shows that, in 2014, in all countries for which data were available except Slovenia, higher education was the largest performing sector of educational R&D (as measured by expenditures) – and often the sector that spent the large majority of the country's expenditure on educational R&D. Korea (45%) and Slovenia (25%) were the only countries where the higher education sector spent less than 50% of the total education expenditures. This might explain why Korea had such a large government appropriation for educational R&D. The educational R&D expenditures coming from business (BERD) were very limited compared to most other sectors, never achieving 25% of all expenditures. Only Korea (25%), Spain (21%) and Slovenia (21%) reach at least 20%. It would be interesting to know whether this has changed with the emergence of the "education technology" sector.

Figure 8.9. Distribution of the gross expenditures on educational R&D by sector (2014)



Note: * 2013 instead of 2014 for New Zealand and South Africa. HERD = Higher Education expenditures on R&D, GovERT = Government expenditures on R&D; BERD = Business expenditures on R&D.
Source: OECD MSTI

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R&D personnel

The R&D personnel working on educational research is the last indicator that could allow one to compare the relative importance of educational research across sectors and countries. Data on R&D personnel are collected by means of especially designed surveys targeted at performers of research and development. Like the domestic expenditures on R&D data, they are collected for different sectors of the economy (government, higher education, business and private non-profit) and can be broken down by field of science. Education is a sub-field of "social science", but reporting at that level of detail has also been discontinued.

According to the Frascati manual (OECD, 2015[7]), data on personnel should ideally include all occupations levels (administrators, researchers, technical and support staff) and internal as well as external personnel. They should also be reduced to full time equivalent (FTE) units. While personnel data were generally available at this desired level of detail, human resources devoted specifically to education research were only listed as headcount of researchers.

Table 8.3. Percentage of government and higher education researchers (headcount) by field of science, 2013

	Social sciences			Social sciences: Education			Agricultural Sciences			Engineering and technology			Humanities			Medical and Health sciences			Natural Sciences		
	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE
Austria	30.1	19.3	20.3	5.5	3.2	3.4	11.4	2.9	3.7	6.9	18.5	17.4	24.5	12.4	13.6	6.6	20.4	19.1	20.7	26.5	25.9
Belgium	3.2	17.8	16.2			2.9	12.0	6.9	7.5	38.4	17.9	20.2	8.6	10.6	10.4	5.3	23.0	21.0	32.5	23.7	24.7
Czech Republic	5.9	20.0	16.2			2.9	5.2	7.2	6.7	8.2	23.8	19.6	15.0	8.2	10.1	8.1	20.7	17.3	57.6	20.0	30.1
Denmark	19.7	20.2	20.2			3.7	0.0	4.9	4.5	1.2	14.5	13.5	24.2	8.7	9.9	41.3	35.8	36.2	13.6	16.0	15.8
Estonia	6.9	19.7	17.9			3.2	8.8	5.0	5.5	3.9	16.9	15.1	36.7	16.0	18.8	18.7	8.9	10.2	25.0	33.6	32.4
Finland	16.8	25.3	23.4			4.2	14.7	3.2	5.8	37.2	17.7	22.0	3.7	11.9	10.1	14.1	18.2	17.3	13.6	23.7	21.5
Germany	6.7	14.6	13.0			2.4	4.3	2.9	3.2	25.4	17.7	19.2	8.1	17.9	15.9	8.9	22.6	19.8	46.6	24.3	28.8
Greece	4.2	21.3	18.2			3.3	4.0	4.4	4.4	17.9	28.2	26.4	35.5	15.9	19.5	19.4	13.6	14.7	19.0	16.4	16.9
Hungary	10.7	23.8	20.3	0.6	3.8	2.9	10.6	5.2	6.6	7.7	14.4	12.6	19.3	16.1	17.0	12.0	17.1	15.7	39.7	23.4	27.8
Iceland	6.3	24.3	22.5			4.1	0.0	4.2	3.8	9.5	6.9	7.2	9.9	14.6	14.1	0.0	35.5	31.8	74.3	14.5	20.7
Ireland	17.2	25.7	25.4		3.1	2.9	52.9	2.0	4.2	10.3	17.9	17.6	0.0	10.4	9.9	5.4	19.6	18.9	14.1	24.4	23.9
Italy	8.0	22.1	18.4			3.3	8.4	3.7	4.9	15.9	14.6	14.9	2.1	15.0	11.6	35.2	18.8	23.1	30.4	25.9	27.1
Japan	2.0	17.8	16.1		4.4	4.0	30.8	4.2	7.0	26.8	15.5	16.7	1.4	10.2	9.3	11.7	37.5	34.7	22.7	10.7	11.9
Korea	16.1	16.2	16.2	1.6	3.4	3.0	8.9	4.6	5.5	50.7	34.2	37.7	1.3	11.1	9.0	4.2	19.2	16.0	18.9	14.6	15.5
Luxembourg	30.7	32.9	31.8			5.8	2.3	0.0	1.1	22.8	6.0	14.2	1.8	11.2	6.6	2.8	9.8	6.4	39.6	40.1	39.9
Netherlands	15.2	20.2	18.6			3.4	11.9	4.8	7.0	18.0	17.8	17.9	3.8	9.8	7.9	24.3	31.9	29.5	26.8	15.5	19.1
Norway	20.8	28.0	26.4			4.8	12.6	1.3	3.8	11.7	11.7	11.7	10.7	13.8	13.1	25.9	31.6	30.3	18.4	13.6	14.7
Poland	5.6	24.7	21.2			3.8		5.7		35.0	20.2	22.9	7.4	17.3	15.5		16.5		26.5	15.6	17.6
Portugal	5.9	24.2	22.8	0.2	4.6	4.3	4.9	2.6	2.8	10.1	19.2	18.6	2.4	17.7	16.6	65.3	14.8	18.4	11.4	21.5	20.8
Slovak Republic	12.6	25.2	23.2		6.4	5.4	5.9	4.4	4.6	12.2	28.8	26.2	18.1	14.8	15.3	9.0	14.5	13.6	42.1	12.4	17.1

	Social sciences			Social sciences: Education			Agricultural Sciences			Engineering and technology			Humanities			Medical and Health sciences			Natural Sciences		
	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE	Government	Higher Education	Gov + HE
Slovenia	12.5	17.3	15.7			2.8	5.3	6.0	5.7	2.9	24.7	17.4	13.2	8.5	10.0	16.2	30.8	25.9	50.0	12.8	25.3
Spain	4.1	25.8	21.3			3.9	9.9	2.4	4.0	13.8	21.4	19.8	3.2	14.5	12.2	51.9	17.1	24.3	17.0	18.8	18.5
Sweden	11.5	24.1	22.3			4.0	0.1	2.4	2.1	9.0	15.2	14.3	3.2	12.2	10.9	57.9	23.8	28.7	18.4	22.3	21.7
Türkiye	4.0	26.4	25.1			4.5	32.6	3.9	5.6	32.9	17.8	18.7	0.5	13.0	12.3	3.7	30.8	29.2	26.3	8.1	9.1
United Kingdom	11.2	17.6	17.5			3.2	12.8	1.2	1.5	16.3	17.8	17.8	3.8	20.5	20.0	14.2	23.1	22.8	41.6	19.8	20.4
OECD average	11.5	22.2	20.4	2.0	4.1	3.7	11.3	3.8	4.6	17.8	18.4	18.4	10.3	13.3	12.8	19.2	22.2	21.9	29.9	19.9	21.9

Note: In Austria, in 2013, 5.5% of researchers involved in educational R&D performed for the government and 3.2% for the higher education sector; together they account for 3.4% of total researchers in both sectors.
Source: Calculations based on OECD MSTI data.

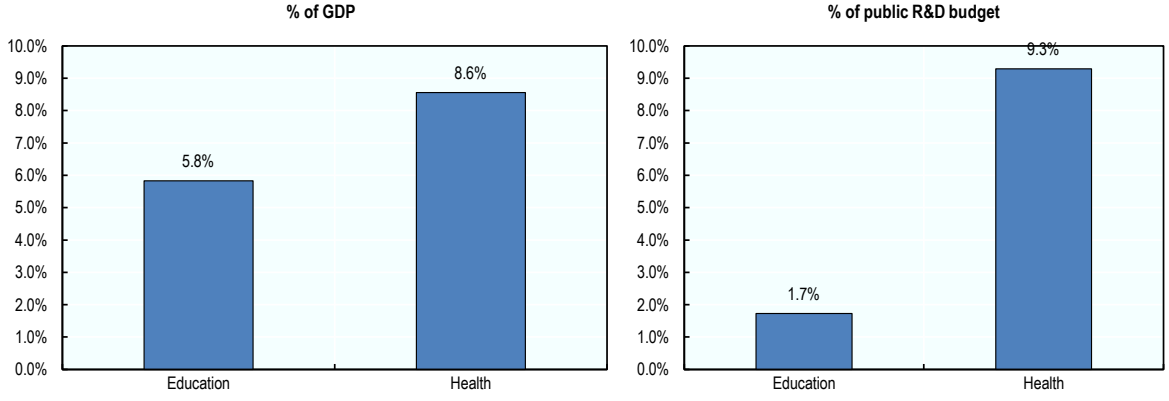
Table 8.3 presents the percentage of researchers (headcount) engaged in R&D by sector of performance and by field of science in 2013. Human resources in R&D were mainly concentrated in STEM disciplines: on average, 47.6% of all government researchers worked in engineering and natural sciences, and 38.3% of higher education institutions researchers. Social sciences appeared as the third most prominent field of science in terms of researchers (20.4%) considering government and higher education sectors together, at par with medical sciences (21.9%). Researchers involved in humanities represented 12.8% of researchers employed in both sectors and agriculture only 4.6%.

Data on researchers engaged in educational R&D was available for only 7 out of 25 countries. Higher education personnel exceeding the government personnel in three countries over four where full data are available. For these seven countries, the average percentage of all R&D personnel working on educational research (considering both sectors) stood at 3.7%.

Summary and conclusions

The R&D indicators presented in this chapter suggest a small public investment in educational research and experimental development. The public budget allocated to educational R&D is the second smallest of all areas of applied research, with an average budget allocation of 1.7% of all public R&D budget in 2020 within a country, that is, USD 24 per student. Figure 8.10 shows that on average an OECD country spends 1.5 as much of its GDP for health than education, but that it allocates 5.5. as much of its public R&D budget to health than to education.

Figure 8.10. Average share of GDP (2019) and public R&D budget (2020) for education and health in an OECD country



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While no recent data are available, the share of all expenditures on educational R&D in the government and higher education sectors was also relatively small in 2014, at an estimated 3.2% of all R&D expenditures, and the percentage of R&D personnel for educational R&D was estimated at 3.7% in the few countries for which information was available. Those older data suggested that in most countries educational R&D was overwhelmingly performed by the higher education sector.

What is the “appropriate” level of public educational R&D? Difficult to say. There are many reasons why educational R&D could be less funded than other sectors. Some have argued that, like humanities or some branches of mathematics, it is less capital intensive. Perhaps these arguments have become less relevant as expensive research strategies such as randomised control trials, experimental research, large scale

surveys and other forms of data collections have gained ground. Debates about the value of public investment in educational research and just the role in educational improvement remain vibrant (OECD, 2000[9]; OECD, 2007[10]; OECD, 2022[3]). Sceptics argue that the quality of educational research does not warrant more public investment, to which others counterargue that it is precisely the lack of public investment that prevents a leap in its quality (Bransford et al., 2009[11]).

The main contribution of this chapter to this discussion is that it will be very difficult to reach a conclusion before we get reliable indicators about the amount spent on educational R&D within countries, so that we can research whether they are linked to educational performance, pace of improvement, whether this depends on the type of research, on the level of research, or other considerations.

As of 2023, governments have limited measures of their expenditures and performance of educational R&D. The best available indicator as of 2023 lies in the public budget for educational R&D (education GBARD). All other indicators have been discontinued at the international level (although some countries still collect them). This information would indeed be easier to collect than educational R&D performed in the business enterprise sector.

Current data on governments' public budgets for educational R&D have two main limitations, even though they are very high-quality data collected by countries' statistical offices according to internationally agreed standards.

First, the public budget allocated to research and development does not necessarily equal countries' actual expenditures on research and development. This may come from discrepancies between the planned and the actual budgets, but also from the fact that some of the public budget devoted to research and development may sometimes be spent on other activities. Collecting actual expenditures on research and development is thus another way to capture the public investment in research and development.

Second, the indicator is limited to "earmarked" or "applied" R&D. In practice, the collection seems too often cover the budget of public education agencies that are outside the higher education sector. Educational research that takes place in higher education tends to be included in general advancement of knowledge. As we know that most expenditures and researchers are located in the higher education sector rather than the government sector, the current impossibility to break down the "general advancement of knowledge" by socio-economic objective makes it possible that the significant percentage of public budget allocated to universities hides very different allocations to educational research across countries – even though it is unlikely that that more than a very small share of general university funds are allotted to educational research given existing information. The real issue may lie in the fact that the data reflect countries' institutional structure rather than the full reality.

Finally, as good as they are, they may remain too generic to guide education policy makers in their educational R&D planning. Additional information about the performance of educational research by different sectors, its sources of funding, the distribution of research performed by research method, level of education, area of education, and the share of research and experimental development are for example beyond the scope of current data collections on R&D.

However, countries could adopt two different strategies if they wanted to have an informed educational R&D policy: improve existing indicators or implement a specific national or international survey on educational R&D.

Given the currently collected data, the most straightforward approach would be to improve the comparability of the government budget for R&D by socio-economic objective (GBARD). Most of the improvement work should be about unpacking the categories of "general advancement of science" and notably the "general university funds" so they can be ascribed to educational R&D and other socio-economic objectives such as education (and the other ones). One simple way would be to evaluate the weight of educational research within the higher education sector (or the higher education research output on education). The main value of this indicator is to provide a reliable budget for educational R&D and to

allow for comparisons with other sectors. This could probably be estimated without an actual survey. Countries could also reactivate the data collections of the gross expenditures on R&D by socio-economic objective and collect research personnel data by both socio-economic objective and sub-fields of science.

As it is usually difficult to reliably collect information at a granular level (by socio-economic objective or by sub-field of science), especially when all objectives and fields of science are targeted, another possibility would be for education ministries and their statistical agencies to collect themselves relevant information about the expenditure, funding, performance and topics covered by educational R&D in their country. Chapter 9 of this publication suggests survey tools and techniques that would allow to do it in a targeted way, and thus without being too resource-intensive (Vincent-Lancrin, 2023[12]). Some countries such as Norway already carry out this type of survey.

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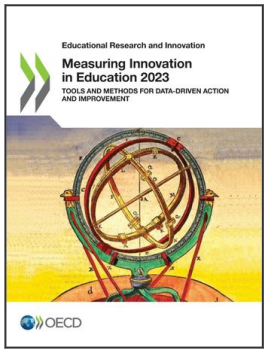

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