

RESEARCH FUTURES 2.0

A new look at the drivers and
scenarios that will define the decade

Summary of key research results

April 2022

Objective

Build on our original study examining the future of research

Back in 2018, with the help of Ipsos MORI, we set out to conduct a study to try to understand how the rapid and profound changes we were witnessing in science, technology and medicine were impacting the research landscape.

- Our goal was straightforward: To equip all of us in the industry with the knowledge we needed to navigate the opportunities and challenges that lay ahead. Drawing on a comprehensive literature review, interviews with 56 technology, research and publishing experts around the globe, and a survey of 2,055 researchers, we attempted to build a blueprint for the coming 10 years. In February 2019, we published the report based on that study - [*Research futures: Drivers and scenarios for the next decade*](#).
- There were two pillars to this study:
 - Pillar one: nineteen key drivers expected to shape developments in the decade ahead were identified during our discovery phase. We grouped these drivers into six themes and explored each of them in essay form.
 - Pillar two: Three scenarios, developed through workshops with internal and external experts based on how the nineteen key drivers might influence research, each envisaging what the future might look like a decade later. We named these scenarios Brave open world, Tech titans and Eastern ascendance.

Fast forward to today

- Since early 2020, the pandemic has transformed every aspect of researchers' work. We felt the time was ripe to revisit our first report and consider how the themes and scenarios we identified were playing out, particularly in light of COVID-19.

Approach

- **Overall:** During 2020 and 2021 we conducted two separate researcher surveys asking questions on a broad range of topics, from collaboration to education and from open science to public engagement. We reviewed the world of research through the changes of the past two years. We also asked researchers to help us understand the impact of the pandemic on their work.
- **Method:** Survey was administered online and was available in English only. Survey took 20 minutes to complete (median average).
- **Fieldwork:** Two waves of fieldwork: August 2020 and August 2021.
- **Audience:** Researchers **2021** n=1,173 and **2020** n=1,066.
- **Results:** During fieldwork, we closely monitored respondents by country and adjusted the sample to ensure results were as representative of the research community as possible. Responses are from a multitude of disciplines and locations. Results have been weighted to be representative of the global researcher population by country (UNESCO/OECD data). Base sizes shown in this report are unweighted, unless otherwise stated. Percentages shown in this report may not add together accurately due to rounding.
- **Statistical Error:** Maximum error margin for 1,173 responses is ± 2.41 percent and for 1,066 response is ± 2.53 percent at 90 percent confidence levels. When comparing the main group and sub-groups we have used a Z-test of proportion to identify differences between the overall average and the sub-group (90 percent confidence levels).

Differences are indicated by a tick or a dot. A green ✓ tick indicates the 2021 result is higher than the 2020 result while a red ✓ tick indicates it is lower. Significant difference 2021 to 2020. A green • dot indicates the subgroup result is higher than the overall result while a red • dot indicates it is lower.

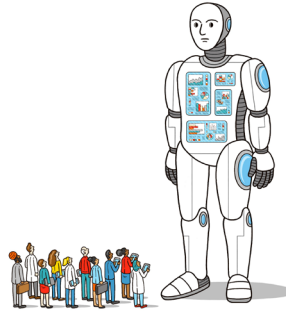
Visualizing the future through scenarios

Brave open world



Globally, state and philanthropic organizations and funders align in their goals, approaches and principles, resulting in open science taking off, especially in Europe, aided by advances in artificial intelligence-enabled technologies. Platforms are interoperable and content is easy to access.

Tech titans



Significant advances in artificial intelligence (AI) products drive innovation, enabling technology companies to support the research ecosystem and become knowledge creators and curators in a world where industry and philanthropic foundations are the key research funders.

Eastern ascendance



China's growing economic power and focus on research and development (R&D) influences the previously Western-dominated research landscape, resulting in a fragmented world.

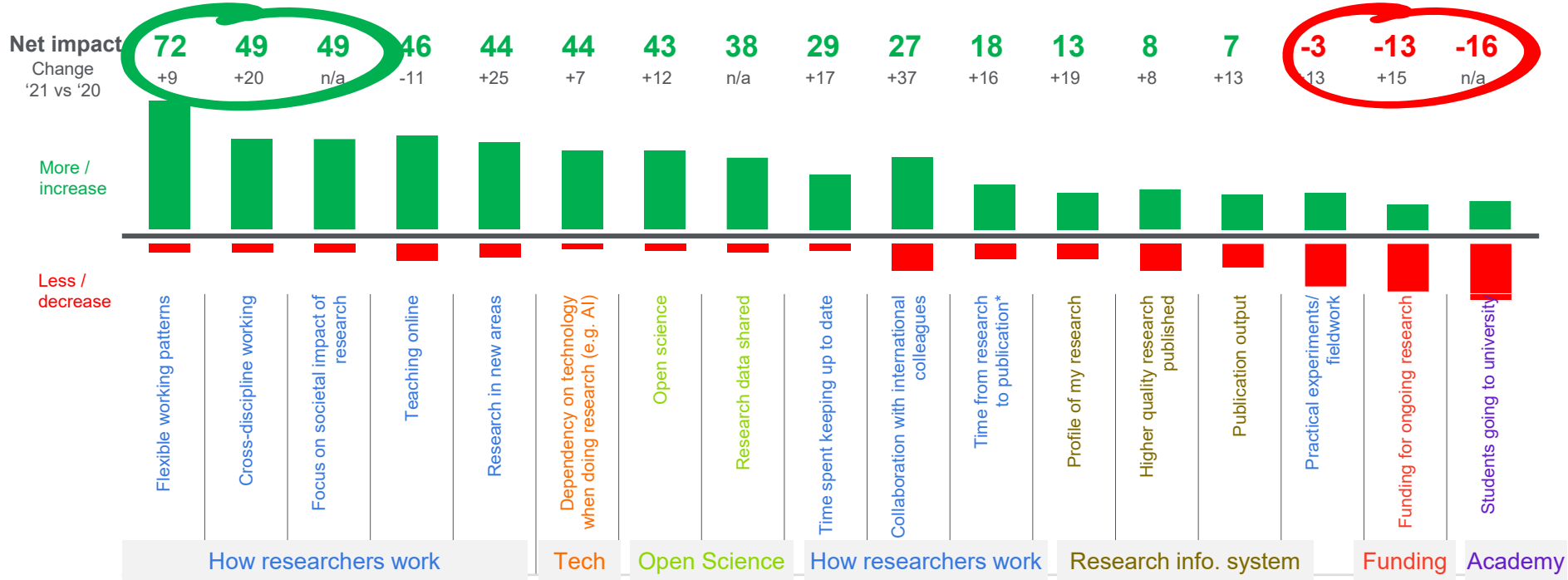
Six major themes shaped the scenarios in the original 2019 study and were examined in the follow-up studies.

- **Funding**
- **How researchers work**
- **Technology**
- **Open science**
- **Research information system**
- **Role of the academy**

Anticipated long term impact of Covid-19 on research

Anticipated longer term impact of COVID-19 is more flexible working, greater cross-discipline collaboration and extra focus on societal impact. However, researchers think there will be fewer students at university, less funding and fewer practical experiments/fieldwork.

Do you think the longer term impact of COVID-19 will lead to...



Source: Do you think the longer term impact of COVID-19 will lead to... scale was '+' 'no change' '-', Net Impact shown in chart is % positive score - % negative score

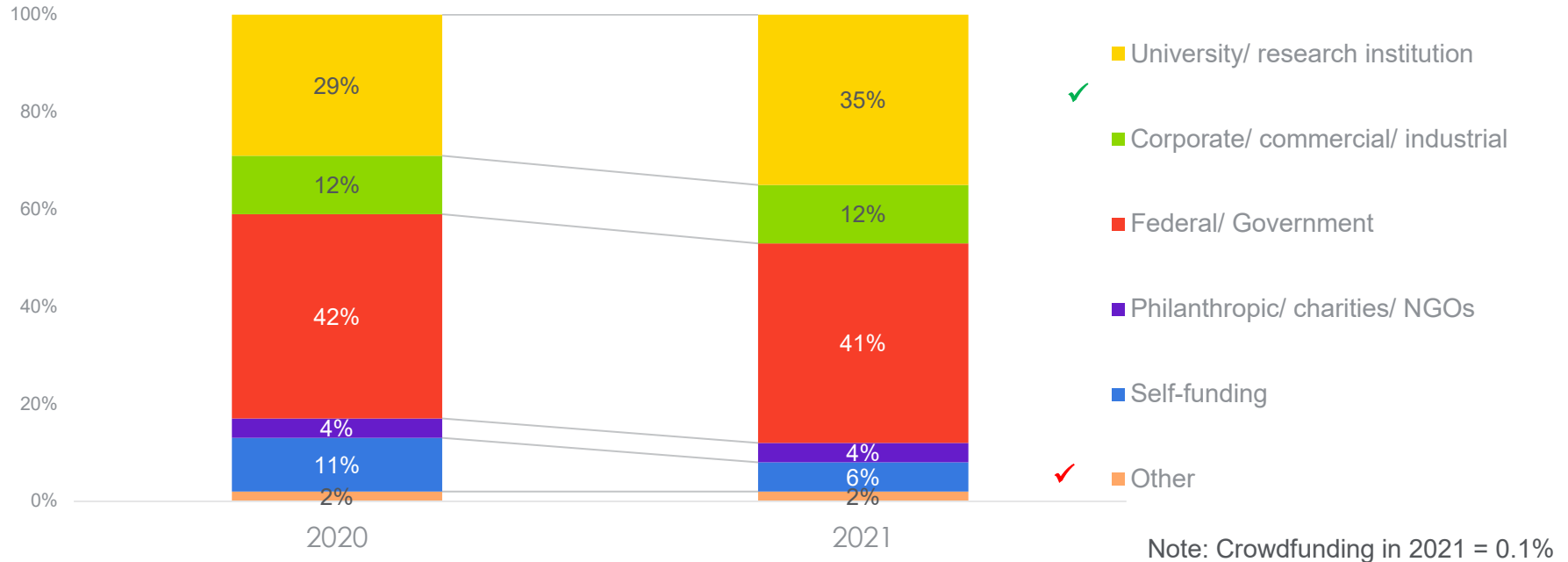
* Shorter time to publication is positive and longer time to publication is negative

N varies from 971 to 1,062 because respondents were offered a 'not applicable' option and these responses are not reported

Funding

Proportion of funding from university/ research institution dipped in 2020. Contribution from self-funding declines.

Q. Thinking about your current funding, what proportion of your funding is from the following sources: Percentage (sums to 100%).

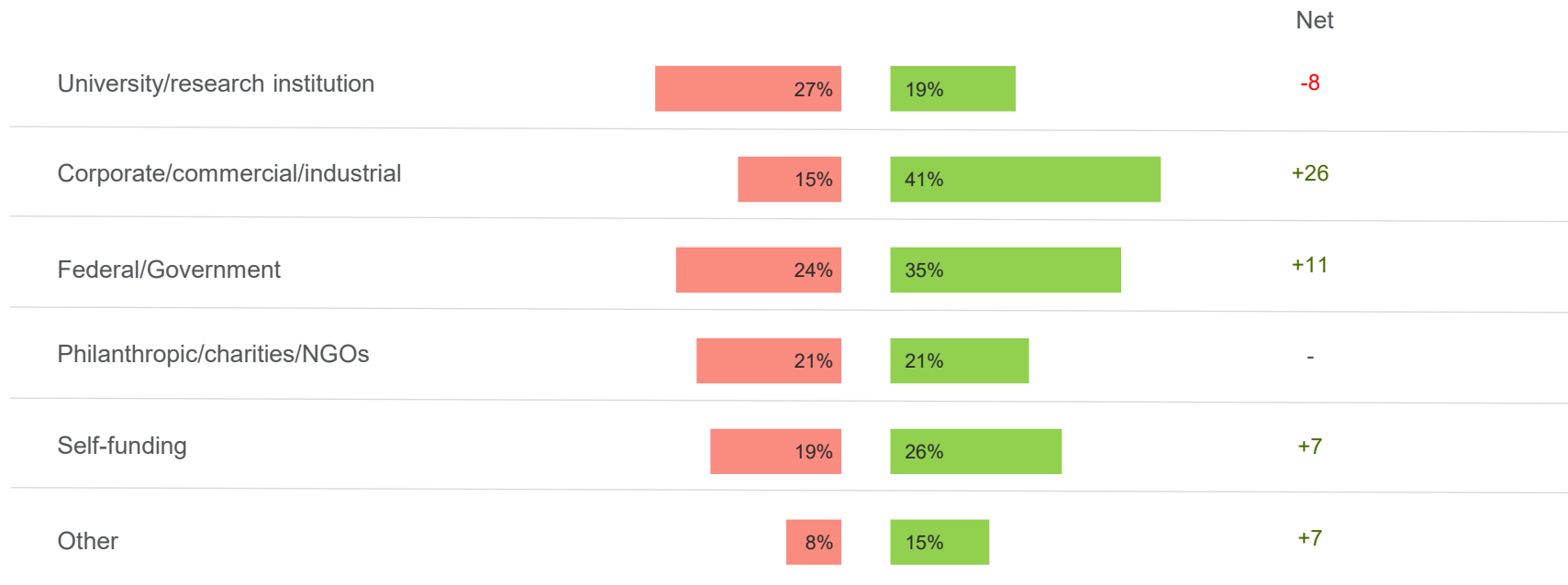


Base: 2021 n=1,024
2020 n=1,066

✓ Higher Significant difference 2021 to 2020
✓ Lower

...but over the next two to three years the **funding from university/ research institution expected to drop but increase from Corporate.**

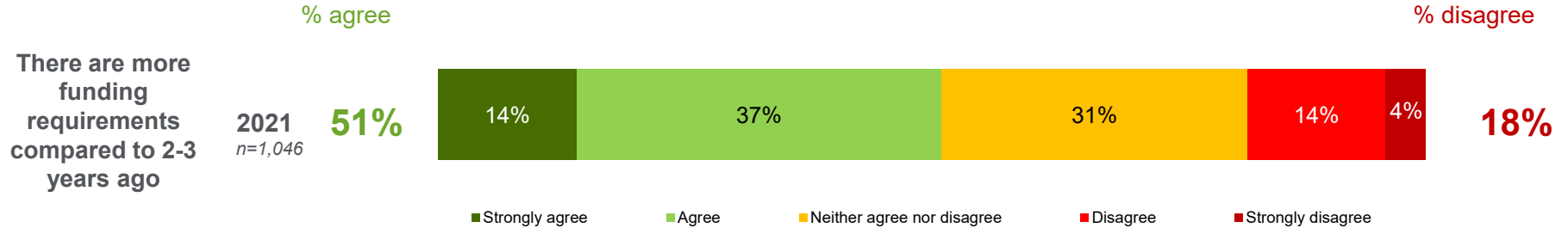
Q: Apart from inflationary increases, do you think over the next two to three years your research funding from the following sources will ...



Base: total 1,173 – don't know excluded.
Chart shows figures for increase and decrease

Decrease
Increase

Half believe there are **more funding requirements** compared to 2-3 years ago.



Reasons for AGREEING:

- Increasing demand/ competition for finite funds
- More detail evidence/ information required in submissions
- Applications more bureaucratic/ compliance necessities

“There is less money but the same number of research groups, so more constraints are established to ensure it is distributed to a maximum number of research groups.” (Arts/ Humanities, Spain, aged 36-45)

“The bureaucratic burden of writing proposals and reports has increased.” (Materials Science, USA, aged 36-45)

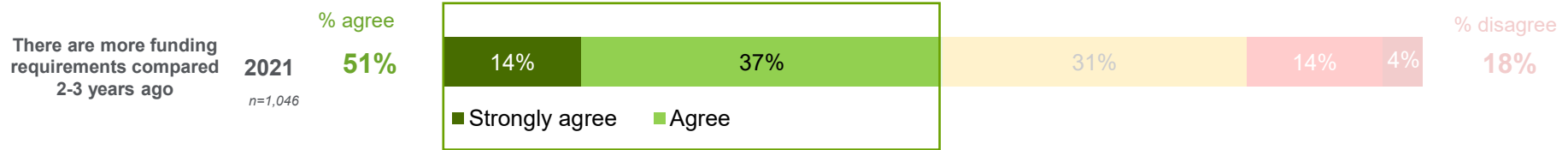
Reasons for DISAGREEING:

- Funding declining in particular field/ area of research

“Funding has shifted more towards the big labs doing SARS-CoV-2 research. It's harder to get funding for "other" work on infectious disease.” (Biochemistry, Genetics, and Molecular Biology, USA, aged 46-55)

“My research field is rather new in our country and does not attract many organizations to fund it.” (Medicine and Allied Health, Vietnam, aged 36-45)

Most common new funding requirements are **increased number of publications** and **increased progress reporting**.

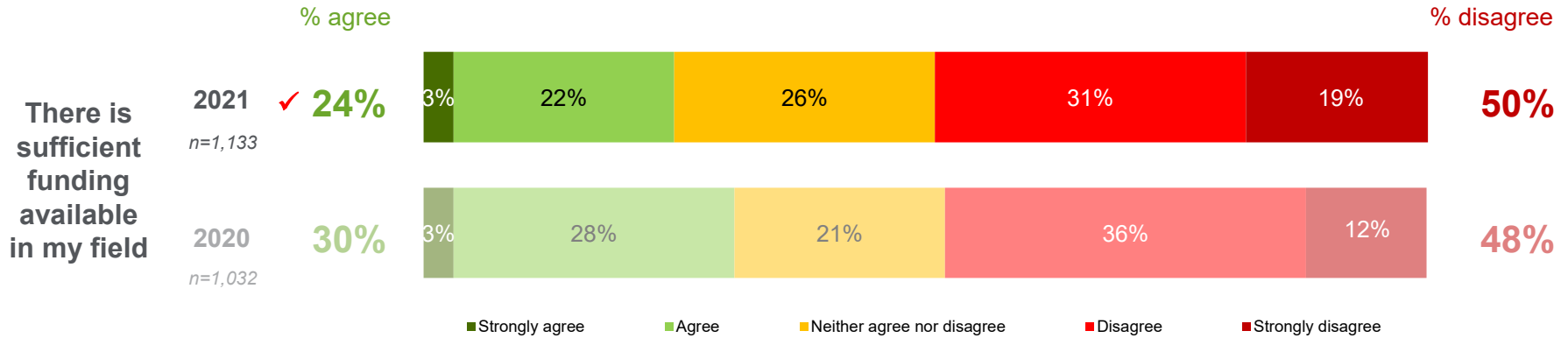


Agreed - What are the most common new requirements?



Base: All researchers who agreed there are more funding requirements (n=539)

Funding continues to be a major concern for the research community, with **half (50%)** stating there is insufficient funding available in their field.



Reasons for AGREEING:

- Field of research in-vogue/ of strong interest/ well funded/ a priority area
- Sources of funding broad/ abundant/ traditionally sufficient/ continuous

“My field of research is quite applied, and I expect strong engagement of states and enterprises to boost the fundings.” (Materials Science, France, aged 46-55)

Reasons for DISAGREEING:

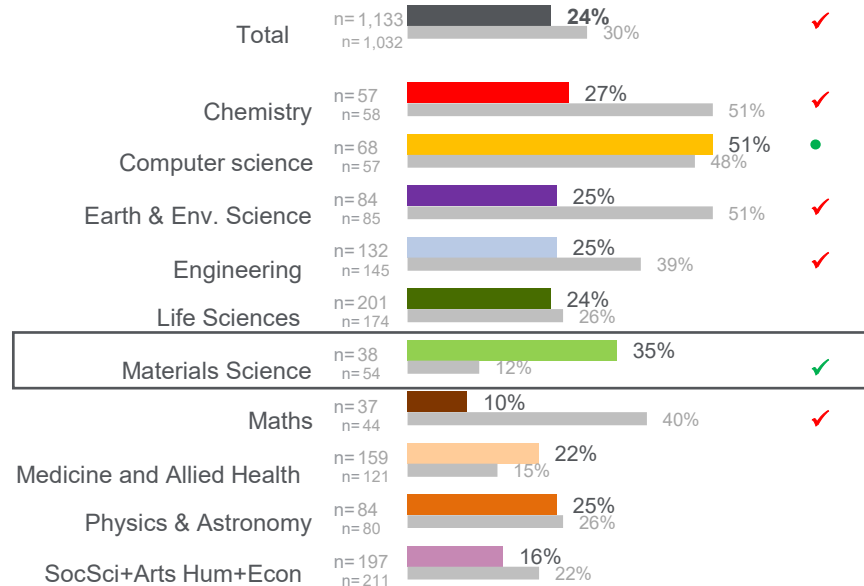
- Limited/ reducing funding/ grants specific to field
- Increased competition for available funding
- Other fields take precedence/ prioritised
- Impact of/ funds diverted/ reallocated to COVID-19

“Fewer public agencies providing funding and more competition for the funds; requirements/research topics being funded very narrow.” (Social Science, USA, aged 36-45)

✓ Higher Significant difference 2021 to 2020
 ✓ Lower

Materials Science research has seen the biggest growth in funding satisfaction in 2021, with 35% saying available funding is sufficient, almost three times the 12% who were satisfied with funding levels in 2020.

There is sufficient funding available in my field - (% agree)



Legend

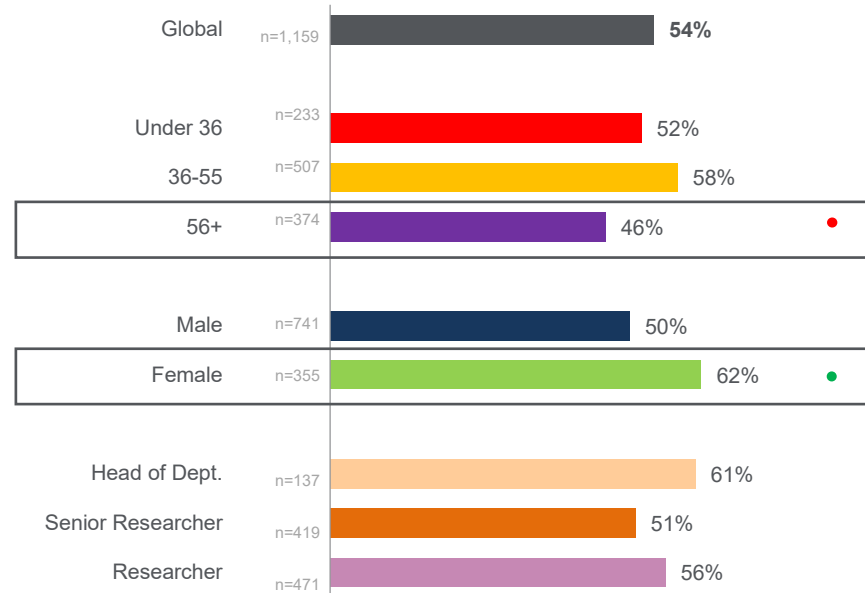
2021	Solid colour	✓ Higher	Significant difference 2021 to 2020
2020	Light Grey	✓ Lower	
		• Higher	Significant difference between 2021 subgroup and overall
		• Lower	



How researchers work

Maintaining a **good work-life balance has been difficult** during the pandemic but **more difficult for women** and less difficult for those aged 56+.

Ensuring I have a good work-life balance has been difficult during Covid - (% agree)

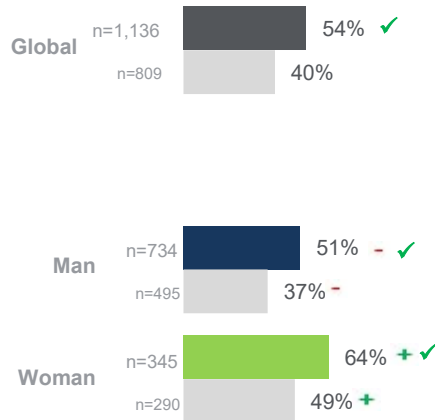


Legend

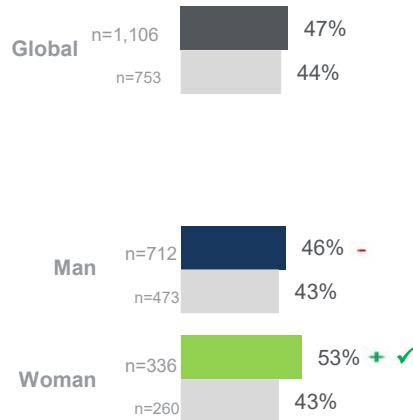
- Higher Significant difference between 2021 sub-group and overall
- Lower

Women are expecting to collaborate more than before the pandemic, are embracing technology faster than their male counterparts and are more likely to share their research with the wider public than men.

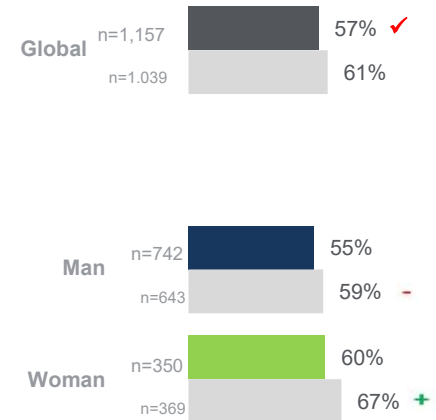
% who think the longer term impact of COVID-19 will lead to an increase in cross-discipline working



% who think the longer term impact of COVID-19 will lead to greater dependency on technology when doing research (e.g. AI)



% who have done outreach activities to share research findings with the wider public

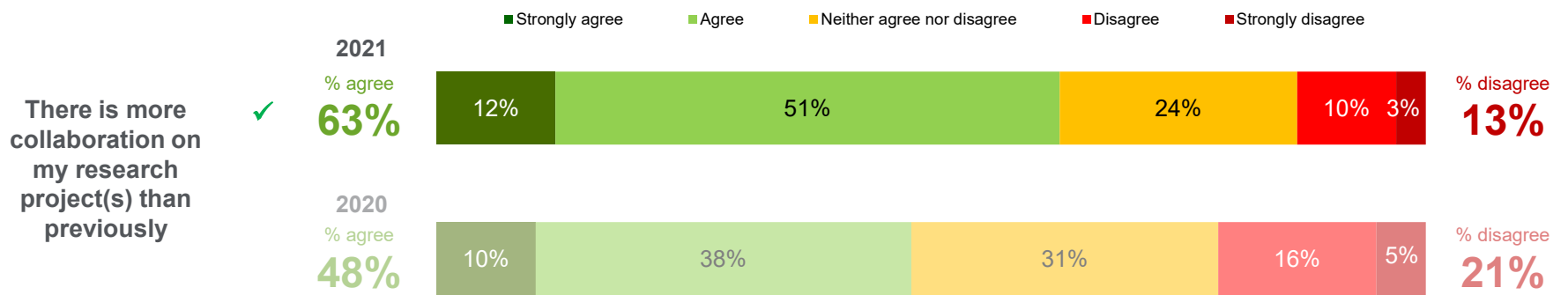


Legend

2021	 Solid colour	+ Higher	Significant difference between men and women	✓ Higher	Significant difference 2021 to 2020
2020	 Light Grey	- Lower		✓ Lower	



There has been a **sizeable increase in collaboration** on research project(s) since 2020.



Reasons for AGREEING:

- International collaboration easier/ increasingly prevalent
- Multi-disciplinary research/ expertise a necessity/ prerequisite
- Required/ valued by funders
- Digital/ online communications intensified

“I’ve always done a lot of interdisciplinary/global collaboration, but it now seems to be becoming a standard.” Medicine/ Allied Health, USA, aged 36-45)

Reasons for DISAGREEING:

- COVID and loss of in-person contact
- Lack of funding
- Always collaborated/ interdisciplinary
- Conduct research alone

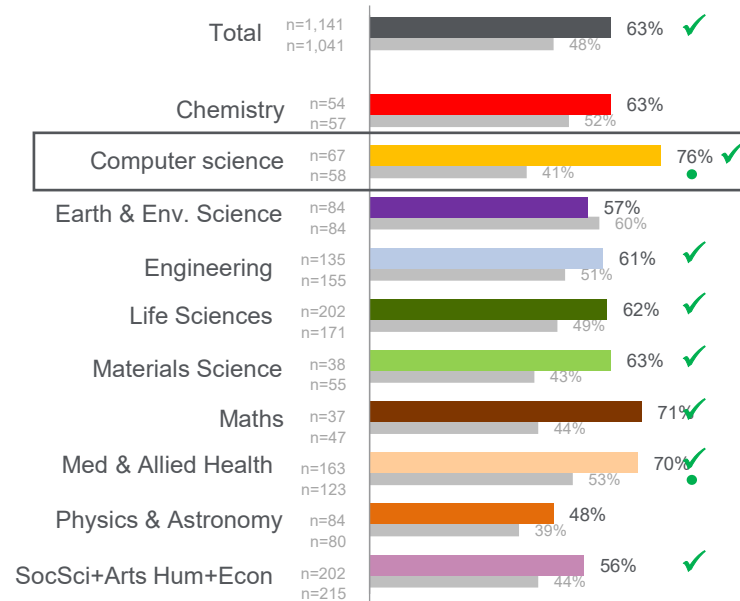
“Virtual meetings cannot replace in-person networking and collaboration.” (Computer Sciences/ IT, Austria, aged 26-35)

Base: 2021 n=1,141
2020 n=1,041

✓ Higher Significant difference 2021 to 2020
✓ Lower

Researchers in **computer science have seen the biggest rise**, with 76% agreeing that there is more collaboration involved in their projects than previously, a substantial rise from the 41% who agreed in 2020.

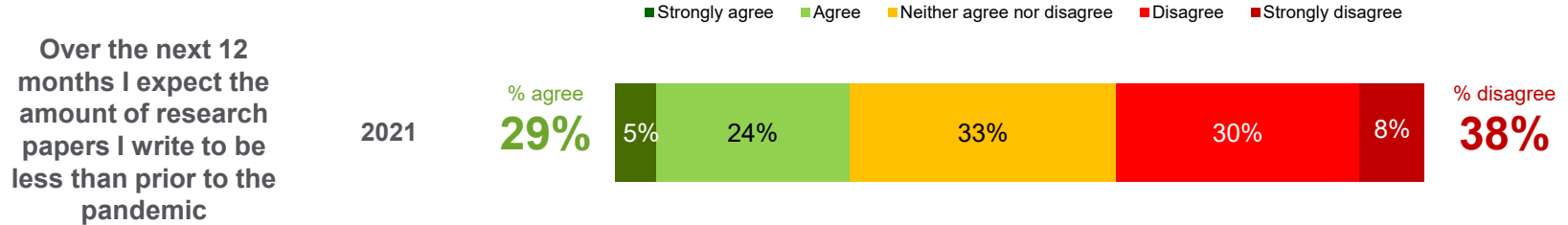
There is more collaboration on my research project(s) than previously – (% agree)



Legend

2021	Solid colour	✓ Higher	Significant difference 2021 to 2020
		✓ Lower	
2020	Light Grey	● Higher	Significant difference between 2021 subgroup and overall
		● Lower	

A minority, just under a third believe the number of **articles they will write in the next 12 months** will be less than prior to the pandemic.



Reasons for AGREEING:

- Pandemic restricted/ halted/ suspended research projects
- Experimental work reduced as a result of the pandemic
- Funding declined

“Data collection was challenging during the pandemic.”
(Neuroscience, Canada, aged 36-45)

Reasons for DISAGREEING:

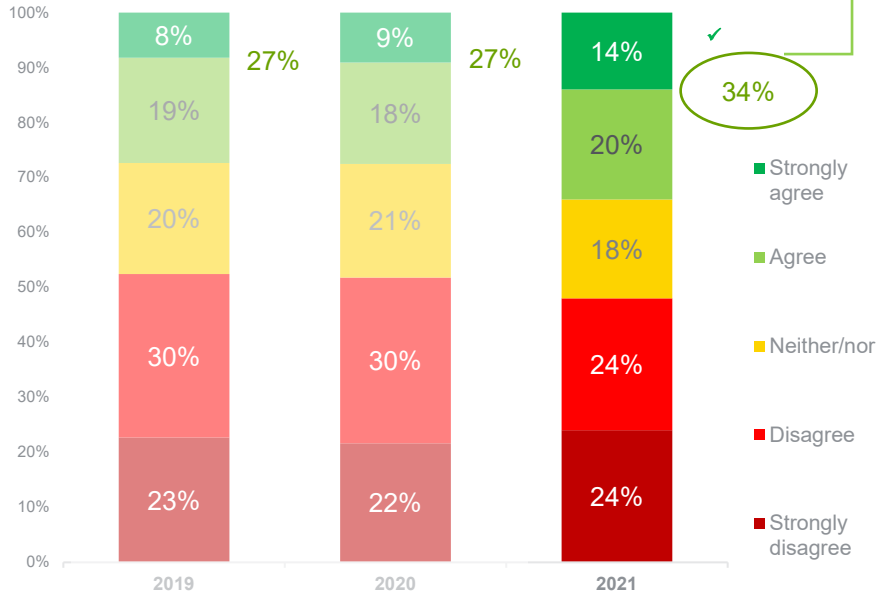
- Remote/ online working enabled more time for producing papers
- Restrictions easing will allow more in-person research to be conducted
- Pandemic had limited impact on research output/ producing papers

“During pandemic, work has gone on, with almost no delay”
(Materials Science, France, aged 56-65)

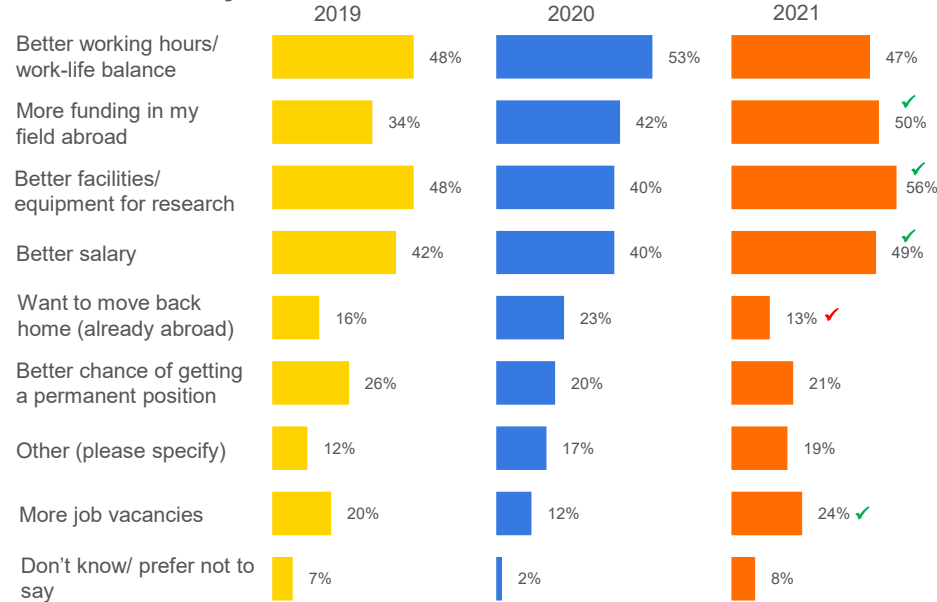
Base: n=1,121

More researchers are considering relocating - just over a third. Better facilities, funding, salary and work-life balance are key drivers.

“I would consider moving to another country to further my career in research (in the next 2 years)”



What are the main reasons you would consider relocating to another country?



Legend

- 2021 Solid colour
- 2020 Shaded colour
- ✓ Higher Significant difference 2021 to 2020
- ✓ Lower Significant difference between 2021 sub-group and overall
- Higher
- Lower

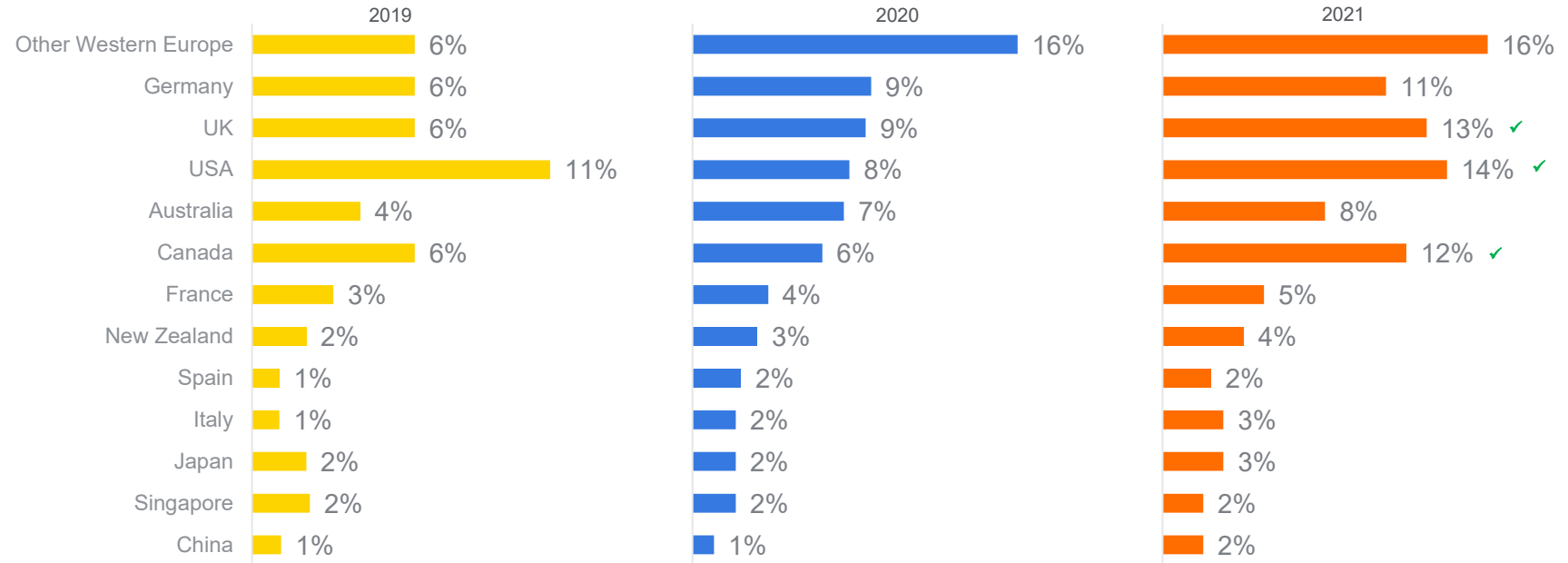
Base: All; 2019 n=1,450, 2020 n=1,031, 2021 n=1,127

Base: Researchers that agreed with 'I am considering moving to another country to further my career in research' n=392 in 2019, n=284 in 2020 and n=355 in 2021



Researchers' willingness to relocate to US, Canada and UK increases since 2020 – China as a destination remains low.

Which countries would you consider moving to:



Legend

2021	■ Solid colour	✓ Higher Significant difference 2021 to 2020
2020	■ Light Grey	● Higher Significant difference between 2021 sub-group and overall
		● Lower

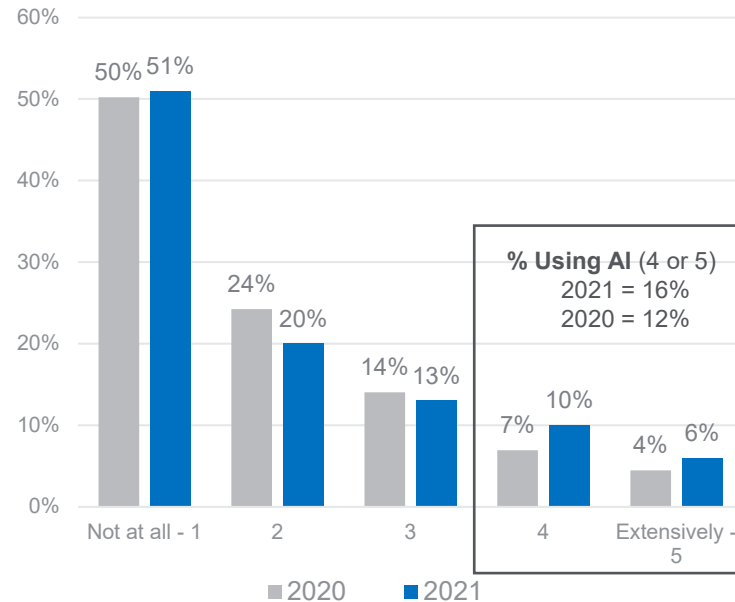
Base: Researchers that agreed with 'I am considering moving to another country to further my career in research' n=392 in 2019, n=284 in 2020 and n=355 in 2021



Technology

Although just over half of researchers do not use AI in their research, those who could be considered **heavier users of AI represent around one in six researchers, an increased proportion since 2020.**

To what extent do you use Artificial Intelligence (AI) in your research? Please indicate your response on a five-point scale where 5 is extensively and 1 is not at all.



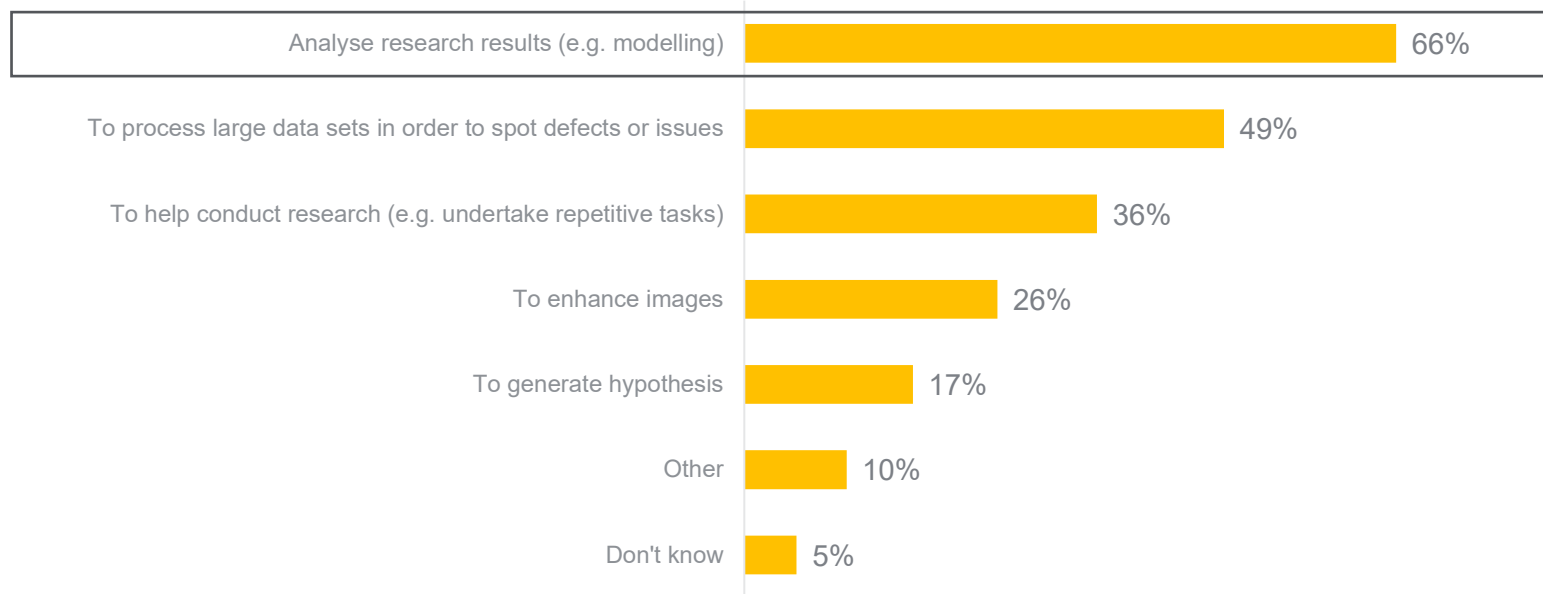
Base: 2021 n=1,040

2020 n=1,066

Due to rounding some figures will not add up

Among those who use AI, **to analyse research results** (e.g. modelling) was the most cited reason for using AI.

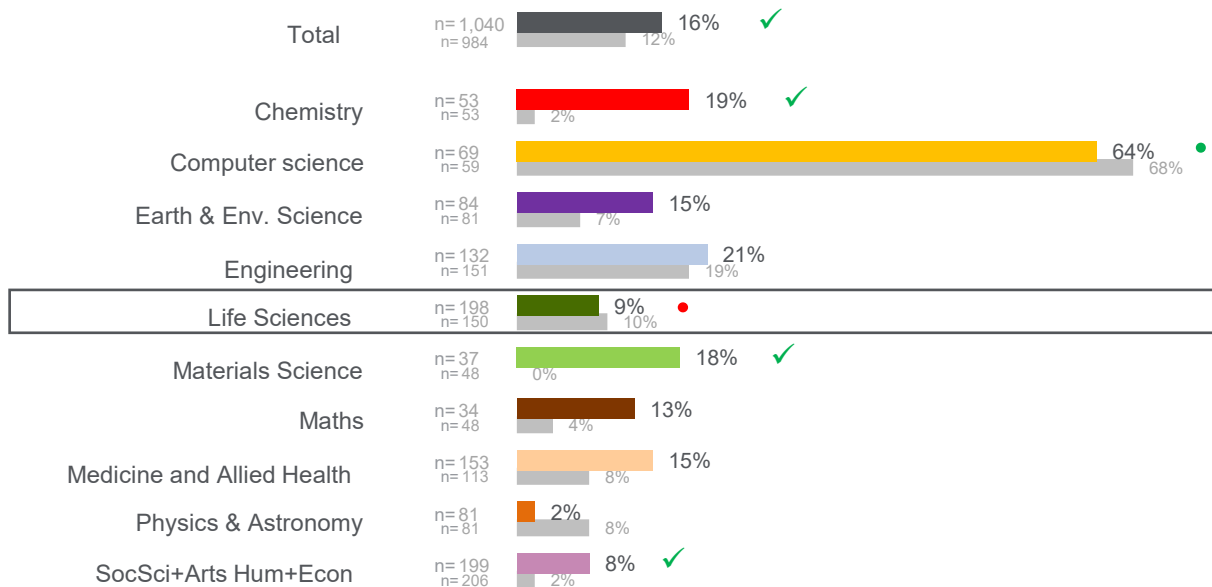
How do you use Artificial Intelligence (AI) in your research?



Base: All researchers who use AI n=479

Use of AI in research increases most amongst Chemists and Material Scientists. Life scientists are significantly less enthusiastic than overall.

Q. To what extent do you use Artificial Intelligence (AI) in your research? Please indicate your response on a five-point scale where 5 is extensively and 1 is not at all. % shows sum of those rating a 4 or a 5

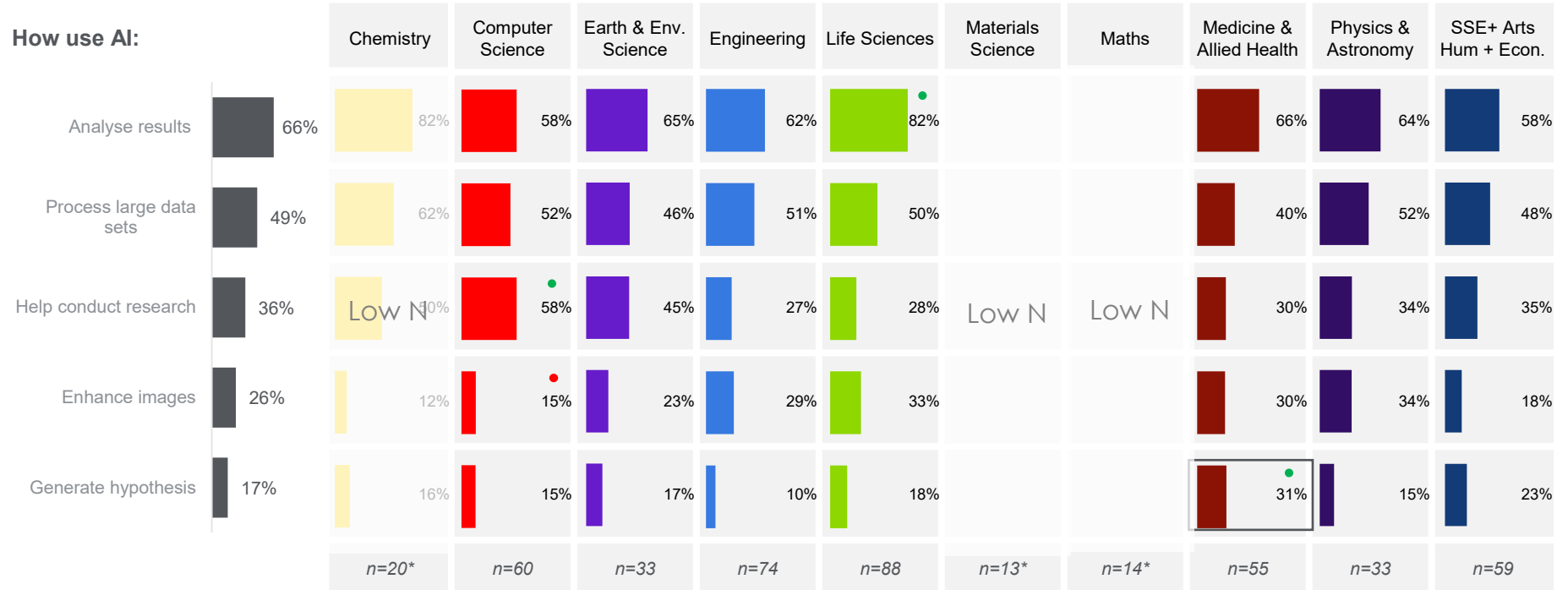


Legend

2021	Solid colour	✓ Higher	Significant difference 2021 to 2020
2020	Light Grey	✓ Lower	
		• Higher	Significant difference between 2021 sub-group and overall
		• Lower	

Using AI to analyse results is most common. Medicine more likely to use AI to generate hypotheses than other disciplines.

BY SPECIALTY

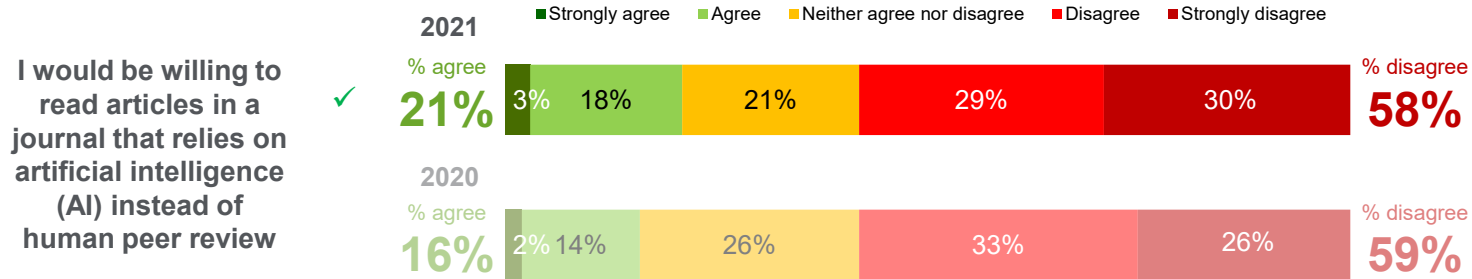


Legend

- Higher Significant difference between 2021 subgroup and overall
- Lower

* Caution low base

Although researchers question AI as a substitute for human understanding in peer review, **more are willing to read articles reliant on AI for peer review than in 2020.**



Reasons for AGREEING:

- Reduces subjectivity/ biases – more objectivity
- Reviews not always currently of an acceptable standard

“Artificial intelligence (AI) is fairer than human peer review, human peer review is not a good thing because reviews are biased by the subjective view of the reviewers, reviewers are not balanced in comparison to AI.” (Psychology, Germany, aged 36-45)

Reasons for DISAGREEING:

- Human insight/ intellect/ understanding/ analysis superior
- Limited trust, AI currently incapable of quality peer review

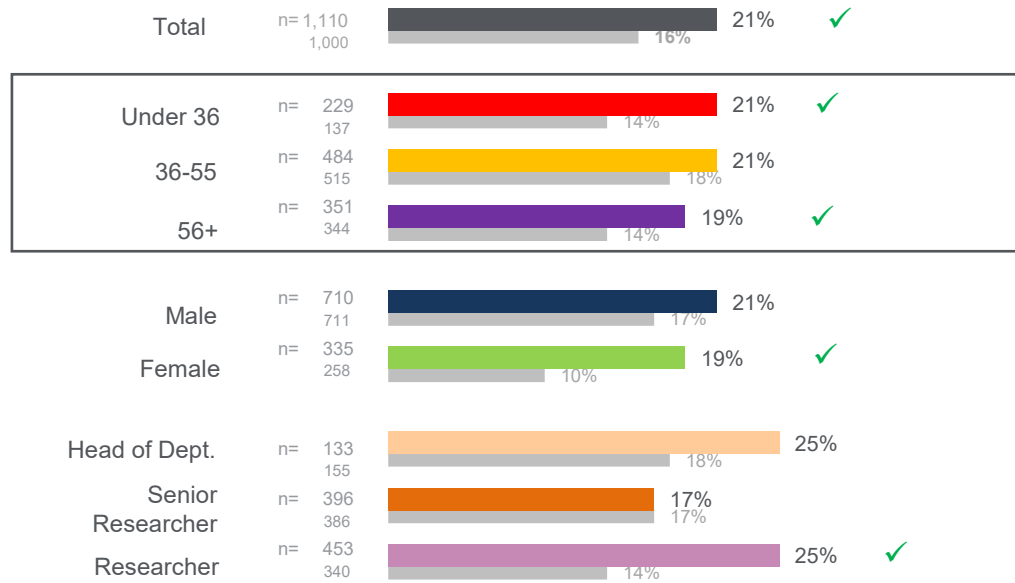
“Peer review is very complex, and requires deep knowledge and critical thinking to assess the value and innovation of a given research work, and to identify possible confounding factors or biases. It is already very complicated for humans, and is far beyond the capabilities of (current) AI systems” (Computer Sciences / IT, France, aged 36-45)

✓ Higher Significant difference 2021 to 2020
 ✓ Lower

Base: 2021 n=1,110
 2020 n=1,000

Those **aged 55 and under** are the most willing to read AI-reviewed articles, while those aged 56 and over have increased their willingness compared to a year ago.

I would be willing to read articles in a journal that relies on artificial intelligence (AI) instead of human peer review? - (% agree).
 Note in 2020 it was not % agree BUT % likely)



Legend

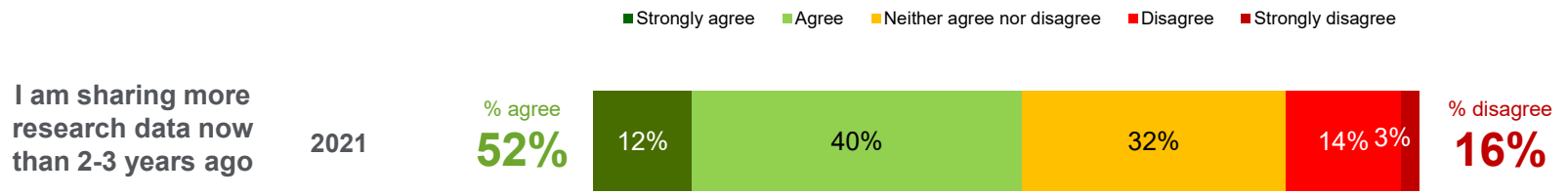
- ✓ Higher Significant difference 2021 to 2020
- ✓ Lower Significant difference between 2021 sub-group and overall
- 2021 Solid colour
- 2020 Light Grey
- Higher
- Lower





Open Science

Just over half (52%) state that they are **sharing more research data now than 2-3 years ago.**



Reasons for AGREEING:

- Increased means/ practices/ databases/ technology outlets for sharing data/ open science/ source
- More productive/ data to share
- Sharing now a necessity/ even more encouraged/ a requirement

“Increased awareness of necessity and possibilities for sharing research data due to development of data repositories.” (Physics, Germany, aged 56-65)

Reasons for DISAGREEING:

- Approach to/ level of sharing of research data unchanged
- Conducting less research currently

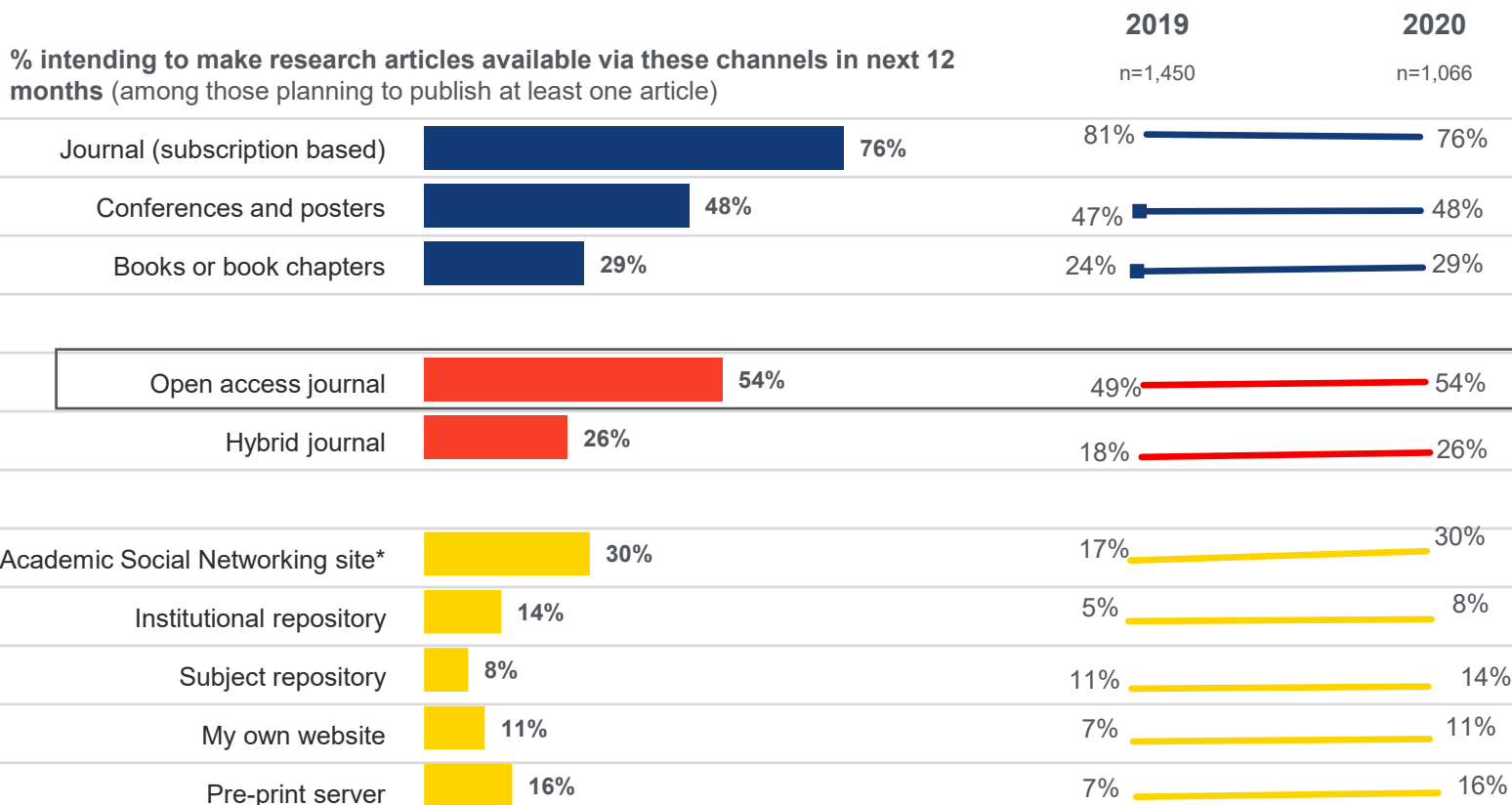
“I share the same amount of research data as before. There is no change I have seen” (Materials Science, India, aged 56-65)

“I have always shared all my research data” (Computer Sciences / IT, Germany, aged 56-65)

Base: n=1,159



54% of respondents said they **planned to publish open access** in 2020, which is 5 percentage points higher than in 2019. (Note: 2021 data not collected for this question).



Source: Which of the below, if any, do you believe you will use within the next 12 months to make your research articles available?

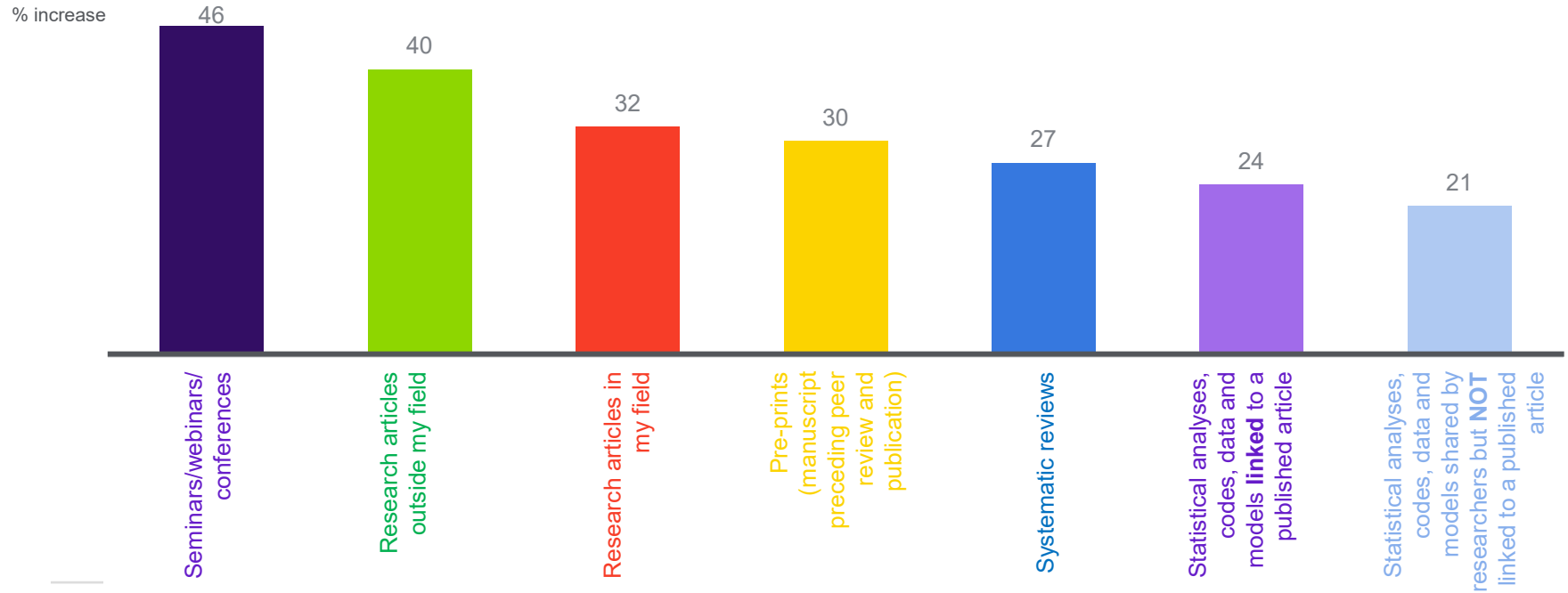
* e.g. ResearchGate, Academia.edu, Mendeley



Research information system

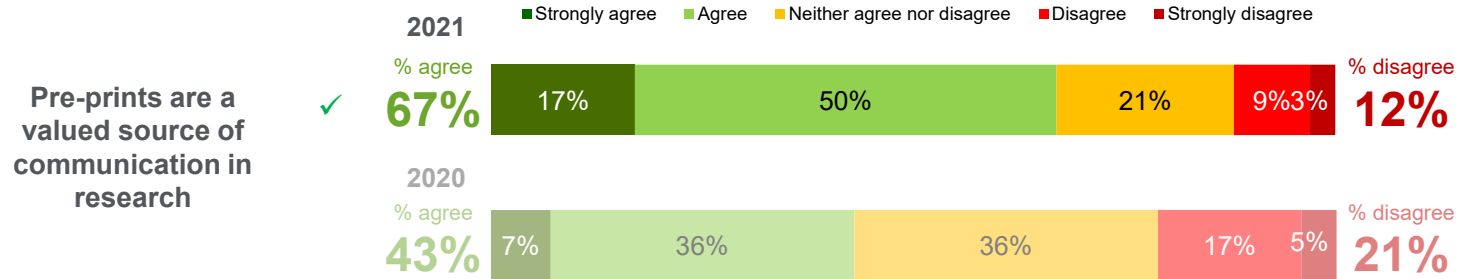
Use of seminars/webinars increased most during the pandemic, followed by use of research articles outside field of research.

Since the start of the Covid-19 pandemic, has your use of the following increased, stayed the same or decreased...



Source: Since the start of the Covid-19 pandemic (approx. 18 months) has your use of the following types of research output increased, stayed the same or decreased. Scale was 'Increased' 'Stayed the same' 'Decreased', figure shown in chart is % increase score - % decrease score. N varies from 850 to 1,135 because respondents were offered a 'not applicable' option and these responses are not reported

The **value of pre-prints increases significantly** in the last year – over two-thirds consider pre-prints a valued source of communication.



Reasons for AGREEING:

- Valuable to see prior publication/ earlier accessibility/ sharing of research
- More timely, up-to-date communication of the information
- Easier to access/ feely accessible

“I want to be able to read good research results quickly and not after one or two years, which is sometimes the time it takes to be published.” (Astronomy, France, aged 56-65)

Reasons for DISAGREEING:

- Lacks peer review/ revision/ validation
- Limited value in getting access earlier/ before formal/ full publication

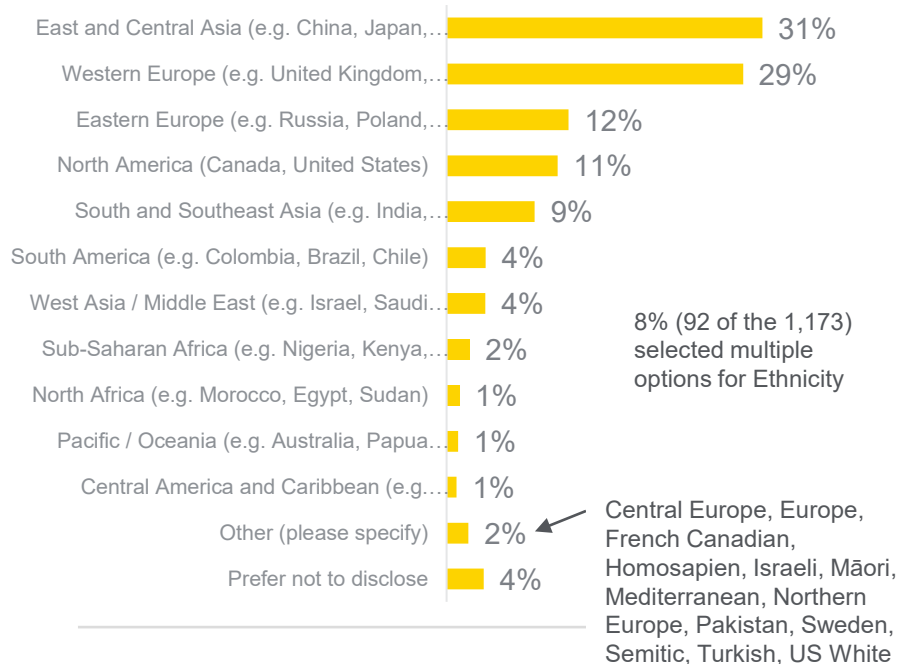
“I strongly believe in peer review. Most preprints do not successfully pass through the preprint stage without revision. These revisions can be important to the interpretation of the results” (Medicine and Allied Health, USA, aged 46-55)

✓ Higher Significant difference 2021 to 2020
 ✓ Lower

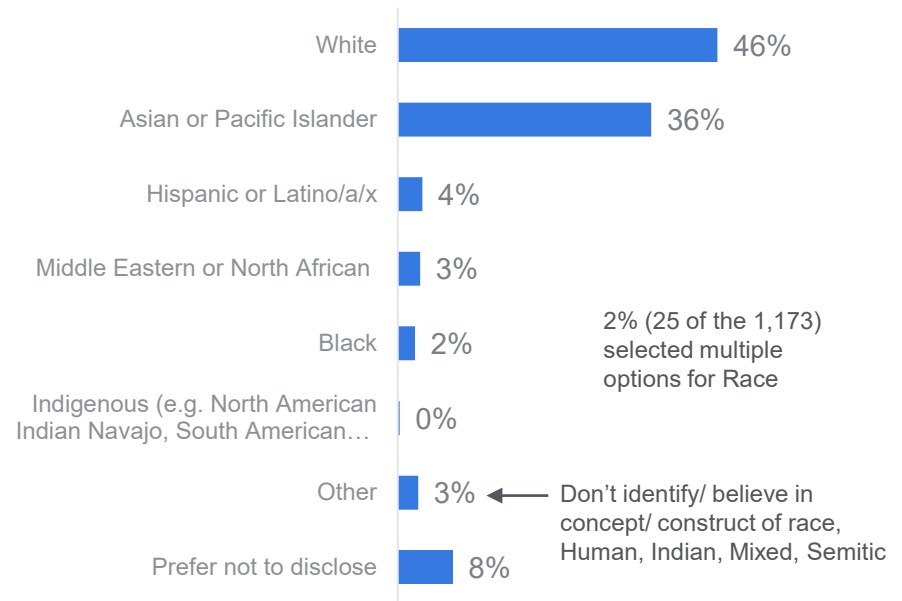
Base: 2021 n=1,134
 2020 n=993

Diversity – ethnicity and race: East and Central Asia as well as Western Europe were the top two selected origins of ethnicity. Just under half (46%) identified as White and just over one third (36%) as Asian or Pacific Islander.

Which of the following best describes your Ethnic Origin(s)?



How do you identify yourself in terms of Race:

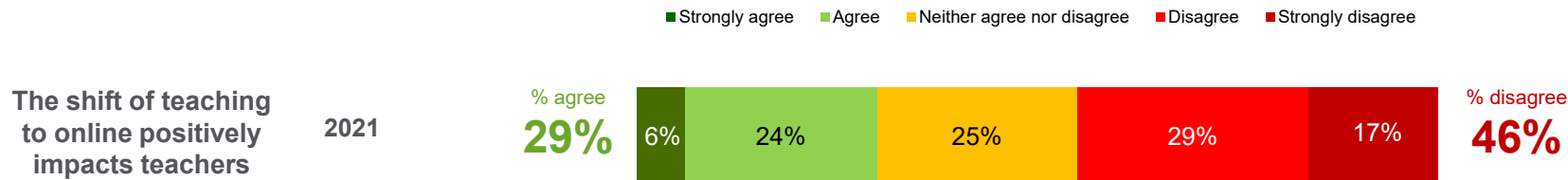


Base: All researchers (n=1,173)



Academy

Nearly half (46%) are of the view that the shift of **teaching to online negatively impacts teachers** against under a third (29%) who see the shift to teaching online as a positive for teachers.



Reasons for AGREEING:

- Reduces travel, convenience, saves time, improved personal life
- Facilitates flexibility/ ease of individual/ one-to-one contact
- Enables a wider reach/ teach independent of geography
- Improved/ new digital resources

“Online work is a great value to reconcile personal life, to optimize time.” (Biochemistry, Spain, aged 46-55)

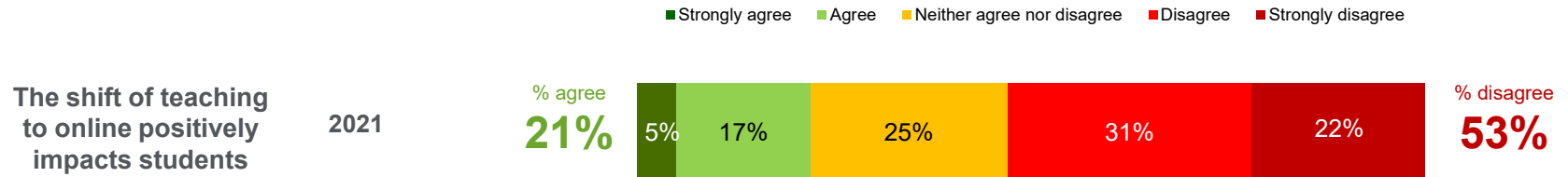
Reasons for DISAGREEING:

- Remote/ indirect interaction less valuable/ not as effective/ not as involving/ engaging/ not a substitute for direct contact
- Shift to online teaching/ courses involved substantial preparation/ workloads/ overheads for teachers
- Lab use/ field activities of paramount importance

“Students are disengaged online... teaching becomes less rewarding for both students and teachers” (Physics, Australia, aged 36-45)

Base: n=1,097

Just over half believe the shift of **teaching to online negatively impacts students** against just over a fifth (21%) who see the shift as a positive.



Reasons for AGREEING:

- Convenience, flexibility, reduces travel time
- Improved work/life balance/ family life
- Access to greater/ better materials online
- More opportunity for individual consultation

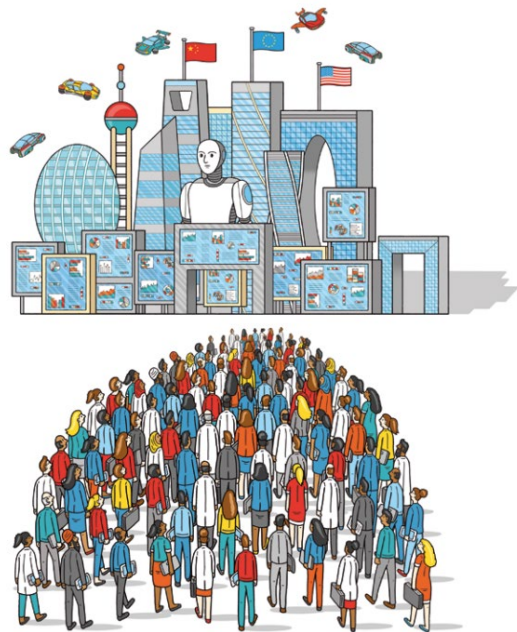
“Online teaching gives students the flexibility of engagement hours and also put multiple sources of information at their disposal.... content delivery more engaging for the students.” (Environmental, India, aged 36-45)

Reasons for DISAGREEING:

- Less effective, disengaged/ distraction (impersonal, disconnected)
- Less interaction, interpersonal communication, informal discussion
- Practical, hands-on, field, lab work not feasible

“Online-only education cannot provide a similar level of student engagement, community building and interpersonal communication--all critical for successful learning outcomes” (Biochemistry, USA, aged 56-65)

Base: n=1,096



**Research Futures 2.0 will be
released on April 20th**

<https://www.elsevier.com/connect/research-futures-2022>

Previous report:
bit.ly/research-futures