

Awareness and Attitudes Towards Science. The Case of CERN



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Abstract The chapter highlights the need for public understanding and support of scientific research, especially basic research with no immediate practical applications. It discusses the polarization in public attitudes towards science and emphasizes the importance of valuing curiosity-driven research for societal progress. An experiment conducted in 2022 involving CERN and the FCC project surveyed 8,443 responses from adult laypersons outside the scientific community, expanding on previous surveys in France and Switzerland. Key findings indicate public awareness and generally positive attitudes towards CERN and particle physics research. The public's attitudes vary according to respondents' socioeconomic traits.

Keywords Public support of science · Stated preferences · Citizens' attitudes towards basic research

1 Introduction

Scientific research potentially generates innovations that offer solutions to pressing societal issues [5, 7], thereby ultimately enhancing the quality of life for individuals [2, 3]. The process takes time, is uncertain, and often difficult to understand by citizens.

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Hostile attitudes toward scientific research and the public funding that supports it are reported in the media, especially when the outcomes of research are not immediately tangible by lay-people, such as large-scale investments in basic research without immediate practical application [10].

Indeed, while large-scale scientific projects continue to be on the roadmap of international and national agencies through government funding,¹ hence ultimately by taxpayers, the debate on public engagement with science is still ongoing. Public's attitudes towards science increasingly polarise among people who trust science unconditionally, and others who routinely reject and dismiss scientific evidence [11, 13].

For these reasons, we submit that research institutions need to systematically understand the extent of the citizens' support of their activities. Are citizens outside the scientific community aware of the potential socioeconomic benefits that basic research could generate? According to Flexner [4] society can tackle societal challenges, achieve deeper understanding, and pursue progress only by really valuing and funding the curiosity-driven "pursuit of useless knowledge" in both the sciences and the humanities.

This chapter describes an experiment of public engagement in science conducted to understand better on how laypeople perceive and value investments in infrastructures for fundamental scientific research together with CERN in the frame of the European Commission H2020 co-funded FCCIS project.² Specifically, together with the estimation of the socioeconomic benefits directly associated with the Future Circular Collider (FCC) project, in 2022 [1], CERN issued a call to perform a survey in a subset of CERN member states and associated countries to a representative sample of the adult population (aged 18–75) in each country across the following parameters: gender, age, level of education, income, and geographical area of residence (urban vs. rural). Among other questions, the survey aimed to assess the public's awareness and opinions about CERN and its research activity in countries with different types of relationship with CERN, including CERN member and non-member states.

Built on previous similar experiments conducted in France in 2017 and in Switzerland in 2019 [6, 8], the 2022 wave enlarged the scope to seven additional countries: five of them CERN member states (UK, Italy, Germany, Israel, and Poland), and two non-members of CERN, but involved in the LHC research programme and the FCC international feasibility study collaboration (USA and Japan). The fieldwork took place from September to November 2022 and involved 8443 valid responses. In

¹ Example of funding agency /programmes include: the Horizon Europe programme managed by the European Commission DG-RTD, the UK Research and Innovation (UKRI), the National Laboratories (<https://www.energy.gov/national-laboratories>) of the USA Department of Energy (DOE). As regards roadmap, see (ESFRI, 2021) Roadmap 2021, Strategy Report on Research Infrastructures, European Strategy Forum on Research Infrastructures; retrieved from <https://roadmap2021.esfri.eu/media/1295/esfri-roadmap-2021.pdf>.

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total, including the respondents of the previous surveys in France and Switzerland, 10,448 valid responses were considered in the analysis selectively reported below.

The following paragraphs summarise some of the findings of the experiment related to the public's awareness of CERN, attitudes and perceptions towards particle physics research at the laboratory. The full preliminary findings are reported in Secci et al. [12].

2 Awareness of CERN

Interviewees' awareness of CERN was investigated by asking respondents to indicate international and national organisations that they had heard about among a pre-filled list.

Organisations like NASA, WHO, and UNESCO rank in the first positions, with 84%, 78%, and 68% of respondents having heard about them respectively (Fig. 1). NASA is the most known organisation in Japan (87% of the adult population), the USA and in the CERN member states (83%),³ followed by WHO with 86% in Japan, CERN member states (80%) and the USA (72%).⁴ UNESCO is more popular in the CERN member states (81%),⁵ followed by Japan (57%) and the USA (37%).

Focusing on CERN, 41% of the respondents heard about it and its research activity, with some differences among countries. CERN is, unsurprisingly, very well-known in Switzerland, with 81% of surveyed people being aware of it. Awareness is also high in Italy (64%) and to a lesser extent in the other European CERN member states (France, UK, Germany, and Poland). In contrast, the level of awareness, as expected, is the lowest in non-EU countries, namely Israel, the USA and Japan (Fig. 2).

The sociodemographic profile of respondents aware of CERN is illustrated in Fig. 3. Awareness of CERN is higher among the employed compared to the unemployed (42% vs. 30%), among men than women (50% vs. 34%), and among respondents with tertiary education compared to those with primary education (42% vs. 16%). Additionally, respondents interested in science-related topics show a higher awareness than those with no interest in science (50% vs. 29%), which represents the largest difference. Respondents in different age groups, income levels, or living areas (urban and rural) display small to moderate differences in the percentage of awareness of CERN.

While the CERN awareness by gender is likely associated with the well-known gender gap in science (e.g., [9]), showing a scientific interest, also in subjects beyond

³ Respondents aware of NASA are 84% in Germany, 88% in Italy, 89% in Poland, 84% in the UK, 86% in France, 93% in Switzerland, and 50% in Israel.

⁴ Respondents aware of WHO are 76% in Germany, 80% in Italy, 89% in Poland, 80% in the UK, 82% in France, 83% in Switzerland, and 49% in Israel.

⁵ Respondents aware of UNESCO are 83% in Germany, 87% in Italy, 63% in Poland, 80% in the UK, 89% in France, 93% in Switzerland, and 39% in Israel.

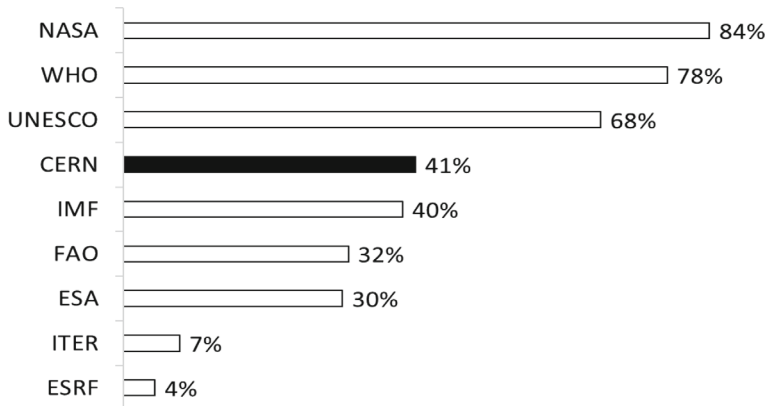


Fig. 1 Awareness of CERN compared to other international organisations. *Source* Authors. Total sample: $n = 10,448$ (including France and Switzerland). IMF: International Monetary Fund; FAO: Food and Agriculture Organization of the United Nations; ESA: European Spatial Agency; ITER: International Thermonuclear Experimental Reactor; ESRF: European Synchrotron Radiation Facility Authors elaboration on experiment data

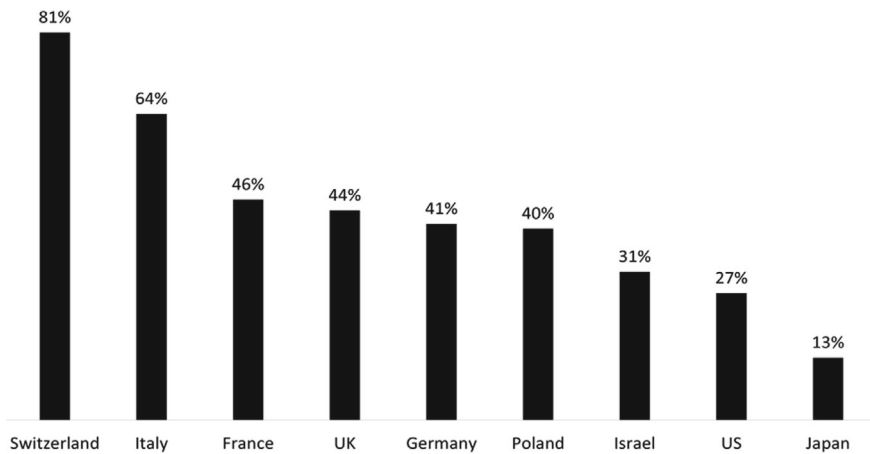


Fig. 2 Awareness of CERN across countries (%). *Source* Authors. Total sample: $n = 10,448$ (including France and Switzerland)

physics, triggers the curiosity of people looking for science-related information, including CERN research. High income, occupation status, and education are often correlated, identifying more well-off layers of society. Moreover, living in urban areas is usually associated with easier access to culture, science, and innovation, which might explain a broader awareness of organisations such as the CERN.

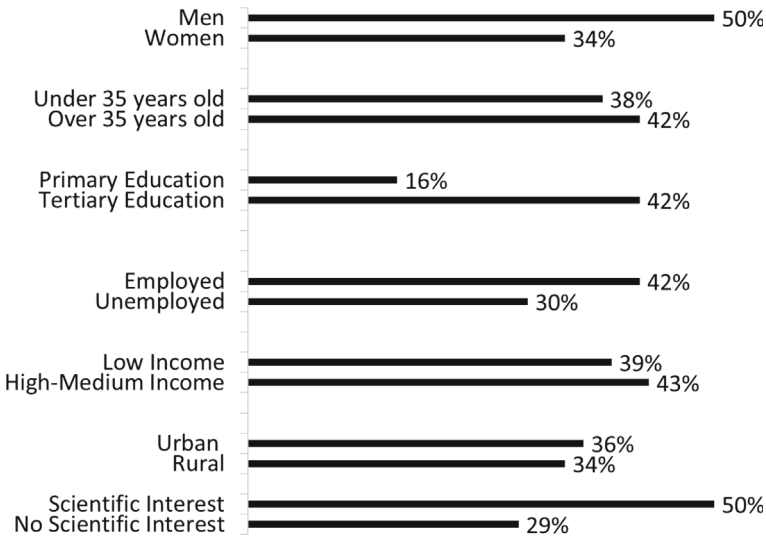


Fig. 3 Share of people aware of CERN across personal selected characteristics (%).Notes: Scientific Interest reflects the share of respondents with an interest in one of the following subjects: biology, physics, astronomy, medicine, and geology (see details in [12]). Source Authors. Total sample: $n = 10,448$. The category Men represents 46% of the total sample, Under 35 years old 29%, Primary Education 5%, Tertiary Education 33%, Employed 72%, Unemployed 7%, High-Medium Income 61%; Urban 66%, Scientific Interest 59%

3 Opinions and Attitudes About CERN and Its Activity

Respondents were asked to express their level of agreement with a list of statements regarding the scientific research at CERN according to a five-point Likert question from *strongly disagree* to *strongly agree* (Table 1).

The majority of respondents (77%) hold a favourable view expressing positive sentiments towards research activity at CERN. People agree that the societal benefits generated by CERN’s research extend to society at large, going beyond the scientific community. According to them, CERN’s scientific research broadens society’s understanding of the universe, with agreement rates ranging from 79% in Israel to 86% in Switzerland. Respondents also think that CERN contributes to advancing products to enhance the quality of life, including the contribution to new technologies for diagnosing and treating diseases. Similarly, 70% of people believe that CERN’s education programs for students and young professionals create value for society and, because of these reasons, CERN’s scientific activities should be intensified over the coming decades, according to two-thirds of the respondents.

In contrast, only a minority of the interviewed sample (from 3 to 5%) perceive the societal impact of CERN as being limited to scientists, those residing in the proximity of the laboratory, or viewed research activities at CERN as hazardous to the environment.

Table 1 Percentage of respondents who agree with proposed statements about CERN scientific research

Statements about CERN scientific research	%
CERN's discoveries allow us to enrich our knowledge of the origins and evolution of the Universe	80
CERN's discoveries can lead to the creation of products that could improve the quality of life	77
CERN's education programs for students and young professionals creates value for society	74
CERN develops new technologies for the diagnosis and treatment of diseases	68
I am proud that my country is part of the CERN international scientific research projects	67
Research activity at CERN should be intensified over the coming decades	66
Research at CERN has a positive effect on my everyday life	51
CERN's research activities contribute to peace in the world	46
CERN is a humanitarian aid organisation	42

Source Authors. Total sample: $n = 10,448$ (including France and Switzerland)

At the country level, Poland (88%) shows the highest share of positive sentiment of CERN research activities, followed by Italy (86%), the UK (84%), while Japan (53%) scores the lowest, mirroring the low level of awareness of CERN.

The survey also investigated what people appreciate or do not appreciate of CERN. To this end, respondents were asked to spontaneously report their first thoughts coming to their mind instead of picking items from a prefilled list.

“*Scientific research*”, “*development/innovation*”, and “*potential for a brighter future*” are the top three positive items mentioned by respondents with differences across countries. In Poland, the UK, the USA, and Israel, the contribution of CERN to technology development and innovation is appreciated the most; while Italian, French, and Swiss people primarily mentioned “*scientific research*”. Japanese respondents mainly focused on “*nuclear research*” attributing to it a negative sentiment. Negative perceptions of CERN can be also associated with thoughts such as “*excessive cost*”, “*inadequate safety*”, “*insufficient communication/information*”, and the “*topic being too intricate or challenging to grasp*”.

The sociodemographic profile of the respondents who exhibit positive attitudes towards CERN research activity and who value its societal benefits mostly follows the traits of those respondents aware of CERN (Fig. 3).

On top of that, the above opinions about CERN are also coherent with the respondents' thoughts about the potential roles of scientific research in general (not only related to CERN) since most of the respondents to the experiment point out that scientific research plays a crucial role in enhancing the quality of life and in satisfying human curiosity about the universe's origins and nature ([12]; Chap. 3).

In conclusion, despite the frequent over-exposure in the media of anti-science attitudes, the survey conveys a clear message: there is high support of a large-scale research infrastructure such as CERN. Ongoing work on other aspects of the survey will reveal the determinants and intensity of such support.

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