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# MORE RESEARCHERS, THE SAME MONEY? R&D SPENDING PER RESEARCHER IN KAZAKHSTAN, 2010-2024

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**Abstract:** Between 2010 and 2024 the number of researchers per million people in Kazakhstan more than doubled, from 360 to 758, while spending on research and development (R&D) was about the same share of GDP in both years (0.15% and 0.16%). This study used World Bank and UNESCO data to check whether each researcher therefore received less money, as I expected, and compared Kazakhstan with the other former Soviet republics. In constant 2021 purchasing-power-parity (PPP) dollars, R&D spending per full-time equivalent (FTE) researcher fell from 112.4 thousand in 2010 to 77.1 thousand in 2024 (-31.4%): the number of FTE researchers grew 2.57 times and spending 1.77 times. Almost all of the fall happened in 2012 and 2013, when the FTE count rose by 61.2% and 22.4%, and UNESCO marks both years as breaks in the series. National statistics show that the number of researchers counted as persons grew by only 17.5% in 2012, all of it in the higher education sector, and spending per person fell by 3.9%, compared with 30.0% per FTE researcher. On the comparable data for 2013-2024, spending per FTE researcher fell to 58.1 thousand in 2018 and then rose to 7.4% above its 2013 level. In 2024 Kazakhstan spent less per researcher than Russia (151.3 thousand) and Belarus (109.1 thousand) but more than the five other former Soviet republics with data for that year. Most of the long-run fall therefore coincides with the breaks in the series and, in 2012, with a rise in the share of the year each researcher was counted as spending on research, not with a matching rise in the number of people; the data cannot separate a change in counting from a real increase in research time. Kazakhstan's R&D spending relative to GDP was the second lowest of the eight countries.

**Keywords:** research and development; R&D expenditure; researchers; full-time equivalent; science funding; statistics; Kazakhstan; Central Asia

## Introduction

Research needs two resources: people and money. International statistics measure them with two indicators that are used to follow Sustainable Development Goal target 9.5: gross domestic expenditure on R&D (GERD) as a percentage of GDP and the number of researchers per million inhabitants [2, 3, 5]. In Kazakhstan these two indicators moved in different ways. GERD was 0.15% of GDP in 2010 and 0.16% in 2024, while the number of researchers per million people rose from 360 to 758 [2, 3]. For comparison, Russia spent 0.94% of its GDP on R&D in 2024 [2].

The 2010s were a period of reform for science in Kazakhstan. In 2011 the Law "On Science" No. 407-IV was passed; among other things it introduced obligatory external anonymous peer review of grant applications and national scientific councils, bodies of elected experts with the right to make funding decisions [7]. At about the same time a publication in a Scopus-indexed journal became a condition for receiving an academic degree [7], and by 2015 the grant system of the Ministry of Education and Science took into account the quantity and impact of researchers' publications [8]. The number of Scopus publications from Kazakhstan grew steadily after the new

law was adopted [8]. Reforms like these can change both how many people do research, especially at universities, and how much money each of them has.

If the number of researchers grows faster than spending, the amount of money per researcher falls. When my mentor told me that R&D spending was 0.16% of GDP, almost as in 2010, and that researchers per million had risen from 360 to 758, and asked why the number of researchers had doubled while spending had not and what this meant for the scientists themselves, I wrote my hypothesis before any calculations (in Russian, translated by my mentor with the help of an AI assistant): "I think that the number of researchers in Kazakhstan grew because of the development of universities and young people's interest in science. But since funding stayed the same, each scientist gets less money. This may lead to a shortage of equipment and worse conditions for scientific work."

The study asks three questions:

- How did R&D spending per researcher in Kazakhstan change between 2010 and 2024, and in which years did it change?
- How much of the growth in the number of researchers, in particular the jump in 2012, reflects new researchers, and how much a change in the way they were counted?
- How does Kazakhstan's spending per researcher in 2024 compare with that of the other former Soviet republics?

**Materials and Methods**

Data. Four series from the World Bank's World Development Indicators were used: "Research and development expenditure (% of GDP)" (code GB.XPD.RSDV.GD.ZS) [2], "Researchers in R&D (per million people)" (SP.POP.SCIE.RD.P6) [3], "GDP, PPP (constant 2021 international $)" (NY.GDP.MKTP.PP.KD) and "Population, total" (SP.POP.TOTL) [1]. All four were downloaded through the World Bank data interface on 6 November 2026 (database last updated 8 October 2026). The two R&D series are compiled by the UNESCO Institute for Statistics (UIS) from national R&D surveys [2, 3]. GERD includes "both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit" [2].

Full-time equivalents. For Kazakhstan, the researcher values in the World Bank database are identical to the UIS series "Researchers per million inhabitants (FTE)" [4], so they count full-time equivalents, not persons. In the UIS definition, which follows the OECD Frascati Manual, "one full-time equivalent may be thought of as one person-year", and a person who spends 30% of their time on R&D and the rest on other work, such as teaching, counts as 0.3 FTE [5]. The FTE number therefore depends on how much of their working time researchers, and university teachers in particular, are recorded as spending on research. The UIS database also marks values that cannot be compared with the year before. For Kazakhstan it marks the researcher values for 2012 and 2013 and the GERD value for 2013 as a "Break in series with previous year for which data are available" [4]. No such mark appears in the researcher series of Russia, Belarus or Uzbekistan, but UIS marks Russia's researcher values for 2021-2024 as its own estimates, Moldova's values as national estimates, and the 2024 researcher values of Armenia and Georgia as excluding the business and private non-profit sectors [4].

Headcount. To see whether the jump in 2012 came from new people, the national statistical compilation "Science and innovation activity of Kazakhstan 2008-2012" of the Agency of the Republic of Kazakhstan on Statistics [6] was also used. It gives the number of researchers as persons (headcount) at the end of each year, in total and by sector of activity: government, higher professional education, business and non-profit [6, p. 20]. Later editions of this compilation were not used, so the headcount comparison covers 2008-2012 only.

Calculations. For each country and year, the number of FTE researchers was calculated as researchers per million multiplied by the population and divided by one million; GERD in constant 2021 PPP dollars as GDP in PPP multiplied by the R&D share of GDP; and spending per researcher as GERD divided by the number of FTE researchers. PPP dollars convert national currencies into

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the same purchasing power, and constant prices remove inflation, so the values can be compared across countries and years. For 2008-2012, GERD was also divided by the national headcount of researchers. Changes were calculated for the whole period 2010-2024 and for three parts of it: 2010-2011, before the marked break; 2011-2013, the two years marked as breaks; and 2013-2024, when no break is marked. The start year 2010 is the year with which the topic was first described; because the R&D share of GDP fell from 0.229% in 2009 to 0.153% in 2010, results for start years from 2007 to 2011 are reported as well. All values were calculated from the unrounded data and rounded at the end.

Comparison countries. All 15 former Soviet republics were checked. Eight of them have all four series for 2024: Kazakhstan, Russia, Belarus, Uzbekistan, Armenia, Georgia, Azerbaijan and Moldova. For Estonia, Latvia and Lithuania the latest year with all four series is 2023 and for Ukraine 2022; these values are given in the text. Kyrgyzstan, Tajikistan and Turkmenistan have no researcher data. In several countries the researcher series starts late (Armenia 2022, Belarus 2020, Azerbaijan 2019), so the countries are compared in 2024 only.

## Results

### Spending per researcher in Kazakhstan, 2010-2024

In 2010 Kazakhstan spent 0.68 billion 2021 PPP dollars on R&D and had about 6,060 FTE researchers (estimated from the rate per million and the population), or 112.4 thousand dollars per researcher (Table 1). In 2024 it spent 1.20 billion on about 15,610 researchers, or 77.1 thousand, which is 31.4% less. Over these years the number of FTE researchers grew 2.57 times and spending 1.77 times. Over the whole period, then, the numbers go in the direction of the hypothesis.

The timing, however, is uneven (Figure 1a). From 2010 to 2011 spending per researcher hardly changed (+1.7%). From 2011 to 2013 it fell by 37.2%, from 114.2 to 71.8 thousand, because the number of FTE researchers rose by 61.2% in 2012 alone (from 6,408 to 10,328) and by a further 22.4% in 2013 (to 12,644), while spending grew by 12.8% in 2012. These are the two years that UIS marks as breaks in the series [4]. From 2013 to 2024, when no break is marked, spending per researcher rose by 7.4%.

Inside the comparable period there was a real fall and a recovery. From 2013 to 2018 GERD fell by 21.2% while the number of FTE researchers changed by -2.7%, so spending per researcher fell by 19.1% to 58.1 thousand in 2018, the lowest value since 2010; the R&D share of GDP was 0.117% that year. From 2018 to 2024 spending per researcher rose by 32.7% as the R&D share returned to 0.162%. The result for the whole period also depends on the start year: measured from 2007, 2008, 2009 and 2011, the fall to 2024 is 40.2%, 47.7%, 54.3% and 32.5%, respectively.

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**Table 1. R&D spending and researchers in Kazakhstan, 2007-2024**

| Year | GERD, % of GDP | Researchers per million | FTE researchers (estimated) | GERD, billion 2021 PPP $ | Per researcher, thousand 2021 PPP $ |
|---|---|---|---|---|---|
| 2007 | 0.209 | 395 | 6,416 | 0.827 | 128.9 |
| 2008 | 0.217 | 366 | 6,004 | 0.886 | 147.5 |
| 2009 | 0.229 | 339 | 5,629 | 0.949 | 168.6 |
| 2010 | 0.153 | 360 | 6,062 | 0.681 | 112.4 |
| 2011 | 0.153 | 375 | 6,408 | 0.732 | 114.2 |
| 2012* | 0.165 | 597 | 10,328 | 0.826 | 80.0 |
| 2013* | 0.171 | 720 | 12,644 | 0.908 | 71.8 |
| 2014 | 0.167 | 781 | 13,922 | 0.923 | 66.3 |
| 2015 | 0.170 | 761 | 13,759 | 0.947 | 68.8 |
| 2016 | 0.142 | 679 | 12,467 | 0.801 | 64.2 |
| 2017 | 0.127 | 651 | 12,138 | 0.745 | 61.4 |
| 2018 | 0.117 | 650 | 12,306 | 0.715 | 58.1 |
| 2019 | 0.118 | 620 | 11,903 | 0.757 | 63.6 |
| 2020 | 0.126 | 669 | 13,030 | 0.786 | 60.3 |
| 2021 | 0.130 | 610 | 12,043 | 0.847 | 70.3 |
| 2022 | 0.117 | 662 | 13,257 | 0.786 | 59.3 |
| 2023 | 0.144 | 693 | 14,090 | 1.019 | 72.3 |
| 2024 | 0.162 | 758 | 15,609 | 1.203 | 77.1 |

Source: World Bank, World Development Indicators [1-3]; FTE researchers, GERD and spending per researcher calculated from these data. *UIS marks the researcher values for 2012 and 2013, and the GERD value for 2013, as breaks in the series [4].

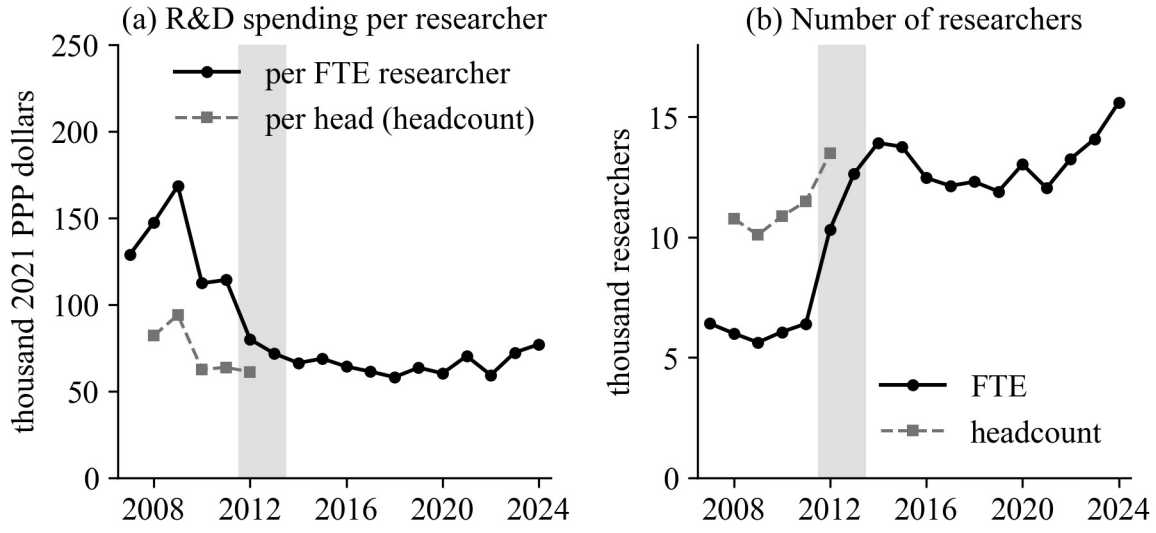



Figure 1. Kazakhstan: (a) R&D spending per researcher, thousand 2021 PPP dollars, per FTE researcher (2007-2024) and per researcher counted as a person (2008-2012); (b) number of researchers, FTE (2007-2024) and headcount at the end of the year (2008-2012). The grey band marks 2012-2013, the years UIS marks as breaks in the researcher series. Sources: [1-3, 6].

**The jump in 2012: new researchers or a new way of counting?**

The national headcount tells a different story from the FTE series (Table 2, Figure 1b). The number of researchers as persons grew from 11,488 at the end of 2011 to 13,494 at the end of 2012, by 17.5% (2,006 people), not by 61.2% [6, p. 20]. The whole increase came from the higher education sector, where the number of researchers rose by 2,435, from 4,410 to 6,845 (55.2%). In the government sector it fell by 389 and in the business sector by 65, while the non-profit sector added 25. The share of university researchers in the total rose from 38.4% to 50.7% in one year.

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Dividing the FTE number by the headcount gives the average share of a working year that each researcher was counted as spending on R&D. It was almost the same in every year from 2008 to 2011 (0.557-0.558) and then rose to 0.765 in 2012. As a result, spending per researcher counted as a person fell by only 3.9% in 2012, from 63.7 to 61.2 thousand dollars, while spending per FTE researcher fell by 30.0%. Most of the fall in 2012 therefore came from the FTE figure, not from more people sharing the same money. The almost constant ratio before 2012 may mean that the earlier FTE values were estimated from the headcount with a fixed coefficient, but the sources used here do not describe how the FTE values were produced, so this remains a possibility. The headcount for 2013, the second year marked as a break, was not available in the edition used.

**Table 2. Researchers in Kazakhstan as persons and as full-time equivalents, 2008-2012**

| Indicator | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Researchers, headcount, total | 10,780 | 10,095 | 10,870 | 11,488 | 13,494 |
| of which government sector | 4,060 | 3,429 | 3,581 | 3,144 | 2,755 |
| of which higher education sector | 3,647 | 3,615 | 3,928 | 4,410 | 6,845 |
| of which business sector | 2,832 | 2,215 | 2,303 | 3,052 | 2,987 |
| of which non-profit sector | 241 | 836 | 1,058 | 882 | 907 |
| Researchers, FTE | 6,004 | 5,629 | 6,062 | 6,408 | 10,328 |
| FTE per person | 0.557 | 0.558 | 0.558 | 0.558 | 0.765 |
| GERD per researcher (headcount), thousand 2021 PPP $ | 82.1 | 94.0 | 62.7 | 63.7 | 61.2 |
| GERD per FTE researcher, thousand 2021 PPP $ | 147.5 | 168.6 | 112.4 | 114.2 | 80.0 |

Sources: headcount at the end of the year by sector, Agency of the Republic of Kazakhstan on Statistics [6, p. 20]; FTE and GERD, World Bank [1-3]; ratios calculated from these data.

**Comparison with other former Soviet republics, 2024**

In 2024 Kazakhstan spent 77.1 thousand 2021 PPP dollars per FTE researcher, the third highest value of the eight countries with data (Table 3, Figure 2). Russia spent 151.3 thousand, 2.0 times as much, and Belarus 109.1 thousand; the other five spent less, from 61.0 thousand in Armenia to 17.9 thousand in Uzbekistan. Kazakhstan's middle position does not come from high spending. Its GDP per person was the second highest of the eight (35,974 dollars, after Russia's 42,610), but its R&D share of GDP was the second lowest (0.16%, above only Uzbekistan's 0.10%), and its number of researchers per million people was the third lowest (758, above only Moldova's 650 and Uzbekistan's 640). A small budget is shared among relatively few researchers.

In the latest years available, spending per researcher was 158.1 thousand in Estonia, 140.1 thousand in Latvia and 131.3 thousand in Lithuania (2023), and 72.2 thousand in Ukraine (2022). Of the countries with data for both 2010 and 2024, Russia's spending per researcher rose by 24.4% (from 121.7 to 151.3 thousand), Uzbekistan's by 10.5% (from 16.2 to 17.9 thousand) and Moldova's by 17.0% (from 46.5 to 54.5 thousand, across a break in its series in 2014 [4]), so the fall recorded for Kazakhstan was not a regional pattern.

**Table 3. R&D spending and researchers in the former Soviet republics with data for 2024**

| Country | GERD, % of GDP | Researchers per million | GDP per person, 2021 PPP $ | Per researcher, thousand 2021 PPP $ |
|---|---|---|---|---|
| Russia | 0.94 | 2,639 | 42,610 | 151.3 |
| Belarus | 0.59 | 1,568 | 29,136 | 109.1 |
| Kazakhstan | 0.16 | 758 | 35,974 | 77.1 |
| Armenia | 0.29 | 942 | 20,079 | 61.0 |
| Moldova | 0.22 | 650 | 16,394 | 54.5 |
| Georgia | 0.26 | 1,896 | 24,147 | 33.7 |
| Azerbaijan | 0.21 | 1,663 | 22,091 | 27.6 |
| Uzbekistan | 0.10 | 640 | 10,997 | 17.9 |

Source: World Bank, World Development Indicators [1-3]; GDP per person and spending per FTE researcher calculated from these data. Russia: researcher values are UIS estimates. Moldova: national estimates. Armenia and Georgia: researcher values exclude the business and private non-profit sectors; for Armenia the 2024 GERD value is marked as a break in series, so its two values may not cover the same sectors [4].

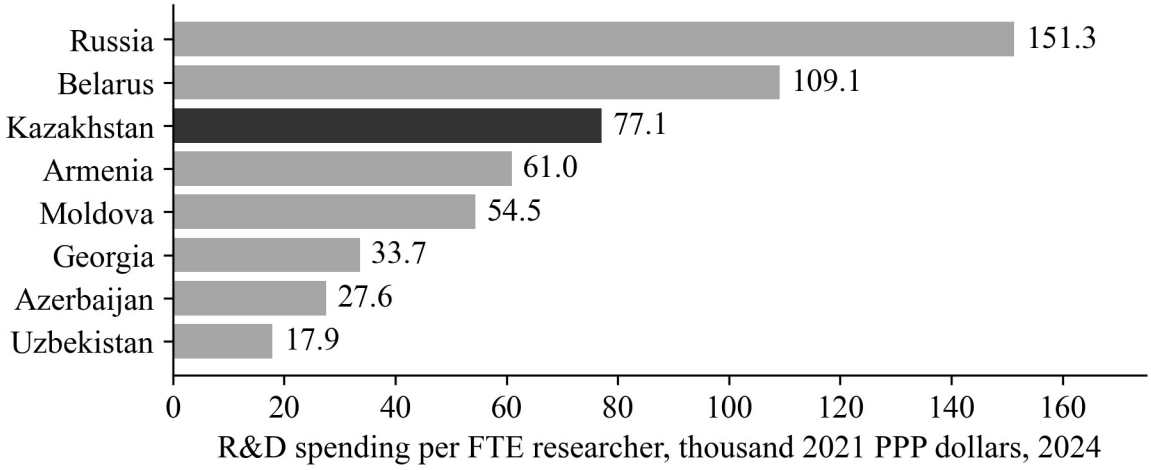



Figure 2. R&D spending per FTE researcher in the eight former Soviet republics with data for 2024, thousand 2021 PPP dollars. Source: calculated from [1-3].

**Discussion**

My hypothesis was that the number of researchers grew while funding stayed the same, so that each scientist receives less money. Funding stayed the same only as a share of GDP: in constant prices it grew 1.77 times. The result for each researcher still agrees with the hypothesis: in 2024 Kazakhstan spent 31.4% less per FTE researcher than in 2010. But almost all of this fall happened in 2012-2013, the years that UNESCO marks as breaks in the series, and on the comparable data for 2013-2024 spending per researcher did not fall overall. The data therefore support only a weaker form of the hypothesis: spending per researcher in Kazakhstan is low and fell in 2013-2018, but the doubling of the number of researchers did not by itself cut the money of each scientist by a third.

When my mentor sent me the first results, he asked why the number of researchers could have grown by 61% in one year and noted that it could be a new policy or a different way of counting. I answered (in Russian, translated by my mentor with the help of an AI assistant): "I think that such a sharp increase could have been connected with a change in state policy in the field of science and an increase in funding for scientific organisations. It is also possible that the methods of counting researchers changed and more employees of universities and scientific institutions were included in the statistics. Therefore, the 61% increase does not necessarily mean that so many new scientists appeared in one year." The national statistics agree with the second part of this answer.

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The number of researchers as persons grew by 17.5%, not 61.2%, all of the increase was in universities, and each counted researcher was recorded as spending a larger share of the year on research.

The first part of the answer cannot be ruled out either. The 2011 law and the new requirements for publications and grants [7, 8] gave university staff reasons to do more research and to report it, and in 2012 spending grew by 12.8%. A real increase in research at universities and a change in how university staff were counted could both have happened in 2012, and the published numbers cannot separate them. What they do show is that a comparison of 2010 with 2024 in the FTE series mixes two different ways of counting, so the fall of almost a third should not be read as the change in the money available to a typical scientist.

Two results do not depend on the break. First, spending per researcher fell by about a fifth between 2013 and 2018 because spending fell while the number of researchers stayed about the same, and it took until 2023-2024 to return above the 2013 level. Second, Kazakhstan is a comparatively rich country in the region with one of the lowest R&D shares of GDP. The first part of my hypothesis, that the growth came from the development of universities, agrees with the headcount data for 2012, when the whole net increase was in the higher education sector; the data used here say nothing about young people's interest in science. The last part, that less money may mean a shortage of equipment and worse working conditions, was not tested here: GERD includes both current and capital spending [2], and this study did not look at how the money is divided between salaries, equipment and other costs.

This study has several limitations. The FTE values and the headcount come from different sources: the FTE number was calculated from the rate per million and the mid-year population, while the headcount is counted at the end of the year. The headcount was taken from one edition of the national compilation, covering 2008-2012, so the second marked break, in 2013, was not checked. GERD includes spending by businesses and covers all costs of R&D, so it is not the same as the money that researchers themselves receive. PPP values are estimates, and in several comparison countries the researcher series is short, so only one year could be compared. The study describes what happened to the numbers and does not show what caused the changes.

## Conclusion

In the World Bank and UNESCO data, R&D spending per FTE researcher in Kazakhstan fell from 112.4 thousand 2021 PPP dollars in 2010 to 77.1 thousand in 2024. Almost all of this fall happened in 2012-2013, when the researcher series has a marked break, and in 2012 the number of researchers counted as persons grew much less than the FTE number, entirely in universities. On comparable data, spending per researcher fell between 2013 and 2018 and then recovered. In 2024 Kazakhstan spent about half as much per researcher as Russia and less than Belarus, and its R&D spending relative to GDP was among the lowest in the region. Anyone who uses these indicators for Kazakhstan should look at the breaks in the series before comparing years, and a study with headcount data after 2012 and with spending split by type could show what the money per researcher actually pays for.

## Data availability

All data are publicly available from the World Bank World Development Indicators [1-3], the UNESCO Institute for Statistics [4] and the statistical compilation of the Agency of the Republic of Kazakhstan on Statistics [6]. The table of all values used in this paper and the script that calculates every number are available from my mentor on request.

## Author contributions and use of AI tools

I chose this topic from two research directions proposed by my mentor, Gaziz Tursyn. After he told me that Kazakhstan's R&D spending was about the same share of GDP as in 2010 while the number of researchers per million people had doubled, I wrote the hypothesis quoted in the Introduction, before any spending per researcher was calculated. After he sent me the first results

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and asked why the number of researchers could have grown by 61% in one year, noting that it could be a new policy or a different way of counting, I wrote the explanation quoted in the Discussion. My mentor set the three research questions and the headcount check, chose the indicators and the comparison countries, downloaded the data, did all calculations in Python with the help of an AI assistant (Claude, Anthropic), found the national headcount tables and the UNESCO notes on breaks in the series, and made the figures. The English text, including the translations of my Russian answers, was drafted by my mentor with the help of the same AI assistant from the results and my written answers. No data, results or citations were generated by AI: every number was calculated from the sources listed, and every cited source was opened and checked. Before submission I checked two numbers myself on data.worldbank.org for Kazakhstan in 2024, R&D spending of 0.16% of GDP and 758 researchers per million people, and both matched the paper.

**Conflicts of interest**

The author declares no conflicts of interest.

**Acknowledgements**

I thank my mentor, Gaziz Tursyn, for guiding this work, doing the analysis and drafting the English text.

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