

The affiliation game between Spanish and Saudi Arabian higher education & research institutions

Analysing affiliation practices in the Highly Cited Researchers™ list from Clarivate™ and explaining the consequences on the ShanghaiRanking's Academic Ranking of World Universities

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SIRIS

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Executive Summary

On the 31st of March 2023, EL PAÍS published [an article](#), which explained that the highly cited chemist Rafael Luque, a full-time civil servant of the University of Córdoba in Spain, had been suspended from employment and salary for the next 13 years, for the incorrect scientific affiliation of his research production.

This is, to the best of our knowledge, the first time that such a decision is taken by a university. This decision is likely to have a massive impact not only in Spain but around the world, as universities reconsider their rights and obligations of their academic staff at a time of growing global competition.

In this short report, **we limit our analysis to a review of the Highly Cited Researchers™ list produced by Clarivate™ (henceforth HCR)**, a list of around 7000 researchers who stand out by having published multiple highly cited papers (articles in the top 1% by citation) over the last decade.

For universities, having HCR employed is important because it is considered a mark of quality of the research ecosystem and increases attractiveness. However, the main reason is because the list of **HCR is a key Indicator of the ShanghaiRanking's Academic Ranking of World Universities (ARWU): a single Highly Cited Scholar can enable a university to gain up to 200 places¹**.

Rafael Luque has been included in the HCR list **since 2018 and his primary affiliation is currently King Saud University in Riyadh (Saudi Arabia)**.

Rafael Luque argued in the article of EL PAÍS, that ***“Without me, the University of Córdoba will drop 300 places. [...] I put it in the Shanghai ranking. Being in the ranking is entirely due to me.”***

This is factually wrong, because Rafael Luque indicated the University of Cordoba only as a secondary affiliation, and King Saud University as a primary affiliation. Due to past gaming practices of Saudi Arabian universities, **since 2015 ShanghaiRanking's ARWU decided to take only primary affiliations into account in their ranking**. For this reason, the University of Cordoba (currently ranked 837-848th in the world and 32nd in Spain²) will not suffer major consequences from the suspension of this researcher. Indeed, we show that by falsely indicating a primary affiliation with King Saud University, Rafael Luque has single handedly caused the University of Cordoba to lose close to 150 positions: if he had correctly indicated his Cordoba as his primary affiliation, then the

¹ ShanghaiRanking's ARWU includes [five other indicators](#) but are far harder for a university to influence: whereas you can hire a Highly Cited Scholar to increase your score in the HiCi indicator, a Nobel Prize must be working in your university when she is awarded the prize for this to count.

² ARWU ranks universities outside the top 100 in groups (i.e. 801-900 in the case of the University of Cordoba). The more precise positions we give are estimations.

University would have been ranked 684-690th in the world and 21-22th in Spain.

Worryingly, the case of Rafael Luque is not unique.

Saudi Arabia, with 112 Highly Cited Researchers has a 5 to 10 times higher share of HCRs amongst its researchers (0.45 %) compared to countries such as Spain, Germany or France. 44 of these HCRs are reported by Clarivate to **only be associated with Saudi Arabian institutions through research fellowships and not through main employment.** Rafael Luque is one of them, together with **6 other Spanish HCRs.** Those 44 cases are mainly distributed amongst the King Saud University and the King Abdulaziz University, accounting for over half of their affiliated Highly Cited Researchers. It is possible that the true number is even higher since in 2021 only 9 researchers were listed with this type of affiliation to Saudi Arabian universities.

We further highlight that amongst the **112 Highly Cited Researchers of Saudi Arabia**, a surprisingly high number, **11 HCRs, indicate Spanish institutions as secondary affiliations** (second behind only China, which appears as secondary affiliation for 12 HCRs). We go on to **analyse the affiliation details of some of those apparent 11 Saudi Arabian researchers who indicate Spanish institutions as secondary affiliation**, and find that for 7 of the 11 they entered the HCR list with a Spanish primary affiliation, but, for most of them 1 year later, started indicating a Saudi Arabian university as their primary affiliation.

Being aware of those cases could serve those institutions to investigate whether the affiliation details should be corrected and thus ensure that the credit (amongst others an increase in the HiCi indicator of the ShanghaiRanking's ARWU) is correctly attributed to the main employer of those Highly Cited Researchers³.

More importantly, investigating these cases is important for ethical, and possibly legal⁴, reasons: indicating an affiliation that is not that of your main employer in a database or a scientific publication is questionable if not downright unacceptable.

Key Facts
<ul style="list-style-type: none">The decision of the University of Cordoba to suspend Rafael Luque, a Highly Cited Researcher (HCR) since 2018, will not cause a drop of 300 ranks in ShanghaiRankings's Academic Ranking of World Universities (ARWU). On the contrary, it is the bad affiliation practice of this researcher that explains why the University of Cordoba is not currently ranked 601-700 instead of 801-900. The reason is that since 2019 Rafael Luque has indicated the University of Córdoba as secondary affiliation and King Saud University as primary affiliation. Only primary affiliations are taken into account by ShanghaiRanking's ARWU.

³ We underline that we do not take position on the current role of rankings in higher education. Indeed, we agree with many commentators that they have become unduly influential and that their methodologies are often questionable.

⁴ We do not enter into the legal implications of such practices in this report.

- Saudi Arabia, with 112 Highly Cited Researchers has a 5-10 times higher share of HCRs amongst its researchers (0.45 %) compared to countries such as Spain, Germany or France.
- In the 2022 Highly Cited Researchers™ list 44 of 112 HCRs are marked as being affiliated to their primary affiliations in Saudi Arabia not through main employment, but through a research fellowship.
 - Rafael Luque and 6 other Spanish HCRs have been identified as such cases by Clarivate and this is probably just the tip of the iceberg, as the number has increased from 9 marked HCRs in 2021.
 - Over half of King Saud and King Abdulaziz University's HCRs have an affiliation only through a research fellowship.
 - ShanghaiRanking's ARWU currently continues to take such cases into account for their ranking.
- Amongst the 112 Highly Cited Researchers of Saudi Arabia, a surprisingly high number, 11 HCRs, indicate Spanish institutions as secondary affiliations (second behind only China, which appears as secondary affiliation for 12 HCRs). 7 out of the 11 HCRs entered the HCR list with a Spanish institution as primary affiliation, but soon after changed it to the Saudi Arabian institution.

Introduction - The case of Rafael Luque and the University of Córdoba

On **March 31, 2023**, EL PAÍS published [an article](#) which explained that the highly cited chemist **Rafael Luque has been suspended from employment and salary for the next 13 years**. The university sanctioned Luque for signing his studies as a researcher at other institutions, such as King Saud University in Riyadh (Saudi Arabia) and the Peoples' Friendship University of Russia in Moscow, despite having a full-time civil servant contract with the University of Córdoba in Spain.

The articles states the following:

*El químico lleva cinco años en la lista de investigadores más citados del mundo, elaborada por la empresa especializada Clarivate. Las instituciones de todo el planeta se pelean por fichar a estos científicos, ya que uno por sí solo puede conseguir que un centro ascienda centenares de puestos en las clasificaciones académicas internacionales, como el influyente ranking de Shanghái, atrayendo a más alumnos y más dinero de las matrículas. "Sin mí la Universidad de Córdoba va a bajar 300 puestos. Se han pegado un tiro en el pie", afirma Luque, que atribuye la sanción a la "pura envidia". [...] "Nunca me he sentido apoyado por la Universidad de Córdoba, pese a que yo la puse en el ranking de Shanghái. Estar en el ranking me lo deben por completo a mí."*⁵

In English:

The chemist has been on the Clarivate list of the world's most cited researchers for five years. Institutions all over the world are fighting to sign up these scientists, as one of them alone can move a centre up hundreds of places in international academic rankings, such as the influential Shanghai ranking, attracting more students and more tuition money. "Without me, the University of Córdoba will drop 300 places. They have shot themselves in the foot," says Luque, who attributes the sanction to "pure envy". [...] "I have never felt supported by the University of Córdoba, even though I put it in the Shanghai ranking. Being in the ranking is entirely thanks to me."

In this report we will proceed to **proof-check these declarations** about the potential impact on the ShanghaiRanking's Academic Ranking of World Universities (ARWU) of the University of Cordoba's decision as well as **having a wider look at Spanish and Saudi Arabian affiliations and researchers in the Highly Cited Researchers™ list from Clarivate™**. It is important to note that we will not comment in this report on the context of Rafael Luque ending up as one of the most cited researchers and details on his publishing patterns which were revealed in the same article⁶.

⁵ <https://elpais.com/ciencia/2023-03-31/suspendido-de-empleo-y-sueldo-por-13-anos-uno-de-los-cientificos-mas-citados-del-mundo-el-espanol-rafael-luque.html>

⁶ The fact that the author published on average one article every 37 hours over an extended period of time raises many other issues.

Fact-checking the consequences for the University of Córdoba of suspending Rafael Luque

Rafel Luque's affiliation in the Highly Cited Researchers™ list from Clarivate™

The Highly Cited Researchers™ list from Clarivate™ listed approximately 7,200 Highly Cited Researchers (HCRs) in 2022, amongst whom 4,000 are in specific fields and about 3,200 for cross-field performance. Highly Cited Researchers are those researchers who are amongst the top 1% by citations per Essential Science Indicators™ (ESI) field and year, for articles published in the 10 years before the list is published.⁷

Rafael Luque has been listed since 2018 in the Highly Cited Researchers™ list from Clarivate™. In the first year he indicated exclusively the Universidad de Córdoba as affiliation. This changed in 2019, when his primary affiliation switched to King Saud University of Saudi Arabia.

Rafael Luque		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2018	Universidad de Córdoba, Spain	
2019	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2020	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2021	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2022	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain

Table 1. Appearance of Rafael Luque in the Highly Cited Researchers™ list from Clarivate™

His appearance in this list is currently qualified by an asterisk, behind the institution. This is also the case for other researchers, notably from Saudi Arabian institutions, but not all of them, as can be seen in screenshot of the online version of the 2022 Highly Cited Researchers™ list⁸:

⁷ <https://clarivate.com/highly-cited-researchers/methodology/>

⁸ <https://clarivate.com/highly-cited-researchers/>

FULL NAME	CATEGORY	PRIMARY AFFILIATION	SECONDARY AFFILIATIONS
JL Lin, Jun	Materials Science	King Saud University, Saudi Arabia	Chinese Academy of Sciences, China Mainland
JL Lu, J.	Engineering	King Abdulaziz University, Saudi Arabia	
YL Luo, Yonglan	Cross-Field	King Abdulaziz University, Saudi Arabia*	China West Normal University, China Mainland
RL Luque, Rafael	Chemistry	King Saud University, Saudi Arabia*	Universidad de Cordoba, Spain
WM Ma, Wen-Xiu	Mathematics	King Abdulaziz University, Saudi Arabia	University of South Florida, United States
PM Magistretti, Pierre J.	Cross-Field	King Abdullah University of Science & Technology, Saudi Arabia	Ecole Polytechnique Federale de Lausanne, Switzerland
LM Martinez, Luis	Computer Science	King Saud University, Saudi Arabia*	Universidad de Jaen, Spain

Fig. 1 Screenshot of the online version of the Highly Cited Researchers™ list, marking some affiliations with an asterisk.

Clarivate indicates the role of the asterisk as follows:

An **asterisk** accompanying a primary affiliation indicates that the Highly Cited Researcher is **associated with this institution through a research fellowship**. This rarely occurs since **most researchers follow the established tradition of using the secondary affiliation for such appointments** and reserve the primary affiliation slot for their main employer. **There may well be such associations for other Highly Cited Researchers that have not been brought to our attention.**

This year we extended the identification of affiliated or guest researchers, designating these as Research Fellows or Associates. These individuals were not counted in our own ranking of nations or institutions.⁹

Having analysed 10% of the 7200 HCRs¹⁰ showed us that **the only country whose affiliations have such an asterisk**, thus indicating as primary affiliation, not their primary employer, but an institution at which they have a research fellowship, **is Saudi Arabia**. We will go more into depth into this issue in a separate chapter below.

⁹ <https://clarivate.com/highly-cited-researchers/faq/>

¹⁰ 723 tabs of the webpage would have to be looked at, in case 100% of the HCRs were to be analysed...

The researchers in question, all world leaders in their fields, defended themselves by arguing that this is “just capitalism” and “no different from Harvard hiring a prominent researcher”. Such a strategy works best under economic conditions and freedom of spending those funds, which are available to a very limited number of institutions in the world.

The HCR list includes two categories: primary and secondary affiliation. Logically, in 2014, 8 HCR included KAU as a primary affiliation and 123 as a secondary affiliation. In 2015, due to increasing occurrences of this, **ShanghaiRanking's ARWU decided to stop including secondary affiliations in their HCR indicator¹² and only assign the HCR indicator scores to institutions that appear in the primary affiliation.**

This led to a second phase of gaming, whereby **some researchers chose to switch their primary and secondary affiliations¹³**. As a result, Clarivates started adding an asterisk to cases where they believed the primary affiliation was not that of the main employer.

It is important to underline that, unlike Clarivate who exclude primary affiliations with an asterisk from their own ranking of countries and institutions, **ShanghaiRanking assigns points to all institutions with Highly Cited Researchers as their primary affiliation including those marked with an asterisk.** This means that researchers who list, as their primary affiliation, an institution where they had a Research Fellowship, have a major negative impact on the ranking of their permanent home institution.

The University of Cordoba thus **only had a non-zero score on the HiCi indicator in ShanghaiRanking's ARWU 2019¹⁴** (due to Rafael Luque's primary affiliation in the HCR list being the University of Cordoba) and it had in this year its **best ranking position, namely 601-700**, indicated on ARWU's web, and more precisely **rank 616**, based on our calculation of the exact total score and thus also the exact rank¹⁵. The next year, **in ARWU 2020¹⁶**, without the HiCi score of Rafael Luque, the **University of Córdoba lost about 150 positions (not 300) to rank 701-800, more precisely rank 767.**

¹² KAU changed their policy to make it more attractive for HCR to resign from their current positions and accept a primary affiliation to KAU, whilst decreasing the size of their offer to scholars who took a secondary affiliation. The result is clearly visible: in 2015, some scholars switched to KAU as their primary affiliation, some retained their KAU secondary affiliation and half stopped referring to KAU. See Bornmann, Lutz, and Johann Bauer. 2015. *Which of the World's Institutions Employ the Most Highly Cited Researchers? An Analysis of the Data from Highllycited.com*. Journal of the Association for Information Science and Technology. <https://doi.org/10.1002/asi.23396>; and Bhattacharjee, Yudhijit. 2011. *Saudi Universities Offer Cash in Exchange for Academic Prestige*. Science 334 (6061): 1344–45.

¹³ Presumably in order to secure personal advantages seeing that it seems unlikely that they would not have been aware of the negative consequences that this action would have on their home institution.

¹⁴ <http://www.shanghairanking.com/rankings/arwu/2019>. The ARWU ranking uses the abbreviation HiCi for the indicator calculated on the basis of Clarivates Highly Cited Researchers™ list (abbreviated HCR).

¹⁵ See Annex 1 for the detailed context and methodology of ShanghaiRanking's ARWU.

¹⁶ <http://www.shanghairanking.com/rankings/arwu/2020>

University of Córdoba's rank in 2022, indicated on ARWU's web, is 801-900. Our calculations show that the **University of Córdoba is ranked 837-848 in 2022 and 32nd in Spain**¹⁷. In Spain, universities which rank similarly are the Universitat de Girona and the Universidad de Alcalá (see table below). Moreover, given its current rank, ironically the University of Córdoba can further drop only a maximum of 200 places, as ARWU only lists 1000 institutions...

On the other hand, would the primary affiliation of Rafael Luque be today the one of the University of Córdoba, then the university would obtain a HiCi score of 6.8 (and a readapted PCP score, see Annex 1) and consequently a total score of 9.1, bringing it to a **worldwide rank of 684-690 or a national ranking of 21-22** (see table 2). It would then **score similarly to Universidad Pablo de Olavide** (total score of 9.2), **Universidad de Extremadura** (total score of 9.1) and **Universidad de La Laguna** (total score of 8.9). Its **increase in rank would be around 150 ranks**.

	World Rank	National Rank	ShanghaiRanking's Academic Ranking of World Universities Scores 2022							Number of Highly Cited Researchers (2021 list)
			Total Score	ALU	AWD	HiCi	N&S	PUB	PCP	
Universidad Pablo de Olavide	669-683	20	9.2	0	0	6.8	6.9	19.7	23	1
Universidad de Extremadura	684-690	21	9.1	0	0	9.7	2.5	24.4	16	2
University of Córdoba (simulated, with 1 HCR)	684-690	21-22	9.1	0	0	6.8	2.9	26.1	17.9	1 (simulated)
Universidad de La Laguna	703-709	22	8.9	0	0	0	10.7	25.4	15.2	0
Universitat de Girona	824-836	31	7.8	0	0	0	3	24.3	21.6	0
University of Córdoba	837-848	32	7.7	0	0	0	2.9	26.1	17.3	0
Universidad de Alcalá	849-860	33	7.6	0	0	0	3.5	25.6	16	0

Table 2. Detailed ranking data, total score and indicator scores for the University of Córdoba and a few benchmark universities in ARWU 2022. In red is the simulated rank for the University of Córdoba in ARWU 2022, if they had one Highly Cited Researcher, e.g. Rafael Luque¹⁸.

Rafael Luque's contribution to the other indicators **total publications (PUB) and the Nature & Science (N&S) indicator need to be analysed** in further detail. Between 2017-2022 the University of Córdoba contributed to 1 Nature¹⁹ and 4 Science²⁰ articles.

¹⁷ Simulations were carried out in collaboration with [Domingo Docampo](#).

¹⁸ Source Data from [ShanghaiRanking's Academic Ranking of World Universities](#), analysed by SIRIS Academic in collaboration with Domingo Docampo

¹⁹ Migliavacca, M., Musavi, T., Mahecha, M.D. *et al.* The three major axes of terrestrial ecosystem function. *Nature* 598, 468–472 (2021). <https://doi.org/10.1038/s41586-021-03939-9>

²⁰ Manfredi-Lozano M, Leysen V, Adamo M, et al. GnRH replacement rescues cognition in Down

Out of those, **Rafael Luque contributed to one Science article in 2018²¹**, neither as corresponding nor first author (the position counts in ARWU), thus contributing little to this indicator for the University of Córdoba.

Table 2 shows **how the ranking of all these institutions solely depends on their publications, their publications in Nature and Science and the number of Highly Cited Researchers** affiliated with their university.

syndrome. *Science*. 2022;377(6610):eabq4515. <https://doi:10.1126/science.abq4515>

- Rouco C, Abrantes J, Delibes-Mateos M. Lessons from viruses that affect lagomorphs. *Science*. 2020;369(6502):386. doi:10.1126/science.abd2599
- Shen K, Zhang L, Chen X, et al. Ordered macro-microporous metal-organic framework single crystals. *Science*. 2018;359(6372):206-210. <https://doi:10.1126/science.aao3403>
- Wright IJ, Dong N, Maire V, et al. Global climatic drivers of leaf size. *Science*. 2017;357(6354):917-921. <https://doi:10.1126/science.aal4760>

²¹ Shen K, Zhang L, Chen X, et al. Ordered macro-microporous metal-organic framework single crystals. *Science*. 2018;359(6372):206-210. <https://doi:10.1126/science.aao3403>

Saudi Arabian Universities - the Mecca for Highly Cited Researchers?

The following table shows how the 112 Highly Cited Researchers affiliated to Saudi Arabian institutions in 2022 (accounting for ShanghaiRanking's ARWU 2023) and 106 HCRs in 2021 (accounting for ShanghaiRanking's ARWU 2022) are distributed amongst institutions (primary affiliation). King Saud University (39 HCRs), King Abdulaziz University (31 HCRs) and King Abdullah University of Science & Technology (17 HCRs) are the universities which have the most HCRs affiliated in 2022.

Primary Affiliation Institution (Saudi Arabia)	2022		2021	
	Number of HCRs	HCRs with an *Asterisk (affiliation through research fellowship)	Number of HCRs	HCRs with an *Asterisk (affiliation through research fellowship)
King Saud University	39	21	40	4
King Abdulaziz University	31	19	37	5
King Abdullah University of Science & Technology	17	0	17	0
Taif University	10	0	4	0
Princess Nourah bint Abdulrahman University	7	4	0	0
King Fahd University of Petroleum & Minerals	6	0	6	0
Ministry of Health - Saudi Arabia	1	0	2	0
King Abdullah International Medical Research Center (KAIMRC)	1	0	0	0
Overall	112	44	106	9

Table 3. Distribution of 2022 and 2021 HCRs²² amongst Saudi Arabian institutions and share of them being labelled by Clarivate with an asterisk, i.e. having an affiliation through a research fellowship to their primary affiliation.

With this number of HCRs, Saudi Arabia would appear in 9th position, together with Switzerland, among the countries with most Highly Cited Researchers. **Clarivate does however not consider Saudi Arabia in its ranking of the top countries in terms of the number of Highly Cited Researchers (Fig. 3).** They comment that their figures *do not include the few cases in which a Highly Cited Researcher opted to list a primary affiliation that represented a Research Fellowship rather than a permanent home base.*²³

²² <https://recognition.webofscience.com/wos-op/awards/highly-cited/2021/>

²³ <https://clarivate.com/highly-cited-researchers/analysis/>

Highly Cited Researchers by country or region

Rank	Country/Region	Number of HCRs 2022	World Share (%)
1	United States	2,764	38.3
2	China, Mainland	1,169	16.2
3	United Kingdom	579	8
4	Germany	369	5.1
5	Australia	337	4.7
6	Canada	226	3.1
7	The Netherlands	210	2.9
8	France	134	1.9
9	Switzerland	112	1.6
10	Singapore	106	1.5

Fig. 3 Screenshot from the [Clarivate HCR Analysis webpage](#), analysing the countries with the highest amount of HCRs

Table 3. above shows **how many of those researchers have been marked with an asterisk by Clarivate**, meaning that they are associated with the institution not through main employment, but through a research fellowship. **It seems that Clarivate started identifying far more such cases in 2022 (44), compared to 2021, when it just marked 9 HCRs with an asterisk²⁴. Concretely this means that in 2022 over half of the Highly Cited Researchers of King Saud and King Abdulaziz University are reported not to be mainly employed by those Saudi Arabian universities - and this is probably only the surface of the iceberg.**

Table 4 shows the detailed indicator scores for the ranked Saudi Arabian universities. **It can be seen that they are ranked amongst the worldwide best universities in ShanghaiRanking's ARWU 2022**, largely thanks to their extremely high number of Highly Cited Researchers (from the 2021 list). In a recent article, including the case of King Saud University as an example, it was shown that the redirection of an Highly Cited Researcher affiliation is particularly potent when there are only a few HCRs in an institution, potentially leading to a change of more than 100 places in the rank order.²⁵

²⁴ In 2022 Clarivate decided to extend the list of researchers tagged with asterisk to those identifying as affiliated or guest researchers.

²⁵ Docampo, D., Egret, D. & Cram, L. An anatomy of the academic ranking of world universities (Shanghai ranking). *SN Soc Sci* 2, 146 (2022). <https://doi.org/10.1007/s43545-022-00443-3>

	World Rank	National Rank	ShanghaiRanking's Academic Ranking of World Universities Scores							Number of Highly Cited Researchers (2021 list)
			Total Score	ALU	AWD	HCR	N&S	PUB	PCP	
King Saud University	118-121	1	24.2	0	0	43.2	5.5	58.7	21.4	40
King Abdulaziz University	148-150	2	22.1	0	0	41.6	7.1	50.6	17.7	37
King Abdullah University of Science and Technology	282-284	3	16	0	0	28.2	10.9	30.3	17.8	17
Taif University	408-412	4	12.8	0	0	13.7	0	40	17.6	4
King Fahd University of Petroleum & Minerals	496-499	5	11.4	0	0	16.7	0	28.4	21.3	6
King Khalid University	627-638	6	9.6	0	0	0	1.4	37.5	15.7	0
Prince Sattam Bin Abdulaziz University	812-820	7	7.9	0	0	0	0	32.1	13.4	0

Table 4. Detailed ranking data, total score and indicator scores for Saudi Arabian universities in ARWU 2022.

By comparing to other universities with similar numbers of Highly Cited Researchers, we can simulate the HiCi score per number of Highly Cited Researchers and show **that ShanghaiRanking's ARWU 2022 seems to take Highly Cited Researchers into account, even if they are marked with an asterisk in the HCR list**, despite the fact that Clarivate highlights at least since 2019²⁶ such researchers with an asterisk.

If they had not counted the 4 HCRs associated with a research fellowship to King Saud University in 2021 (see Table 3.) in the ShanghaiRanking's ARWU 2022, its score would have been 41.0 (for 36 Highly Cited Researchers)²⁷, instead of 43.2 points (for 40 Highly Cited Researchers)²⁸. The same for King Abdulaziz University: its score for 32 Highly Cited Researchers would have been 38.7²⁹ instead of 41.6 points for the 37 listed Highly Cited Researchers³⁰.

The question remains, for how long ShanghaiRanking's ARWU will continue taking those HCRs marked with an asterisk into account? The way the number of Highly Cited Researchers compare to other countries and regions, is detailed in more depth in the next chapter.

²⁶ <https://recognition.webofscience.com/wos-op/awards/highly-cited/2019/faq/> - latest available online list (only place where asterisks are visible. They aren't indicated in the archived Excel Sheets of the past HCR lists)

²⁷ Similar score to the University of Melbourne, University of New South Wales, who all have 36 Highly Cited Researchers

²⁸ Similar score to the University of Washington, who had 40 Highly Cited Researchers in 2021

²⁹ Similar score to the National University of Singapore, Mount Sinai School of Medicine, Mayo Medical School, University of Chicago, who all had 32 Highly Cited Researchers in 2021

³⁰ Similar score to Duke University, who had 37 Highly Cited Researchers in 2021

Similar cases in the 2022 Highly Cited Researchers™ list from Clarivate™

In recent days a major focus has been placed on the case of Rafael Luque, who has been employed at the University of Córdoba, but who indicated King Saud University as his primary affiliation in the 2022 Highly Cited Researchers™ (HCR) list from Clarivate™. The following chapter takes a look at other similar cases in this list and tries to understand if a similar pattern can be found for other Spanish or Saudi Arabian researchers.

The source of the data is the Highly Cited Researchers™™ list from Clarivate™³¹ itself, but data were treated and analysed by SIRIS Academic on April 3rd 2023. **Our study is merely about identifying institutional practices and we therefore chose to remove individual names, which, for those interested, are openly available through the Clarivate webpage.**

Understanding the Mercato of 2022 Highly Cited Researchers

In the context of the recent article on **Rafael Luque being associated to institutions from various other countries**, we chose to look in more detail on the cases of **Saudi Arabia, Spain, China, Qatar, Russia and the United Arab Emirates**:

- **Saudi Arabia and Spain**, as they are the focus of this case.
- **China and Russia**, as two of the larger countries, to which Rafael Luque had second affiliations.
- **United Arab Emirates and Qatar**, as countries that have in the past decades **attracted various foreign researchers** to emerging international branch campuses or transnational education zones³².

Amongst those selected countries, China has the most Highly Cited Researchers (1169 HCRs), followed by Saudi Arabia (112 HCRs) and Spain (101 HCRs). In proportion to their total number of researchers, **Saudi Arabia has an over-proportionate high share of Highly Cited Researchers, namely 0.45%, compared to 0.07% in Spain and 0.06% in China. For the US and UK the share is 0.19%, The Netherlands 0.22%, Germany 0.09% and France 0.04% (data not shown).** Clarivate states that “of the world’s population of scientists and social scientists, Highly Cited Researchers are 1 in 1,000”, thus 0.1%.³³ As commented above, 44 of them are reported to only be associated with

³¹ <https://clarivate.com/highly-cited-researchers/>

³² Rottlieb, T., & Kleibert, J. M. (2022). Circulation and containment in the knowledge-based economy: Transnational education zones in Dubai and Qatar. *Environment and Planning A: Economy and Space*, 54(5), 930–948. <https://doi.org/10.1177/0308518X221077105>

³³ <https://clarivate.com/highly-cited-researchers/>

Saudi Arabian institutions through research fellowships and not through main employment.

	Primary Affiliation Country in HCR 2022					
	Saudi Arabia	Spain	China	Qatar	Russia	United Arab Emirates
Number of researchers in FTE (2018) ³⁴	24,808 ³⁵	140,120	1,866,109	1,606	405,772	22,911
Researchers with Primary Affiliation from this country	112	101	1,169	5	3	2
Share of HCRs amongst all researchers	0.45%	0.07%	0.06%	0.31%	0.00%	0.01%
Number of HCRs with secondary affiliations	84	51	162	3	0	1
Share of HCRs, which have a second affiliation	75%	50%	14%	60%	0%	50%

Table 5. Total number of researchers and number 2022 Highly Cited Researchers primarily affiliated to each country and share of those, which indicate a second affiliation institution.

It can also be seen that **amongst those HCRs indicating Saudi Arabia as a primary affiliation, there is a large share (75%) who indicate a secondary affiliation**, which is **less the case for researchers with primary affiliation from other countries** in this benchmark. The following table shows the **secondary affiliation countries of those Highly Cited Researchers**, who indicate one of the benchmark countries as their **primary affiliation** in the 2022 Highly Cited Researchers™ list.

Secondary Affiliation Country	Primary Affiliation Country in HCR 2022					
	Saudi Arabia	Spain	China	Qatar	Russia	United Arab Emirates
China	12	1	100			
Spain	11	37				
United Kingdom	6	3	2			
Italy	6					
Germany	5		1			
India	5					
Pakistan	4					
Turkey	4		4			

³⁴ 2018 data from the 2021 UNESCO Science Report, Statistical Annex: <https://www.unesco.org/reports/science/2021/en/statistics>

³⁵ 2021 data from the General Authority for Statistics, Kingdom of Saudi Arabia: <https://www.stats.gov.sa/en/news/454>

United States	3	3	15			
Denmark	3					
Egypt	3					
Switzerland	3					
Brazil	2					
Estonia	2					
Greece	2					
Netherlands	2					
Russia	2					
Australia	1	3	13			
Malaysia	1	1				
Algeria	1					
Bangladesh	1					
Chile	1					
Mauritius	1					
Norway	1					
Slovakia	1					
Vietnam	1		1			
Saudi Arabia		1	3			1
Finland		1				
Portugal		1				
Hong Kong			4			
Canada			3			
Japan			3			
Sweden			3			
Singapore			2	1		
Iran			2			
Kenya			1			
Slovenia			1			
South Korea			1			
Taiwan			1			
Thailand			1			
United Arab Emirates			1			
Qatar				1		
South Africa				1		

Table 6. Distribution of 2022 Highly Cited Researchers per country of secondary affiliation for researchers who have listed as primary affiliation Saudi Arabia, Spain, China, Qatar, Russia or United Arab Emirates.

- **Saudi Arabia:** a large number of HCRs primarily affiliated to Saudi Arabian institutions have as a secondary affiliation **Chinese institutions** (12 HCRs), followed by **Spanish** (11 HCRs), **UK** (6 HCRs) and **Italian institutions** (6 HCRs). As we will see below, Saudi Arabian institutions are very prominent primary affiliations for researchers who have as a second affiliation a Spanish one.
- **Spain:** 37 out of the 51 secondary affiliations HCRs with **Spanish** primary affiliations indicate other Spanish institutions. This is often the case also in other countries, where one of the affiliations is a university and the second one is either a research institution or a hospital. For foreign secondary institutions, the majority of HCRs have either **US**, **UK** or **Australian** second affiliations. One Highly Cited Researcher has a second affiliation at a **Saudi Arabian university**.
- **China:** Besides 100 out of 161 secondary affiliations coming from **China**, a large number of HCRs indicate **US** (15) or **Australian** (13) institutions as a secondary affiliation.
- **Qatar, Russia and the United Arab Emirates:** No HCR from those regions has as a secondary affiliation a European affiliation. Singapore and South Africa for Qatar, and Saudi Arabian institutions for HCRs who indicated UAE as their primary affiliation.

Are there other Highly Cited Researchers indicating Spanish Institutions as Secondary Affiliations?

In the Highly Cited Researchers™ list of 2022, there were **56 researchers who had as a secondary affiliation a Spanish institution** (see Annex 4 for detailed list of researchers), out of which **37 had as a primary affiliation another Spanish institution**.

Secondary Affiliation Spain - Primary Affiliation not Spain	
Primary Affiliation Country	Number of Highly Cited Researchers
Spain	37
Saudi Arabia	11
United States	3
Australia	1
Canada	1
Croatia	1
Germany	1
United Kingdom	1
Total	56

Table 7. Primary Affiliation Country of 2022 Highly Cited Researchers, who indicated Spanish institutions as a secondary affiliation.

As commented above, this is pretty common in many countries where researchers have double affiliations to e.g. a university and research centre or hospital. It turns out that for **6 out of those 37 researchers with two affiliated Spanish institutions, they indicate the non-university institutions as first affiliation and the university as a secondary affiliation**. Those researchers are affiliated to **Autonomous University of Barcelona (2 HCRs), Universidade de Vigo, University of Valencia, University of Navarra, University of Sevilla and the University of Barcelona** (see Annex 4).

If these researchers were to indicate the university as primary affiliation, this would **increase the ranks of those universities in the ShanghaiRanking's ARWU, without having an impact on the research institutions or hospitals** (which are, by definition not ranked)³⁶.

For the **19 remaining Highly Cited Researchers**, **11 had Saudi Arabian institutions as their primary affiliation, while 3 had US institutions**.

The following table shows the **affiliation details of those researchers with a non-Spanish primary affiliation**. The **Centro Tecnológico da Carne** has 2 HCRs, who

³⁶ Practices in this respect vary from country to country. In France, [an official letter](#) from the Ministry of Higher Education, Research and Innovation asked researchers in similar situations (for example researchers employed by a national research organisation but working within a laboratory of a university) to indicate the university as their primary affiliation from 2019 onwards. This caused much [discussion](#) in the scientific community.

have primary affiliations at the **King Abdulaziz University** and the **University of Santiago de Compostela** has 2 HCRs who have a **UK or US institution** as a primary affiliation. The remaining HCRs with a secondary affiliation to a Spanish institution are distributed amongst various other Spanish universities or research institutions.

Secondary Affiliation Spain - Primary Affiliation not Spain				
Researcher	Primary Affiliation Institution	Primary Affiliation Country	Secondary Affiliation Institution	Secondary Affiliation Country
HCR 1	University of Melbourne	Australia	CSIC	Spain
HCR 2	University of British Columbia	Canada	University of Santiago De Compostela	Spain
HCR 3	University North - Croatia	Croatia	Universidade de Vigo	Spain
HCR 4	Technical University of Munich	Germany	University of Valladolid	Spain
HCR 5	King Abdulaziz University*	Saudi Arabia	AZTI	Spain
HCR 6	King Saud University	Saudi Arabia	Catalan Institute for Water Research	Spain
HCR 7	King Abdulaziz University*	Saudi Arabia	Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)	Spain
HCR 8	King Abdulaziz University	Saudi Arabia	Centro Tecnológico da Carne	Spain
HCR 9	King Abdulaziz University	Saudi Arabia	Centro Tecnológico da Carne	Spain
HCR 10	King Saud University*	Saudi Arabia	CSIC	Spain
HCR 11	King Abdulaziz University*	Saudi Arabia	ICREA	Spain
HCR 12	King Saud University*	Saudi Arabia	Universidad de Córdoba	Spain
HCR 13	King Saud University*	Saudi Arabia	Universidad de Jaén	Spain
HCR 14	King Abdulaziz University*	Saudi Arabia	Universidad Europea del Atlántico	Spain
HCR 15	King Saud University	Saudi Arabia	University of Barcelona	Spain
HCR 16	University College London	United Kingdom	University of Santiago De Compostela	Spain
HCR 17	Massachusetts Institute of Technology (MIT)	United States	Autonomous University of Barcelona	Spain
HCR 18	Arizona State University	United States	Universidad Carlos III de Madrid	Spain
HCR 19	Northeastern University	United States	Universitat Ramon Llull	Spain

Table 8. 2022 Highly Cited Researchers with Spanish institutions as secondary affiliation (names anonymised). *Those HCRs with an asterisk in their primary affiliation are associated with this institution through a research fellowship or counting as affiliated or guest researchers.

For 7 of the HCRs affiliated primarily with Saudi Arabia institutions, Clarivate indicates with an asterisk, that those Saudi Arabian institutions are not the main employer of the researchers, but that they are associated with those institutions through research fellowships or as a guest researcher. For 5 of them 2022 was the first year they were marked as such. It is important to note that Clarivate states that

there may well be similar associations for other Highly Cited Researchers that have not been brought to their attention.

We analysed the affiliation history of those 11 researchers, primarily affiliated to Saudi Arabian universities in the 2022 Highly Cited Researchers™ list from Clarivate™. The aim was to see if they have always been primarily affiliated to Saudi Arabian universities or if there was a specific moment in which this switch happened. As explained in the introduction we merely aim at identifying institutional practices and we therefore chose to remove individual names, which, for those interested, can easily be found through openly available data on the Clarivate webpage.

HCR 5 entered the HCR list in 2018 under the Spanish primary affiliation of AZTI. HCR 5 immediately switched affiliations and in the second year of his appearance in the HCR list, in 2020, HCR 5 indicated AZTI as secondary affiliation, in favour of King Abdulaziz University as primary affiliation (affiliated through a research fellowship).

HCR 5		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2018	AZTI, Spain	
2020	King Abdulaziz University, Saudi Arabia	AZTI, Spain
2021	King Abdulaziz University, Saudi Arabia	AZTI, Spain
2022	King Abdulaziz University, Saudi Arabia*	AZTI, Spain

Table 9. HCR 5's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 6 entered the HCR list in 2016, directly with the primary affiliation of King Saud University as primary affiliation. Only in 2021 did HCR 6 add the Catalan Institute for Water Research as a secondary affiliation.

HCR 6		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2016	King Saud University, Saudi Arabia	
2017	King Saud University, Saudi Arabia	
2018	King Saud University, Saudi Arabia	
2019	King Saud University, Saudi Arabia	
2020	King Saud University, Saudi Arabia	
2021	King Saud University, Saudi Arabia	Catalan Institute for Water Research, Spain
2022	King Saud University, Saudi Arabia	Catalan Institute for Water Research, Spain

Table 10. HCR 6's history in the Highly Cited Researchers™ list (Clarivate™)

HCR 7 entered the HCR list in 2019 under the Spanish primary affiliation of Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF). HCR 7 immediately switched affiliations and in the second year of his appearance in the HCR list, in 2020, HCR 7 indicated CREAM as secondary affiliation, in favour of King Abdulaziz University

as primary affiliation (affiliated through a research fellowship). HCR 7's affiliation to King Abdulaziz University was marked in 2020 as association through research fellowship, in 2021 it wasn't marked as such and then again in 2022.

HCR 7		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2019	Centro de Investigación Ecológica y Aplicaciones Forestales, Spain	
2020	King Abdulaziz University, Saudi Arabia*	Centro de Investigación Ecológica y Aplicaciones Forestales, Spain
2021	King Abdulaziz University, Saudi Arabia	Centro de Investigación Ecológica y Aplicaciones Forestales, Spain
2022	King Abdulaziz University, Saudi Arabia*	Centro de Investigación Ecológica y Aplicaciones Forestales, Spain

Table 11. HCR 7's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 8 and HCR 9 both entered the HCR list in 2022 with King Abdulaziz University as primary affiliation and the Spanish Centro Tecnológico da Carne, as secondary affiliation.

HCR 8 and HCR 9		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2022	King Abdulaziz University, Saudi Arabia	Centro Tecnológico da Carne, Spain

Table 12. HCR 8's and HCR 9's history in the Highly Cited Researchers™ list (Clarivate™)

HCR 10 entered the HCR list in 2018 under the Spanish primary affiliation of CSIC. After the third year of HCR 10's appearance in the HCR list, in 2020, HCR 20 indicated CSIC as secondary affiliation, in favour of King Saud University as primary affiliation.

HCR 10		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2018	CSIC, Spain	
2019	CSIC, Spain	Delft University of Technology, Netherlands
2020	King Saud University, Saudi Arabia	CSIC, Spain
2021	King Saud University, Saudi Arabia	CSIC, Spain
2022	King Saud University, Saudi Arabia*	CSIC, Spain

Table 13. HCR 10's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 11 entered the HCR list in 2021 under the Spanish primary affiliation of University of Barcelona. HCR 11 immediately switched affiliations and in the second year of his appearance in the HCR list, in 2022, HCR 11 indicated University of Barcelona as secondary affiliation, in favour of King Abdulaziz University as primary affiliation (affiliated through a research fellowship)

HCR 11		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2021	University of Barcelona, Spain	
2022	King Abdulaziz University, Saudi Arabia*	ICREA, Spain

Table 14. HCR 11's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 12 entered the HCR list in 2018 under the Spanish primary affiliation of Universidad de Córdoba. HCR 12 immediately switched affiliations and in the second year of his appearance in the HCR list, in 2019, HCR 12 indicated Universidad de Córdoba as secondary affiliation, in favour of King Saud University as primary affiliation.

HCR 12		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2018	Universidad de Córdoba, Spain	
2019	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2020	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2021	King Saud University, Saudi Arabia	Universidad de Córdoba, Spain
2022	King Saud University, Saudi Arabia*	Universidad de Córdoba, Spain

Table 15. HCR 12's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 13 entered the HCR list in 2017 under the Spanish primary affiliation of Universidad de Jaén. In contrast to most other Spanish cases, it took 5 years until HCR 13 moved in 2022 Universidad de Jaén to the secondary affiliation (previously Ulster University), in favour of King Saud University as primary affiliation. **We foresee that this switch will lead to a drop of around 150 positions for Universidad de Jaén in the ShanghaiRanking's ARWU 2023 (701-800 in ARWU 2022)³⁷, which will take the 2022 HCR list into account.**

³⁷ Forecast done in collaboration with ARWU expert Domingo Docampo

HCR 13		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2017	Universidad de Jaén, Spain	
2018	Universidad de Jaén, Spain	Ulster Univ., United Kingdom
2019	Universidad de Jaén, Spain	Ulster University, United Kingdom
2020	Universidad de Jaén, Spain	Ulster University, United Kingdom
2021	Universidad de Jaén, Spain	Ulster University, United Kingdom
2022	King Saud University, Saudi Arabia*	Universidad de Jaén, Spain

Table 16. HCR 13's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 14 entered the HCR list in 2019 under the Spanish primary affiliation of Universidade de Vigo. HCR 14 immediately switched affiliations and in the second year of his appearance in the HCR list, in 2020, HCR 14 added King Abdulaziz University as primary affiliation. HCR 14's secondary affiliations have been Northwest University in China till 2020 and European University of the Atlantic from 2021 on. HCR 14 is one of the only Spanish HCRs which was marked since its first switch to King Abdulaziz University continuously with an asterisk, indicating its affiliation to this university through a research fellowship or guest researcher.

HCR 14		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2019	Universidade de Vigo, Spain	Northwest University, China Mainland
2020	King Abdulaziz University, Saudi Arabia*	Northwest University, China Mainland
2021	King Abdulaziz University, Saudi Arabia*	European University of the Atlantic, Spain
2022	King Abdulaziz University, Saudi Arabia*	European University of the Atlantic, Spain

Table 17. HCR 14's history in the Highly Cited Researchers™ list (Clarivate™) *The asterisk indicates that the HCR is associated with this institution through a research fellowship or counting as affiliated or guest researchers.

HCR 15 entered the HCR list in 2017, directly with the primary affiliation of King Saud University as primary affiliation and the University of Barcelona as secondary affiliation.

HCR 15		
Year	Primary Affiliation Institution	Secondary Affiliation Institution
2017	King Saud University, Saudi Arabia	University of Barcelona, Spain
2019	King Saud University, Saudi Arabia	University of Barcelona, Spain
2020	King Saud University, Saudi Arabia	University of Barcelona, Spain
2021	King Saud University, Saudi Arabia	University of Barcelona, Spain
2022	King Saud University, Saudi Arabia	University of Barcelona, Spain

Table 18. HCR 15's history in the Highly Cited Researchers™ list (Clarivate™)

As shown above, **similar cases to the one of Rafael Luque exist**, and a **correction of those affiliation details might provide the main credit** (amongst others an increase in the HCR indicator of the ShanghaiRanking's ARWU) **to the main employer** of those Highly Cited Researchers.

This **factual presentation** of the way some researchers indicate their affiliation, **opens a major discussion on the impact that affiliations** in such a list, but also in publications, have. Whether we want it or not, **universities are currently partly dependent on the visibility which they gain from rankings**, of which the methodology has been rightly questioned. Within this overall questionable trend, it seems **important to ensure, at a minimum, that information published is correct**. Affiliation is one such factor that can be corrected. **This contribution to the debate thus aims merely at inviting institutions to ensure sound signing practices.**

Some do it differently: indicating Saudi Arabian Institutions as Secondary Affiliations

There are 11 Highly cited researchers³⁸ who have Saudi Arabian institutions as secondary affiliations. It is interesting to note that amongst them is also a **Spanish researcher (HCR 27) affiliated primarily with the Universitat Politecnica de Valencia**. This case could be used as a comparable case for the other 11 researchers who have the Saudi Arabian institutions as their primary affiliation and the Spanish one as second. Again, each case must be analysed individually.

Secondary Affiliation Saudi Arabia			
Researcher	Primary Affiliation Institution	Primary Affiliation Country	Secondary Affiliation Institution
HCR 20	International Institute for Applied Systems Analysis (IIASA)	Austria	King Abdullah University of Science & Technology
HCR 21	International Institute for Applied Systems Analysis (IIASA)	Austria	King Abdullah University of Science & Technology
HCR 22	China University of Geosciences	China Mainland	King Abdulaziz University
HCR 23	University of Electronic Science & Technology of China	China Mainland	King Abdulaziz University
HCR 24	China University of Geosciences	China Mainland	King Abdulaziz University
HCR 25	University of Wurzburg	Germany	King Saud University
HCR 26	University of Hong Kong	Hong Kong	King Abdullah University of Science & Technology
HCR 27	Universitat Politecnica de Valencia	Spain	King Abdulaziz University
HCR 28	Universite de Carthage	Tunisia	Qassim University
HCR 29	Mohamed Bin Zayed University of Artificial Intelligence	United Arab Emirates	King Saud University
HCR 30	University of Oxford	United Kingdom	King Abdullah University of Science & Technology
HCR 31	Temple University	United States	King Abdulaziz University

Table 19. 2022 Highly Cited Researchers with Saudi Arabian institutions as secondary affiliation (names anonymised).

³⁸ Actually, 12 HCRs, since Yoshihide Wada appears twice, once in the category of Environment and Ecology and once in Geosciences

Annex

Annex 1: Context and methodology of the ShanghaiRanking's ARWU

The history of ShanghaiRanking's Academic Ranking of World Universities (ARWU) ranking begins in **1998** when Shanghai Jiao Tong University (SJTU) was selected as part of the “**985 Project**” launched to enable the emergence of world-class universities in China. In this context, the SJTU team submitted a report benchmarking international universities to the Chinese Ministry of Education. After its publication, Chinese and foreign stakeholders recommended turning it into a genuine ranking of world universities³⁹.

The ranking was **first published in 2003** and has been updated annually ever since. SJTU supported the publication until 2009, when an independent consultancy was established (Shanghai Ranking Consultancy).

ARWU takes into account around **2500 of the world's top universities** which qualify by virtue of having Nobel laureates, Fields medallists, Highly Cited Researchers, or papers published in Nature or Science. In addition, universities with a significant number of papers indexed by Science Citation Index-Expanded (SCIE) and Social Science Citation Index (SSCI) are included. Out of these institutions, **1000 are ranked**.

The indicators and weightings as applied by ARWU 2022 methodology are as follows⁴⁰:

Indicator	Indicator	Code	Weight
Quality of Education	Alumni of an institution winning Nobel Prizes and Fields Medals	Alumni	10%
Quality of Faculty	Staff of an institution winning Nobel Prizes and Fields Medals	Award	20%
	Highly cited researchers in 21 broad subject categories, based on Highly Cited Researchers™ list issued in November 2021	HiCi	20%
Research Output	Papers published in Nature and Science between 2017 and 2021	N&S	20%
	Papers indexed in Science Citation Index-expanded and Social Science Citation Index in 2021	PUB	20%
Per Capita Performance	Per capita academic performance of an institution	PCP	10%
Total			100%

Table A1. ShanghaiRanking's ARWU indicators and their weighting

³⁹ Liu, N.C. (2009). *The Story of Academic Rankings*, International Higher Education, 54, pp. 2-3

⁴⁰<http://www.shanghairanking.com/methodology/arwu/2022>

All ARWU indicators depend on **external, publicly available sources for their data**, including the official site of the Nobel Prize, the International Mathematical Union for Fields Medals, the Clarivate Highly Cited Researchers™ list and several Clarivate Analytics websites for citations and publications. This is why, as has been demonstrated by D. Docampo, **ARWU rankings are reproducible by outside experts**⁴¹.

ARWU's methodology has remained globally stable since 2004 after a minor tweak was made between the first edition of the ranking in 2003 and the second edition⁴². The indicator that has changed the most since 2014 is **HiCi**. It is based on the **list of Highly Cited Researchers** produced by Clarivate Analytics⁴³. This list was not updated between 2001 and 2014, thus artificially increasing the stability of the ranking. It was finally updated in 2014 and has been updated annually since.

ARWU's parameters favour **institutions which produce a large amount of world-class research**. All indicators except one are calculated independently of the size of institutions (absolute number of Nobel Prizes, publications and publications in Nature and Science, Highly Cited Researchers, etc.). This methodology means that small institutions have difficulty appearing amongst the leading institutions, as do those specialised in the Humanities and Social Sciences⁴⁴. Conversely, it means that **merging institutions normally improves the position in ARWU of the resultant university**⁴⁵, if these institutions are specialised in fields that produce research published in Web of Science indexed journals and genuine integration modalities are set up (one governance, one budget, one strategy, one diploma-delivering entity, one HR policy...) ⁴⁶. A good example of this is the **merger of Universities of Paris Descartes and Paris Diderot to create the University of Paris**, which enabled the resultant university to rise from 171th (University of Paris Descartes) and 141th (University Paris Diderot) in 2019 to 65th in 2020.

⁴¹ Docampo, D. (2013). *Reproducibility of the Shanghai academic ranking of world universities results*. *Scientometrics* 93:567. In practice, the individual indicators are not all perfectly reproducible because the precise bibliometric queries made by the ARWU team are unknown.

⁴² This methodological change is clear when you compare the positions of institutions in 2003 and 2004, but it is hard to find a precise description of it. To the best of our knowledge, the PCP weight was reduced from 20% to 10% in order to add the category Alumni, also weighed at 10% and Field Medals were added to Nobel Prizes for both Alumni and Award categories

⁴³ <https://clarivate.com/highly-cited-researchers/>

⁴⁴ The difficulty to find relevant indicators for the SSH has been a constant preoccupation for ARWU, which also impacted the way it designed its field-based ranking as we will see below - Cf. Liu, N. C., & Cheng, Y. (2005). *The academic ranking of world universities*. *Higher Education in Europe*, 30(2), 127–136: "The Ranking Group tried hard but was unsuccessful to find additional indicators that are special for humanities and social sciences. However, the indicator of N&S is not considered for institutions specialized in humanities and social sciences (...), its weight is relocated to other indicators".

⁴⁵ This was in fact one of the major explicit motivations of the excellence programmes such as the French IDEX initiative.

⁴⁶ Rauhvargers, A. (2013). *Global university rankings and their impact: report II*. Brussels: European University Association (pp.24-27 and 70).

Annex 2: 2022 Highly Cited Researchers with Primary Affiliation Saudi Arabia

The following table shows detailed affiliation details for all 2022 Highly Cited Researchers, who indicated a primary affiliation with a Saudi Arabian institution.

Primary Affiliation Saudi Arabia			
Researcher	Primary Affiliation Institution	Secondary Affiliation Institution	Secondary Affiliation Country
HCR 32	Princess Nourah bint Abdulrahman University	University Djillali Liabes Sidi Bel Abbes	Algeria
HCR 33	King Saud University	University of Wollongong	Australia
HCR 34	King Abdulaziz University	Jashore University of Science and Technology	Bangladesh
HCR 35	King Saud University	Senac Faculty of Ceara	Brazil
HCR 36	King Saud University	Universidade Federal do Rio Grande do Sul	Brazil
HCR 37	Taif University	Universidad de Tarapaca	Chile
HCR 38	King Abdulaziz University	China University of Mining & Technology	China Mainland
HCR 39	King Abdulaziz University	China West Normal University	China Mainland
HCR 40	King Saud University	Chinese Academy of Sciences	China Mainland
HCR 41	Princess Nourah bint Abdulrahman University (PNU)	Fujian Normal University	China Mainland
HCR 42	King Abdulaziz University	Guangxi Normal University	China Mainland
HCR 43	King Saud University	Huazhong University of Science & Technology	China Mainland
HCR 44	Taif University	Jiangsu University	China Mainland
HCR 45	King Abdulaziz University	Shandong University of Science & Technology	China Mainland
HCR 46	King Abdulaziz University	Southwestern University of Finance & Economics - China	China Mainland
HCR 47	King Abdulaziz University	Xi'an University of Architecture & Technology	China Mainland
HCR 48	King Abdulaziz University	Zhejiang Normal University	China Mainland
HCR 49	King Abdulaziz University	Zhejiang University of Technology	China Mainland
HCR 50	King Abdullah University of Science & Technology	Aarhus University	Denmark
HCR 51	King Abdullah University of Science & Technology	Aarhus University	Denmark

HCR 52	King Abdulaziz University	Technical University of Denmark	Denmark
HCR 53	King Abdulaziz University	Cairo University	Egypt
HCR 54	King Saud University	National Research Centre (NRC)	Egypt
HCR 55	King Saud University	Suez Canal University	Egypt
HCR 56	King Saud University	Estonian University of Life Sciences	Estonia
HCR 57	King Saud University	University of Tartu	Estonia
HCR 58	King Saud University	Max Planck Society	Germany
HCR 59	King Saud University	Research Center Julich	Germany
HCR 60	King Saud University	University of Gottingen	Germany
HCR 61	King Saud University	University of Munster	Germany
HCR 62	King Abdulaziz University	University of Wuppertal	Germany
HCR 63	Taif University	Galanakis Laboratories	Greece
HCR 64	Princess Nourah bint Abdulrahman University	University of Patras	Greece
HCR 65	Taif University	Birla Institute of Technology & Science Pilani (BITS Pilani)	India
HCR 66	Taif University	Ingenium Naturae Private Limited	India
HCR 67	King Saud University	Jamia Hamdard University	India
HCR 68	Taif University	SSN College of Engineering	India
HCR 69	King Saud University	Vishnugupta Vishwavidyapeetam	India
HCR 70	King Saud University	Consiglio Nazionale delle Ricerche (CNR)	Italy
HCR 71	King Saud University	Istituto Italiano di Tecnologia - IIT	Italy
HCR 72	King Saud University	University of Catania	Italy
HCR 73	King Saud University	University of Catania	Italy
HCR 74	King Saud University	University of Florence	Italy
HCR 75	King Saud University	University of Salerno	Italy
HCR 76	Taif University	University of Nottingham Malaysia	Malaysia
HCR 77	King Saud University	University of Mauritius	Mauritius
HCR 78	King Abdullah University of Science & Technology	Delft University of Technology	Netherlands
HCR 79	King Saud University	Westerdijk Fungal Biodiversity Institute (KNAW)	Netherlands
HCR 80	King Saud University	Norwegian University of Science & Technology (NTNU)	Norway
HCR 81	King Saud University	COMSATS University Islamabad (CUI)	Pakistan
HCR 82	Princess Nourah bint Abdulrahman University	University of Agriculture Faisalabad	Pakistan

HCR 83	King Saud University	University of Haripur	Pakistan
HCR 84	Princess Nourah bint Abdulrahman University	University of Swabi	Pakistan
HCR 85	King Saud University	RUDN University	Russia
HCR 86	King Abdulaziz University	Russian Academy of Sciences	Russia
HCR 87	King Saud University	Slovak University of Technology Bratislava	Slovakia
HCR 5	King Abdulaziz University	AZTI	Spain
HCR 6	King Saud University	Catalan Institute for Water Research	Spain
HCR 7	King Abdulaziz University	Centro de Investigacion Ecologica y Aplicaciones Forestales (CREAF)	Spain
HCR 8	King Abdulaziz University	Centro Tecnológico da Carne	Spain
HCR 9	King Abdulaziz University	Centro Tecnológico da Carne	Spain
HCR 10	King Saud University	Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
HCR 11	King Abdulaziz University	ICREA	Spain
HCR 12	King Saud University	Universidad de Cordoba	Spain
HCR 13	King Saud University	Universidad de Jaen	Spain
HCR 14	King Abdulaziz University	Universidad Europea del Atlantico	Spain
HCR 15	King Saud University	University of Barcelona	Spain
HCR 88	King Abdulaziz University	Ecole Polytechnique Federale de Lausanne	Switzerland
HCR 89	King Abdullah University of Science & Technology	Ecole Polytechnique Federale de Lausanne	Switzerland
HCR 90	King Abdulaziz University	Ecole Polytechnique Federale de Lausanne	Switzerland
HCR 91	King Fahd University of Petroleum & Minerals	Abdullah Gul University	Turkey
HCR 92	King Abdulaziz University	Bogazici University	Turkey
HCR 93	King Abdulaziz University	Harran University	Turkey
HCR 94	King Fahd University of Petroleum & Minerals	Uludag University	Turkey
HCR 95	King Abdullah University of Science & Technology	Imperial College London	United Kingdom
HCR 96	Taif University	Scotland's Rural College	United Kingdom
HCR 97	King Abdulaziz University	University of Birmingham	United Kingdom
HCR 98	King Saud University	University of Glasgow	United Kingdom
HCR 99	King Abdulaziz University	University of Leicester	United Kingdom
HCR 100	King Abdulaziz University	University of Leicester	United Kingdom
HCR 101	Ministry of Health - Saudi Arabia	Emory University	United States
HCR 102	King Abdulaziz University	Grambling State University	United States

HCR 103	King Abdulaziz University	University of South Florida	United States
HCR 104	Taif University	Van Lang University	Vietnam
HCR 105	King Abdulaziz University		
HCR 106	King Abdullah University of Science & Technology		
HCR 107	King Abdullah University of Science & Technology		
HCR 108	King Abdullah University of Science & Technology		
HCR 109	King Abdullah University of Science & Technology		
HCR 110	King Saud University		
HCR 111	King Abdullah International Medical Research Center (KAIMRC)		
HCR 112	King Abdullah University of Science & Technology		
HCR 113	Princess Nourah bint Abdulrahman University		
HCR 114	King Abdullah University of Science & Technology		
HCR 115	King Fahd University of Petroleum & Minerals		
HCR 116	King Saud University		
HCR 117	King Abdullah University of Science & Technology		
HCR 118	King Abdullah University of Science & Technology		
HCR 119	King Saud University		
HCR 120	King Fahd University of Petroleum & Minerals		
HCR 121	King Fahd University of Petroleum & Minerals		
HCR 122	King Saud University		
HCR 123	King Abdulaziz University		
HCR 124	King Fahd University of Petroleum & Minerals		
HCR 125	King Abdulaziz University		
HCR 126	King Abdullah University of Science & Technology		
HCR 127	King Abdullah University of Science & Technology		
HCR 128	Princess Nourah bint Abdulrahman University		
HCR 129	King Abdullah University of Science & Technology		

HCR 130	King Abdullah University of Science & Technology		
HCR 131	Taif University		
HCR 132	King Abdulaziz University		
HCR 133	King Saud University		

Table A2. 2022 Highly Cited Researchers with Saudi Arabian institutions as primary affiliation (researchers anonymised).

Annex 3: Distribution of 2022 Highly Cited Researchers amongst Spanish institutions

The following table shows how the 101 Highly Cited Researchers are distributed amongst the Spanish institutions (primary affiliation). Besides CSIC, the universities with the highest number of HCRs are the **University of Granada, Barcelona and Politecnica de Valencia**.

Primary Affiliation Institution (Spain)	Number of HCRs
Consejo Superior de Investigaciones Científicas (CSIC)	15
University of Granada	9
University of Barcelona	9
Universitat Politecnica de Valencia	4
ISGlobal	4
Hospital Universitari Vall d'Hebron	4
University of Valencia	3
Universitat Jaume I	3
ICREA	3
University of Salamanca	2
University of Navarra	2
Universitat de Lleida	2
Universitat de les Illes Balears	2
Universidade de Vigo	2
Pompeu Fabra University	2
Institut de Ciències Fotòniques (ICFO)	2
Hospital Universitario Ramón y Cajal	2
CIC Energigune	2
Autonomous University of Madrid	2
Vall d'Hebron Institute of Oncology (VHIO)	2
University of Oviedo	1
Universitat d'Alacant	1
Universidad de Jaén	1
Universidad de Extremadura	1
Universidad de Castilla-La Mancha	1
Universidad de Alicante	1
Sant Pau Institute for Biomedical Research (IIB Sant Pau)	1
San Pablo CEU University	1
Instituto Ramón y Cajal de Investigación Sanitaria - IRYCIS	1
Institute for Research in Biomedicine - IRB Barcelona	1
Institut d'Investigació Biomèdica de Bellvitge (IDIBELL)	1
IMIM-Hospital del Mar Medical Research Institute	1
IMDEA Nanociencia	1
IESE Business School	1
IDIBAPS	1
Hospital Universitario de Getafe	1

General University Gregorio Maranon Hospital	1
Fundación para el Fomento de la Investigación Sanitaria y Biomédica de la Comunitat Valenciana	1
CSIC - Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS)	1
Clínica Universidad de Navarra	1
CIC biomaGUNE	1
CIBER - Centro de Investigación Biomédica en Red	1
Centro Nacional de Investigación de La Evolucion Humana (CENIEH)	1
Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)	1
Barcelona Supercomputing Center	1

Table A3. Distribution of 2022 HCRs amongst Spanish institutions

Annex 4: 2022 Highly Cited Researchers with Secondary Affiliation Spain

The following table shows detailed affiliation details for all 2022 Highly Cited Researchers, who indicated as secondary affiliation a Spanish institution. In yellow are those highlighted who have a Spanish University, not research institutions or hospitals (which cannot be ranked in ShanghaiRanking's ARWU).

Secondary Affiliation Spain			
Researcher	Primary Affiliation Institution	Primary Affiliation Institution	Primary Affiliation Country
HCR 1	University of Melbourne	Australia	Consejo Superior de Investigaciones Científicas (CSIC)
HCR 2	University of British Columbia	Canada	University of Santiago De Compostela
HCR 3	University North - Croatia	Croatia	Universidade de Vigo
HCR 4	Technical University of Munich	Germany	University of Valladolid
HCR 5	King Abdulaziz University	Saudi Arabia	Centro Tecnológico da Carne
HCR 6	King Saud University	Saudi Arabia	Universidad de Córdoba
HCR 7	King Saud University	Saudi Arabia	Universidad de Jaén
HCR 8	King Abdulaziz University	Saudi Arabia	AZTI
HCR 9	King Saud University	Saudi Arabia	Consejo Superior de Investigaciones Científicas (CSIC)
HCR 10	King Abdulaziz University	Saudi Arabia	Centro Tecnológico da Carne
HCR 11	King Abdulaziz University	Saudi Arabia	Universidad Europea del Atlántico
HCR 12	King Abdulaziz University	Saudi Arabia	ICREA
HCR 13	King Abdulaziz University	Saudi Arabia	Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)
HCR 14	King Saud University	Saudi Arabia	Catalan Institute for Water Research
HCR 15	King Saud University	Saudi Arabia	University of Barcelona
HCR 134	Universitat Politecnica de Valencia	Spain	Consejo Superior de Investigaciones Científicas (CSIC)
HCR 135	University of Barcelona	Spain	IDIBAPS
HCR 136	University of Valencia	Spain	CIBERONC
HCR 137	Hospital Universitari Vall d'Hebron	Spain	Vall d'Hebron Institut d'Oncologia (VHIO)
HCR 138	University of Salamanca	Spain	Instituto Biosanitario de Salamanca (IBSAL)
HCR 139	University of Navarra	Spain	CIBERONC
HCR 140	Vall d'Hebron Institute of Oncology (VHIO)	Spain	Vall d'Hebron University Hospital
HCR 141	Pompeu Fabra University	Spain	Institut Hospital del Mar d'Investigacions Mèdiques (IMIM)

HCR 142	University of Barcelona	Spain	CIBERFES
HCR 143	Institute for Research in Biomedicine - IRB Barcelona	Spain	ICREA
HCR 144	ICREA	Spain	Autonomous University of Barcelona
HCR 145	Barcelona Supercomputing Center	Spain	ICREA
HCR 146	Consejo Superior de Investigaciones Científicas (CSIC)	Spain	CSIC - Centro de Edafología y Biología Aplicada del Segura (CEBAS)
HCR 147	Pompeu Fabra University	Spain	Centre de Regulació Genòmica (CRG)
HCR 148	Institut de Ciències Fotòniques (ICFO)	Spain	ICREA
HCR 149	CIC biomaGUNE	Spain	Universidade de Vigo
HCR 150	University of Barcelona	Spain	IDIBAPS
HCR 151	Consejo Superior de Investigaciones Científicas (CSIC)	Spain	University of Valencia
HCR 152	CIBER - Centro de Investigación Biomédica en Red	Spain	Vall d'Hebron Institut de Recerca (VHIR)
HCR 153	Fundación para el Fomento de la Investigación Sanitaria y Biomédica de la Comunitat Valenciana	Spain	CIBER - Centro de Investigación Biomédica en Red
HCR 154	Consejo Superior de Investigaciones Científicas (CSIC)	Spain	CSIC - Instituto Pirenaico de Ecología (IPE)
HCR 155	IESE Business School	Spain	University of Navarra
HCR 156	Consejo Superior de Investigaciones Científicas (CSIC)	Spain	Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)
HCR 157	Consejo Superior de Investigaciones Científicas (CSIC)	Spain	University of Sevilla
HCR 158	ICREA	Spain	University of Barcelona
HCR 159	University of Barcelona	Spain	Hospital Clínic de Barcelona
HCR 160	Hospital Universitari Vall d'Hebron	Spain	Vall d'Hebron Institut de Recerca (VHIR)
HCR 161	Autonomous University of Madrid	Spain	Donostia International Physics Center
HCR 162	IMDEA Nanociencia	Spain	Donostia International Physics Center
HCR 163	Universitat de les Illes Balears	Spain	Instituto de Investigaciones Agroambientales y de Economía del Agua (INAGEA)
HCR 164	Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)	Spain	Autonomous University of Barcelona
HCR 165	ICREA	Spain	Centro de Investigación Ecológica y Aplicaciones Forestales (CREAF)
HCR 166	Consejo Superior de	Spain	Centro de Investigación Ecológica

	Investigaciones Científicas (CSIC)		y Aplicaciones Forestales (CREAF)
HCR 167	General University Gregorio Marañon Hospital	Spain	CIBERSAM - Centro de Investigación en Red de Salud Mental
HCR 168	University of Oviedo	Spain	Instituto de Investigación Sanitaria del Principado de Asturias (ISPA)
HCR 169	University of Barcelona	Spain	CIBERSAM
HCR 170	Sant Pau Institute for Biomedical Research (IIB Sant Pau)	Spain	CIBERESP
HCR 16	University College London	United Kingdom	University of Santiago De Compostela
HCR 17	Massachusetts Institute of Technology (MIT)	United States	Autonomous University of Barcelona
HCR 18	Northeastern University	United States	Universitat Ramon Llull
HCR 19	Arizona State University	United States	Universidad Carlos III de Madrid

Table A4. 2022 Highly Cited Researchers with Spanish institutions as secondary affiliation

The authors of this report

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