Digital Resilience

Digital Twins for Climate Resilience

Stakeholder Engagement Summary

Grant Agreement: 2024-1-ES01-KA220-HED-000252797

Erasmus+
Enriching lives, opening minds.

Co-funded by
the European Union

The project "Digital Twins for Climate Resilience" is co-financed by the European Union. The opinions and views expressed in this publication are solely those of The Consortium and do not necessarily reflect those of the European Union or those of the Spanish Service for the Internationalisation of Education (SEPIE). Neither the European Union nor the SEPIE National Agency can be held responsible for them.

May 2025

COPYRIGHT

DOCUMENT VERSION

Nr.	Description	Date	Author/s
01	Draft Summary_Lead Submission_V1	20/05/2025	Setenay Sürmelioğlu Taylan Günay Özge Andiç Çakır
02	**Final Summary**		
03			
04			

CONTENT

ACKNOWLEDGEMENTS

This document is a deliverable of the DIGITAL RESILIENCE Project co-funded by the Erasmus+ Key Action 2 under the 2024-1-ES01-KA220-HED-000252797 grant agreement

1.INTRODUCTION

The DigitalResilience needs analysis aims to understand the background knowledge and needs of the target groups and identify the need for curricula, recommendations and guidelines to be created throughout the project. A mixed-type questionnaire was created to collect data for the needs analysis. It consists of 16 questions, one open-ended and 15 closed-ended questions. The study was applied to 3 different target groups in Turkey, Portugal and Spain:

1) Future Professionals: Higher education students enrolled in civil engineering and construction-related degrees, with a keen interest in digital technologies and climate resilience.
2) Young Professionals: Recent graduates in civil engineering and related fields who have entered the workforce and are seeking to enhance their skills in digital twinning and climate adaptation.
3) Stakeholders group:
    a. Educational Bodies: Representatives from Vocational Education and Training (VET) institutions and Higher Education Institutions (HEIs) are responsible for curriculum development and training programs.
    b. Researchers: Professionals with expertise in digital twinning, climate resilience, and construction and engineering sectors.
    c. C&E Sector Experts: Individuals with experience and knowledge in the construction and engineering sectors, including practitioners, consultants, and industry experts.

The collected data will help to draft the digital twin technology training curriculum in civil engineering education.

2.RESULT AND ANALYSIS

A total of 53 people participated in the study at the invitation of O&B, EOLAS (Spain), ENTER (Portugal) and EGE (Turkey) (Figure 1). Among the participants, 30 actively studied or worked in European Union countries and 23 in non-European Union countries (Figure 2).

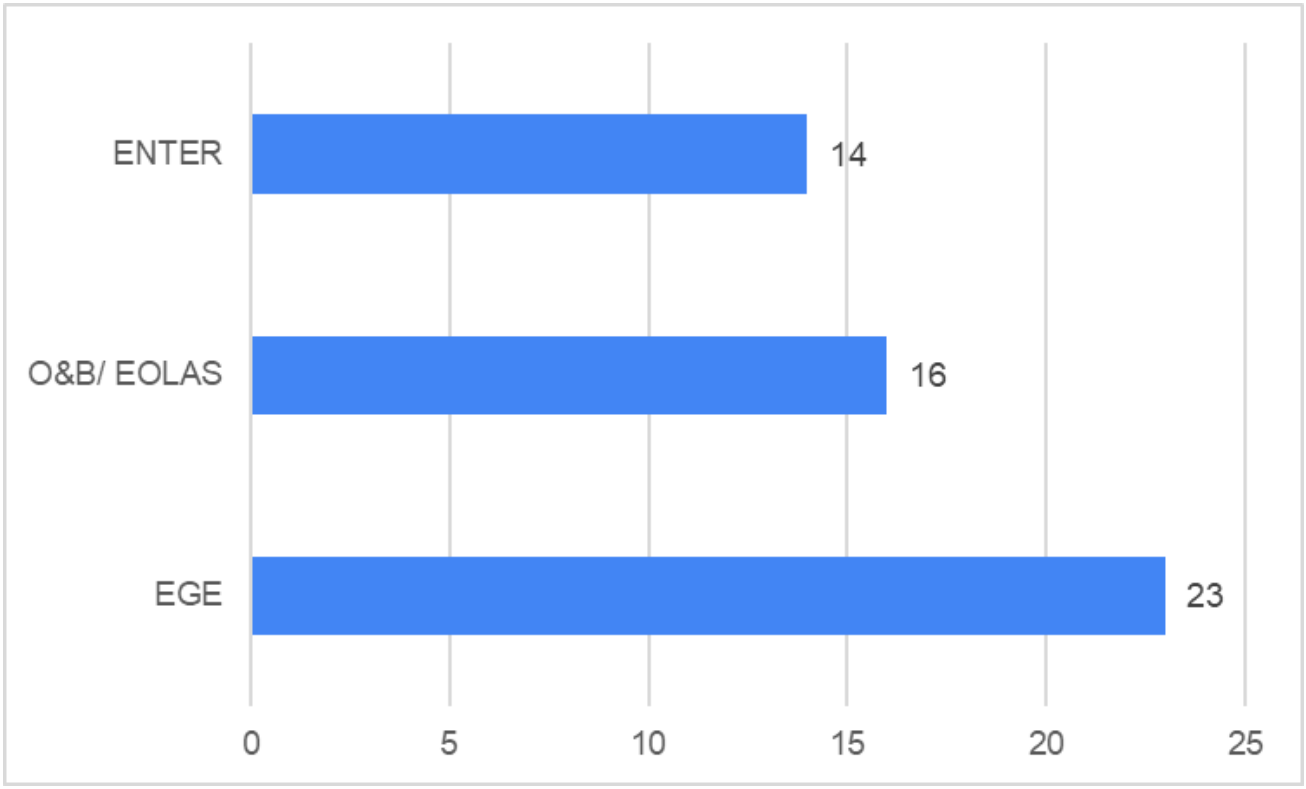

Figure 1. Invited participants to the study

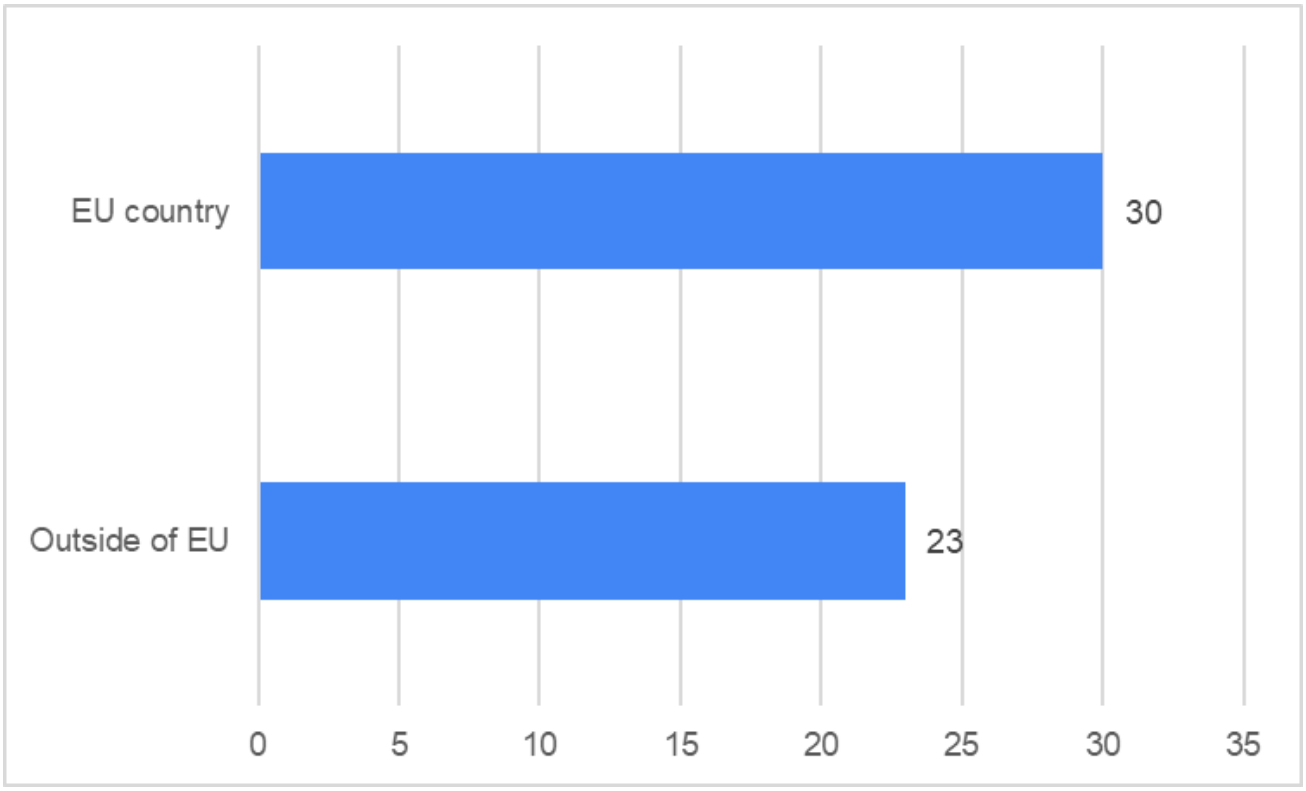

Figure 2. The main countries participants are professionally active (working/studying)

The study provided a balanced distribution between the three target groups. Eighteen participants were in the future professionals group, i.e., they are still students at university. The young professionals group had 17 respondents with a maximum of 5 years since graduation. In the stakeholder group, 18 participants took part (Figure 3).

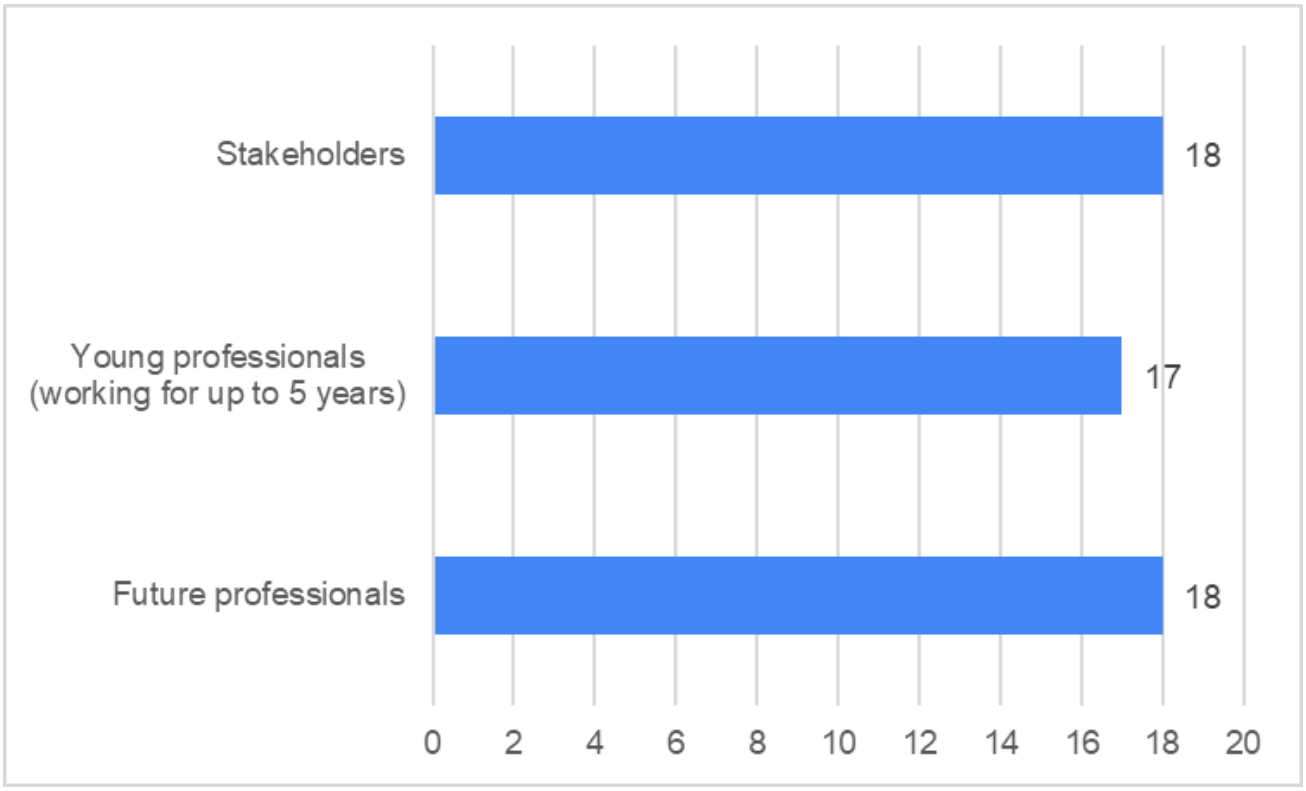

Figure 3. Target group participants

74% of the respondents (39 out of 53) have heard of digital twin technology. 26% of the respondents - the majority of whom are young and future professionals actively studying/working in non-EU countries - have never heard of digital twin technology (Figure 4).

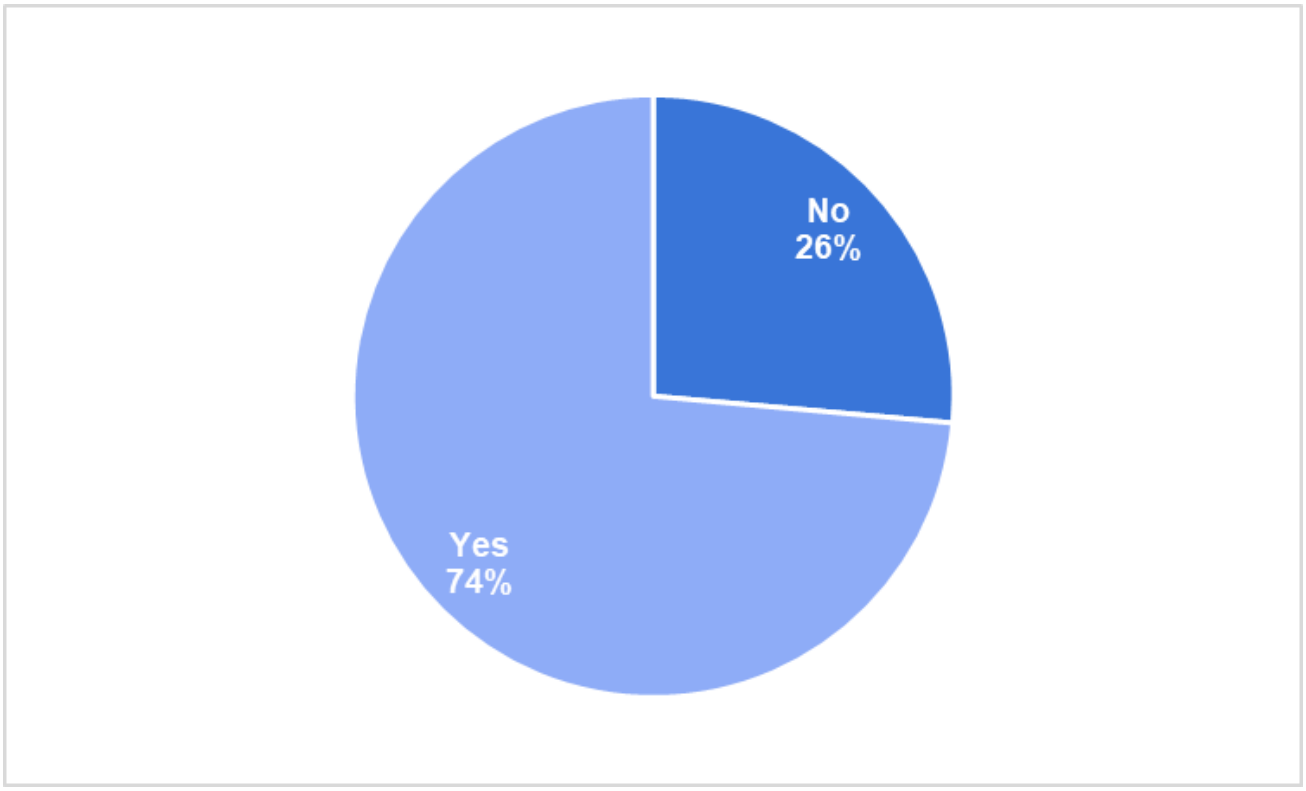

Figure 4. Awareness about digital twin technology

38% of the participants have used applications related to digital twin technology in their work, and 62% have never used it (Figure 5). Only 26% of the participants (14 out of 53) have attended any course/training related to digital twin technology, while 74% have never received such training. There were 20 participants in the study who had both heard about digital twin technology and used an application related to it, and almost half of them (9 people) did not receive any special training or courses on this subject (Figure 6).

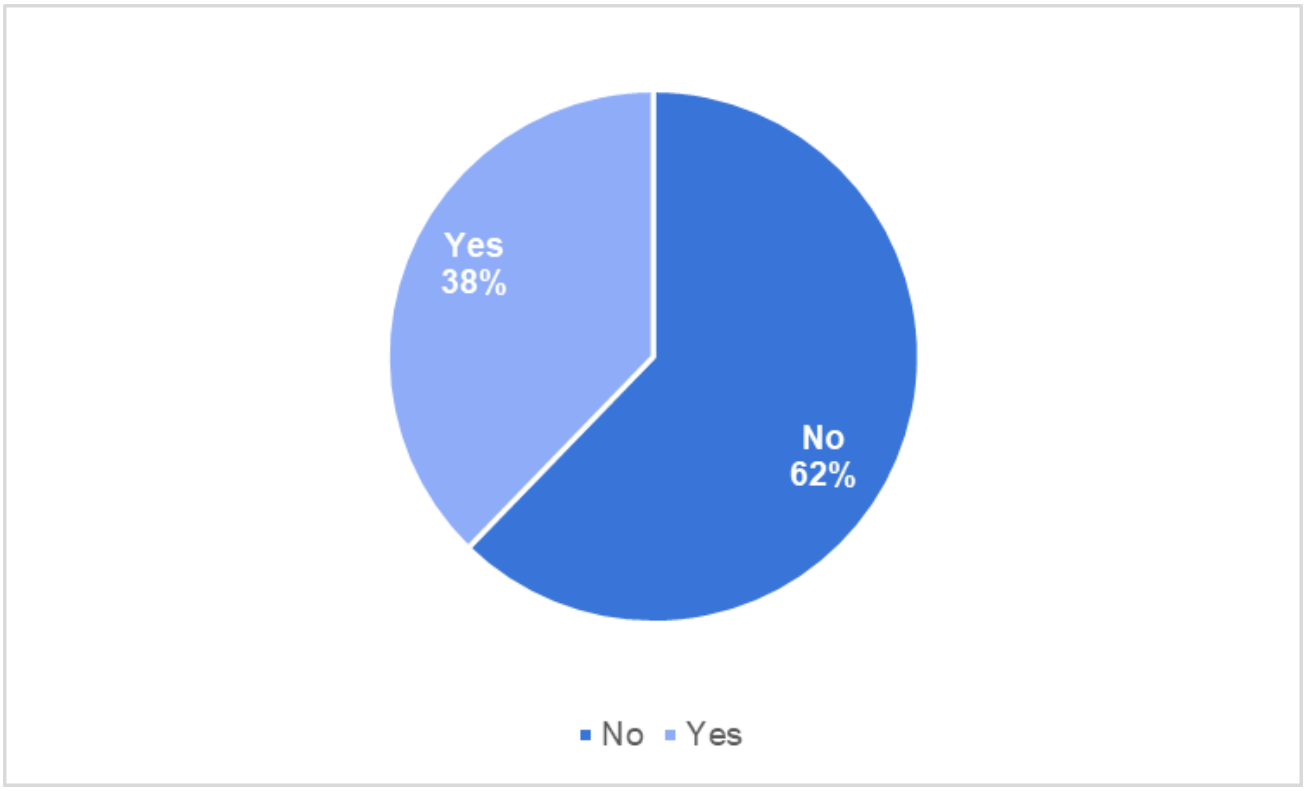

Figure 5. Participants who used applications related to digital twin technology

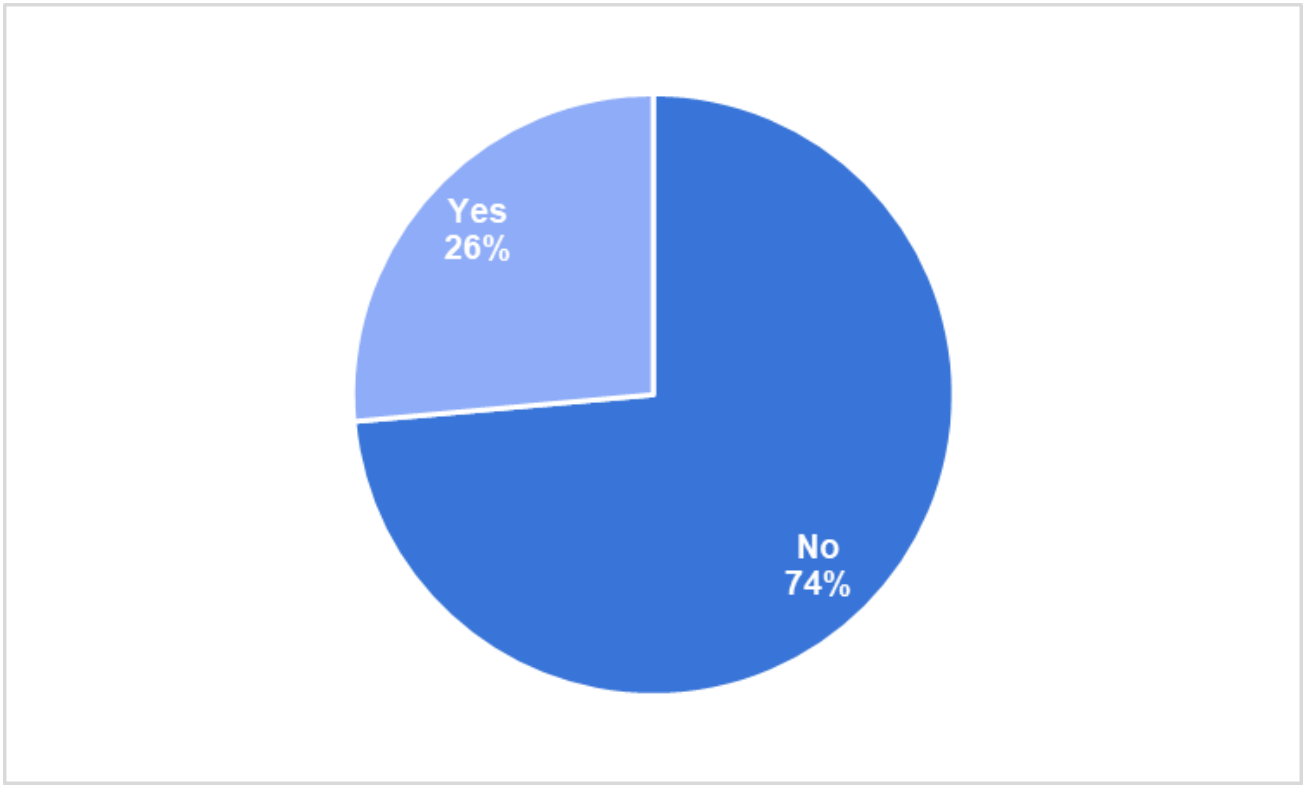

Figure 6. Have you attended any courses/trainings related to digital twin technology?

Most participants (41 out of 53) think that access to case studies about the application of digital twinning in construction and engineering would be definitely/ most useful. Ten respondents answered as neutral. Two others thought that it would not be useful/not useful at all (Figure 7).

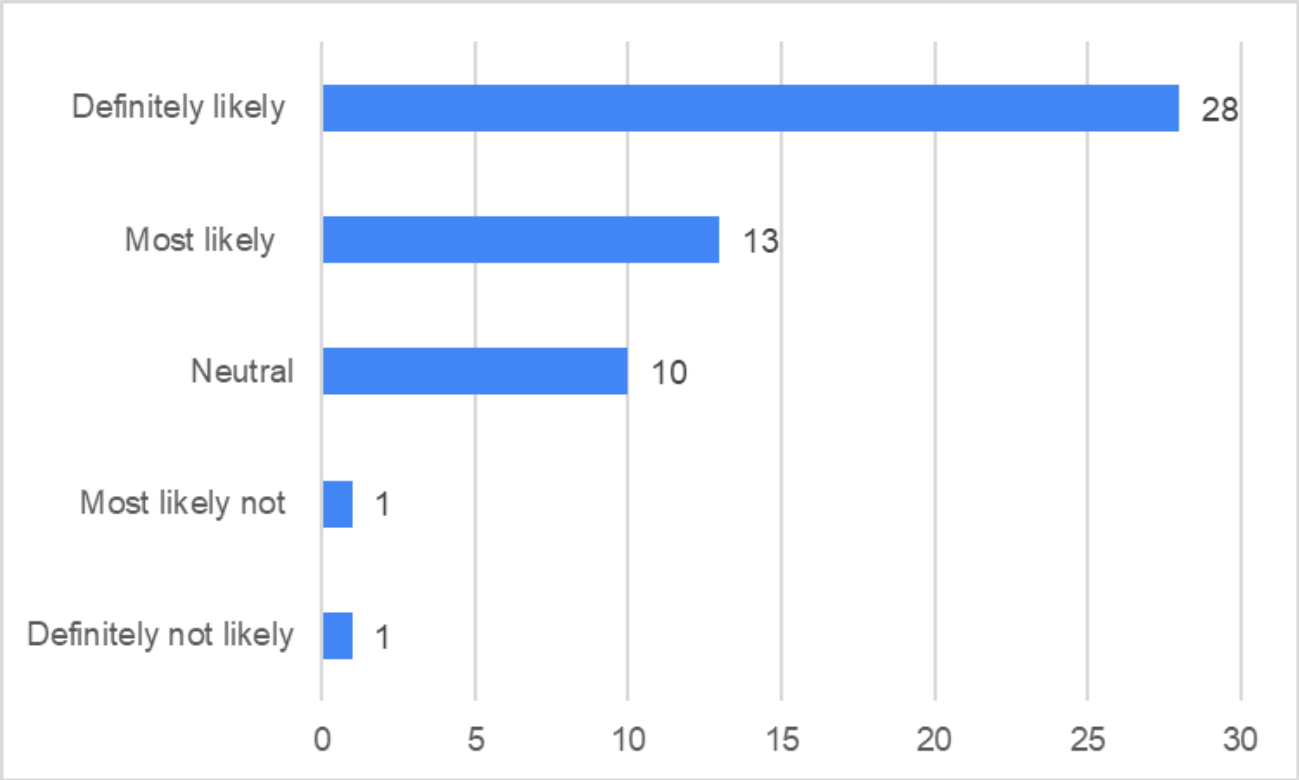

Figure 7. How likely would you benefit from accessing case studies about the application of digital twinning in construction and engineering?

83% of the participants (44 out of 53) think that access to the basic learning materials about digital twins will definitely/most likely be useful. However, 7 respondents answered neutral, and these respondents stated in the previous questions that they had not previously participated in a training programme on digital twin technology. Only two people think that it will not be very/not at all useful, but these people also have not attended a training on digital twin technology and have not used the application (Figure 8).

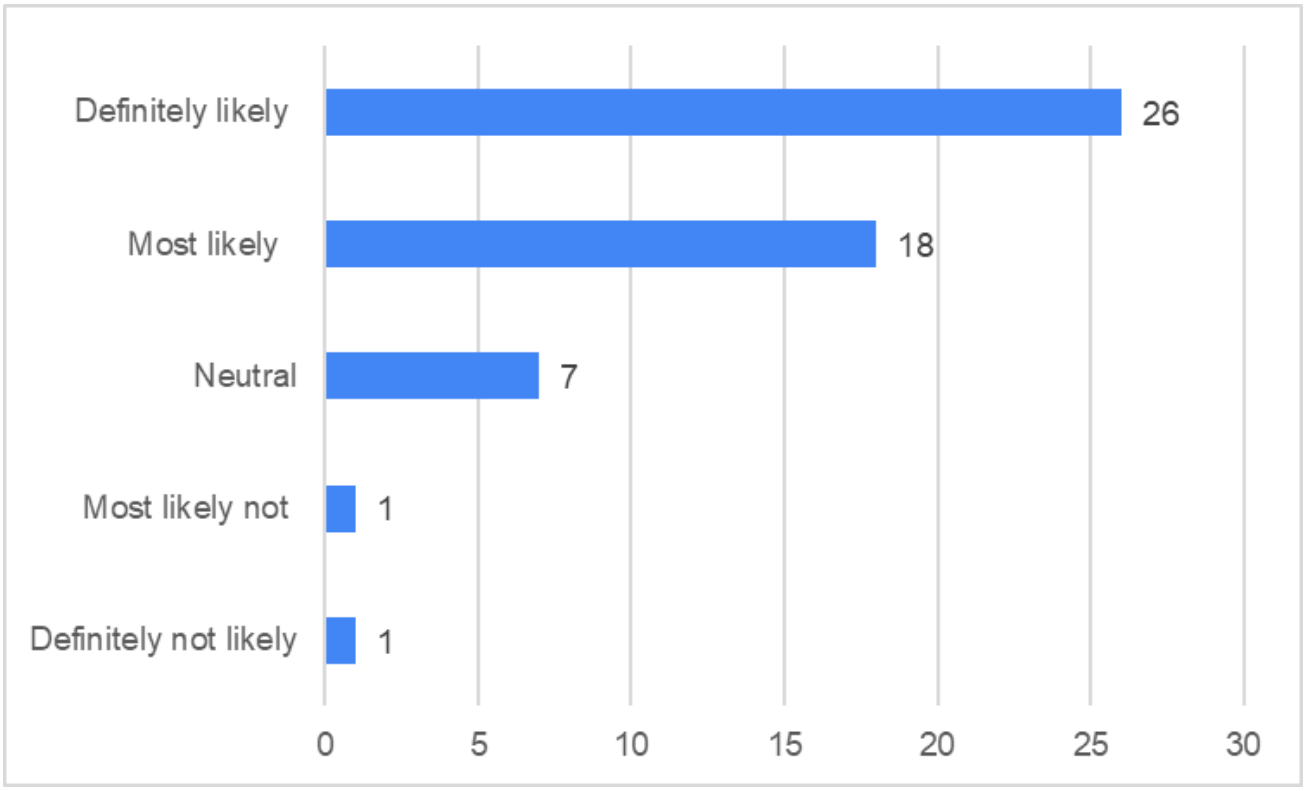

Figure 8. How likely would you benefit from an access to basic learning materials about digital twin?

In their studies, 46% of respondents have never analysed wind, thermal, or other impacts related to climate change resilience. 54% of the respondents have used these analyses, of which about half (14 people) have used digital twin technology before (Figure 9).

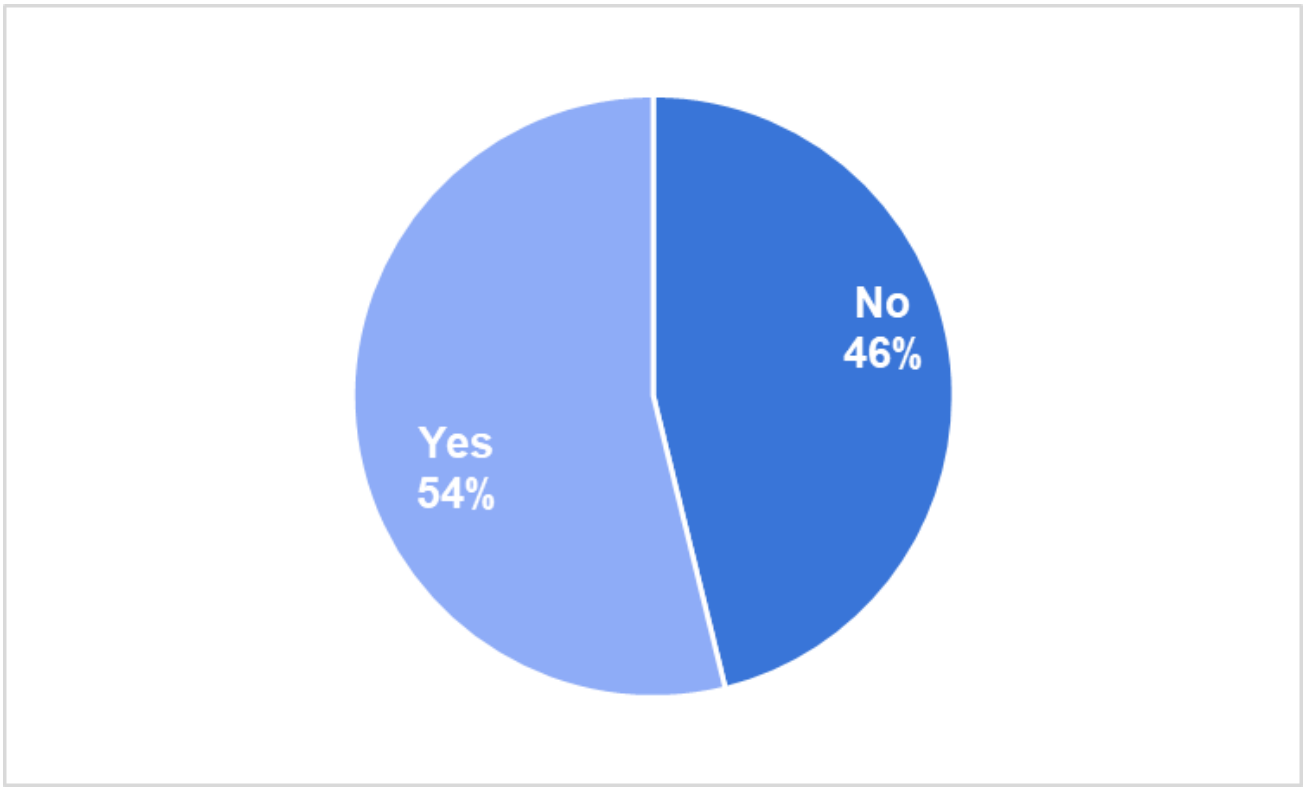

Figure 9. Have you ever analyzed wind, thermal, or other effects related to climate change resilience in your work or studies?

Only 8% of the respondents had access to guidelines where digital twin applications are used for climate resilience. 92% had no access to any guidelines specific to climate resilience (Figure 10). When asked if they had ever enrolled in a training programme on digital twin applications related to climate resilience, 2% of the respondents, i.e. only one person, answered that they had enrolled in a relevant training programme. In comparison, 98% had not enrolled in a relevant training programme (Figure 11).

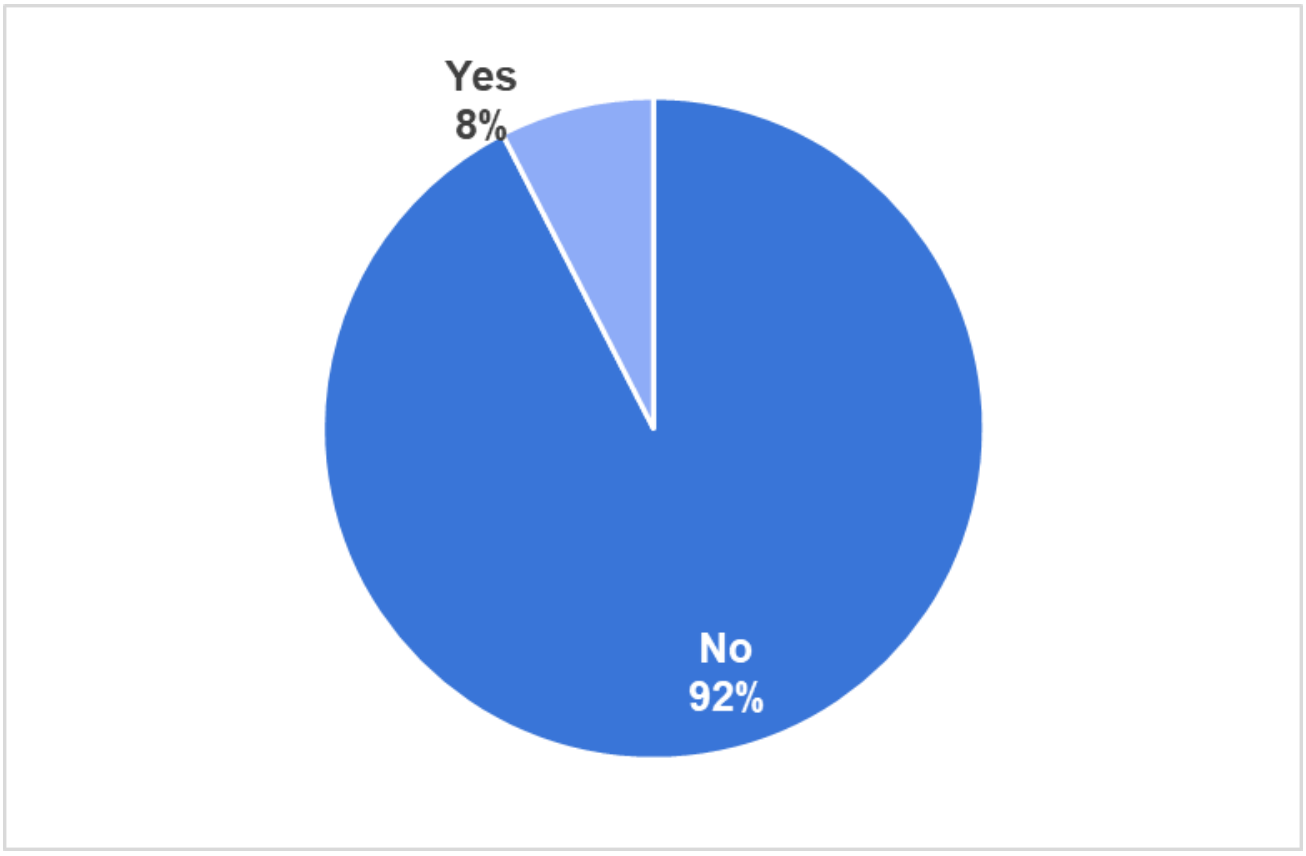

Figure 10. Have you ever accessed any guidelines where digital twin applications are used for climate resilience?

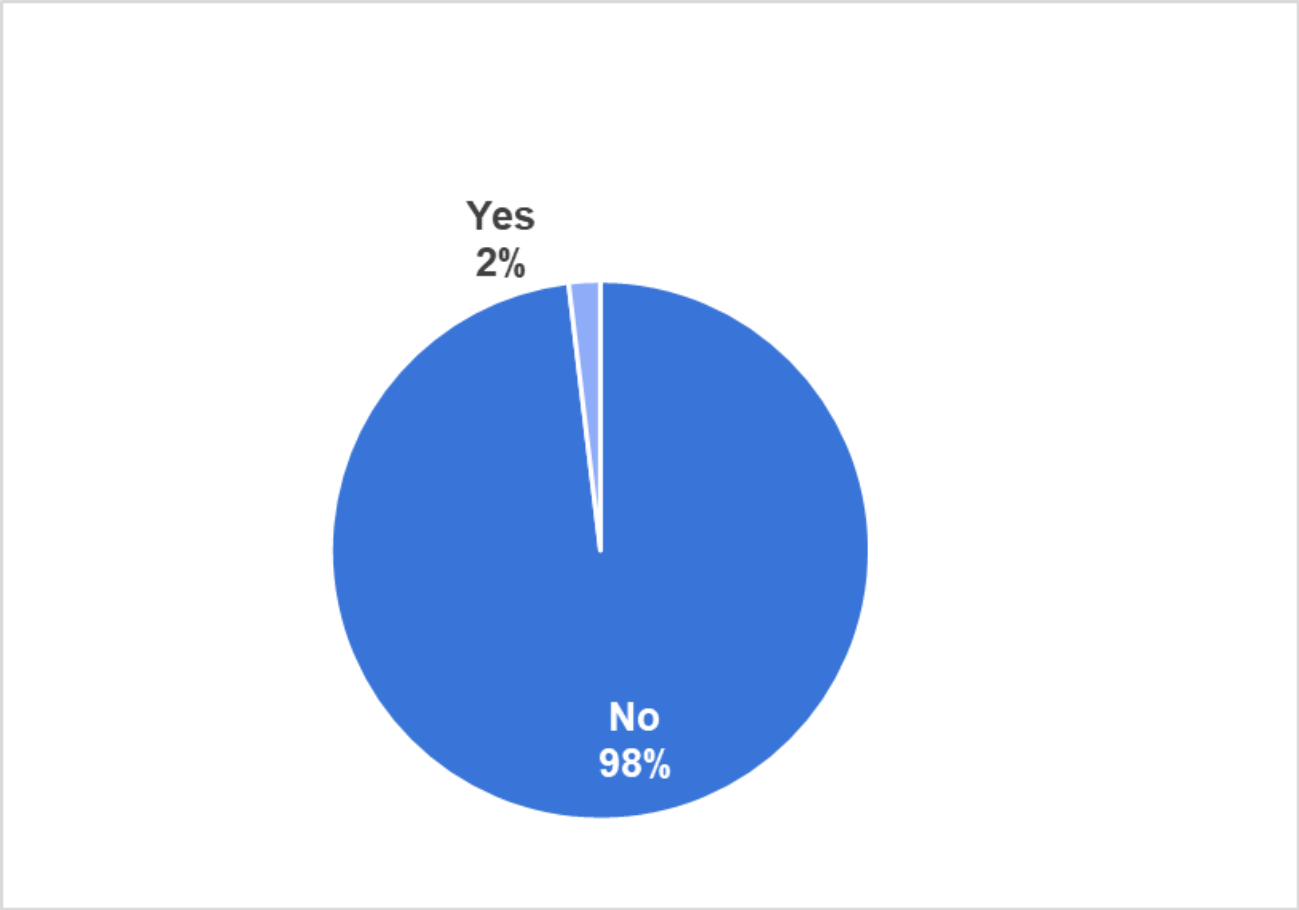

Figure 11. Have you ever enrolled in training programs where digital twin applications for are used for climate resilience?

When asked about the benefit of having access guidelines for integrating the digital twin into education or vocational training, 18 respondents think having access to the guidelines is definitely/most likely. 25 respondents answered neutral; these are the same respondents who stated in the previous questions that they did not have access to the guideline before. 10 respondents answered most likely not /definitely not likely. When asked about their opinion on the benefit of enrolling in training programmes using digital twin applications for climate resilience, 23 respondents found a training programme definitely likely/most likely. 20 respondents answered neutral, and none had attended a training programme before. 10 people answered most likely not /definitely not likely (Figure 13).

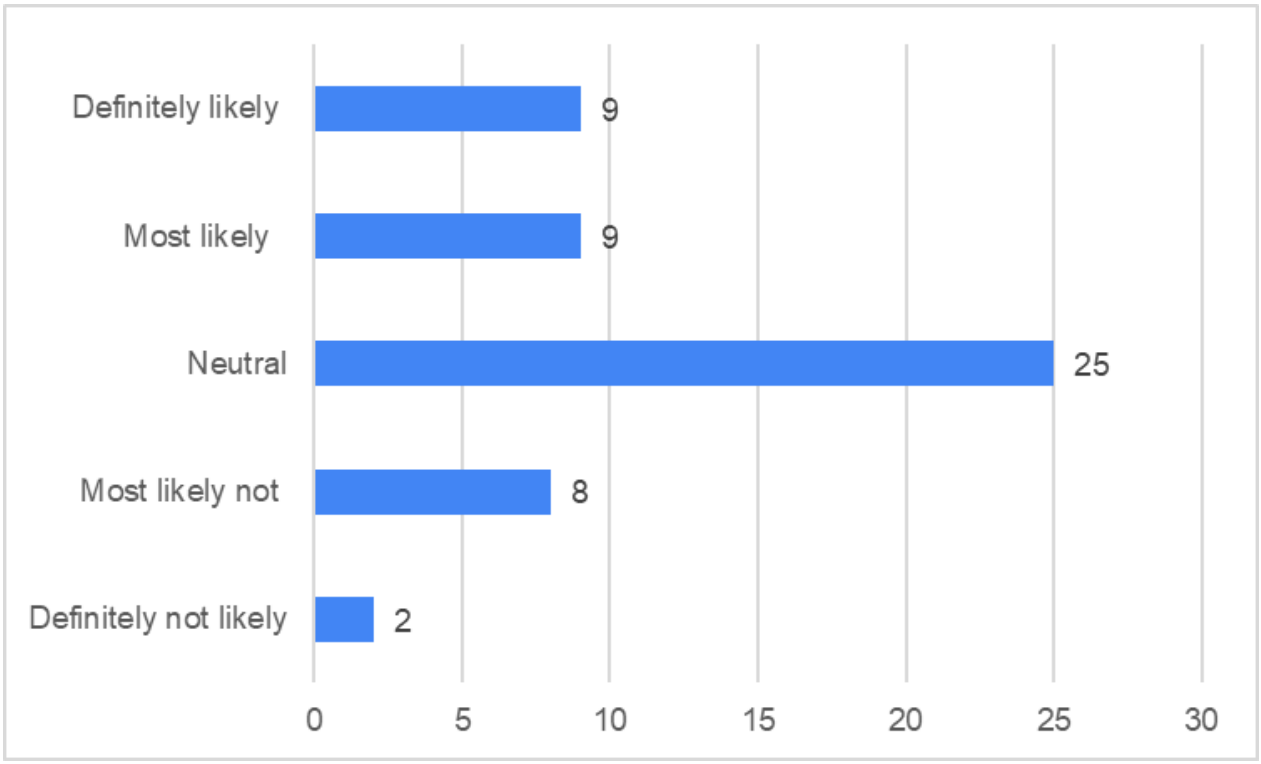

Figure 12. How likely would you have an access guideline for integrating digital twins into educational or professional training?

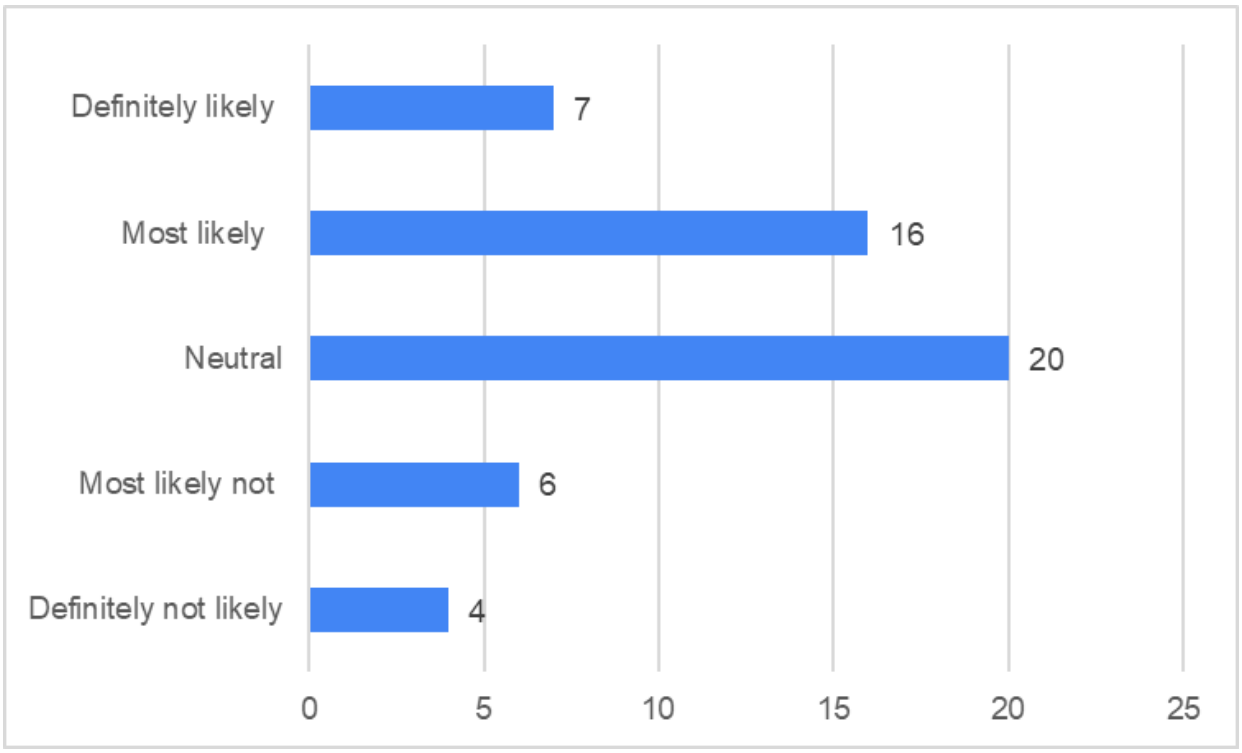

Figure 13. How likely would you enroll in training programs where digital twin applications for are used for climate resilience?

Only 8% of respondents (4 out of 53) have followed guides or resources for digital twins applications used for climate resilience, 92% have not.

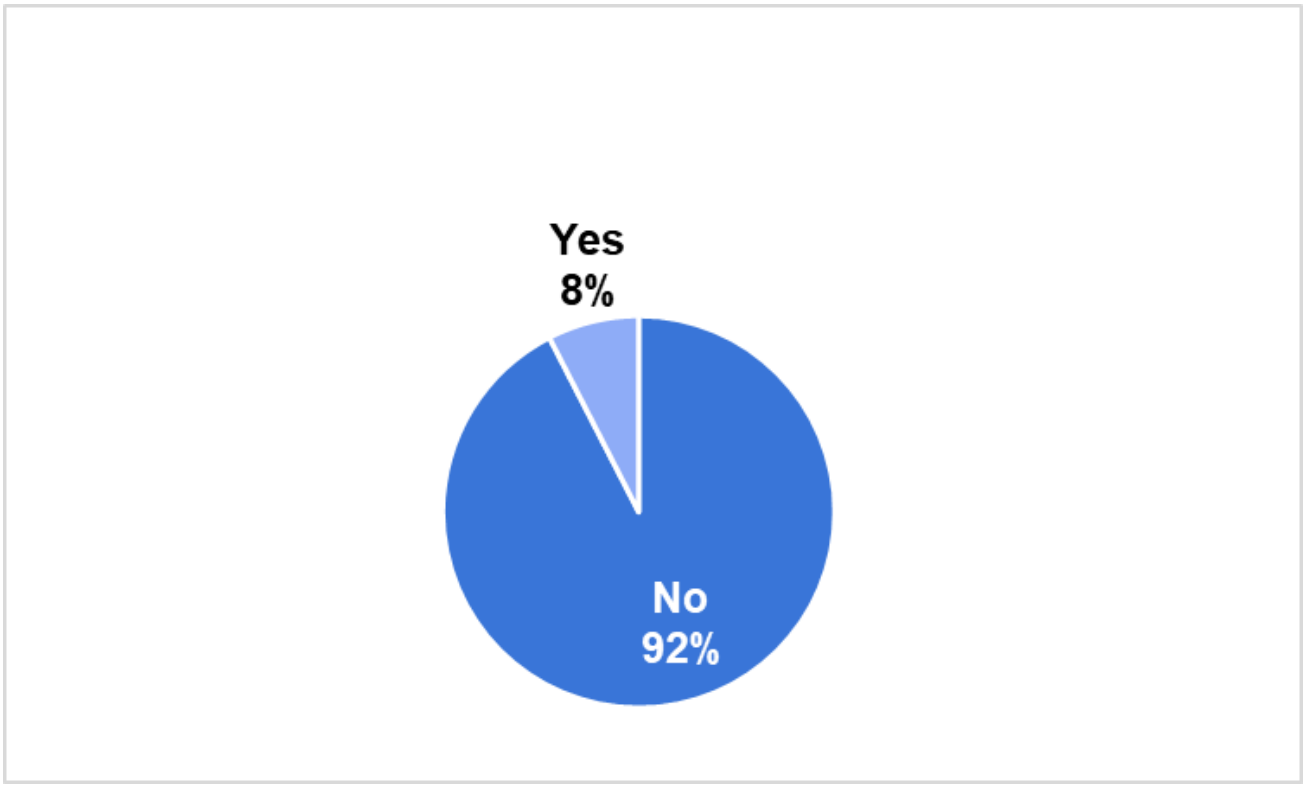

Figure 14. Have you ever followed any guides or resources for digital twin applications that are used for climate resilience?

Among the participants 43 of them believe that having digital twin-related guides and resources in the higher education curriculum would definitely/most likely be useful. 7 people responded neutral, and 3 people responded most likely not. None of the participants thought that it wouldn't definitely be useful.

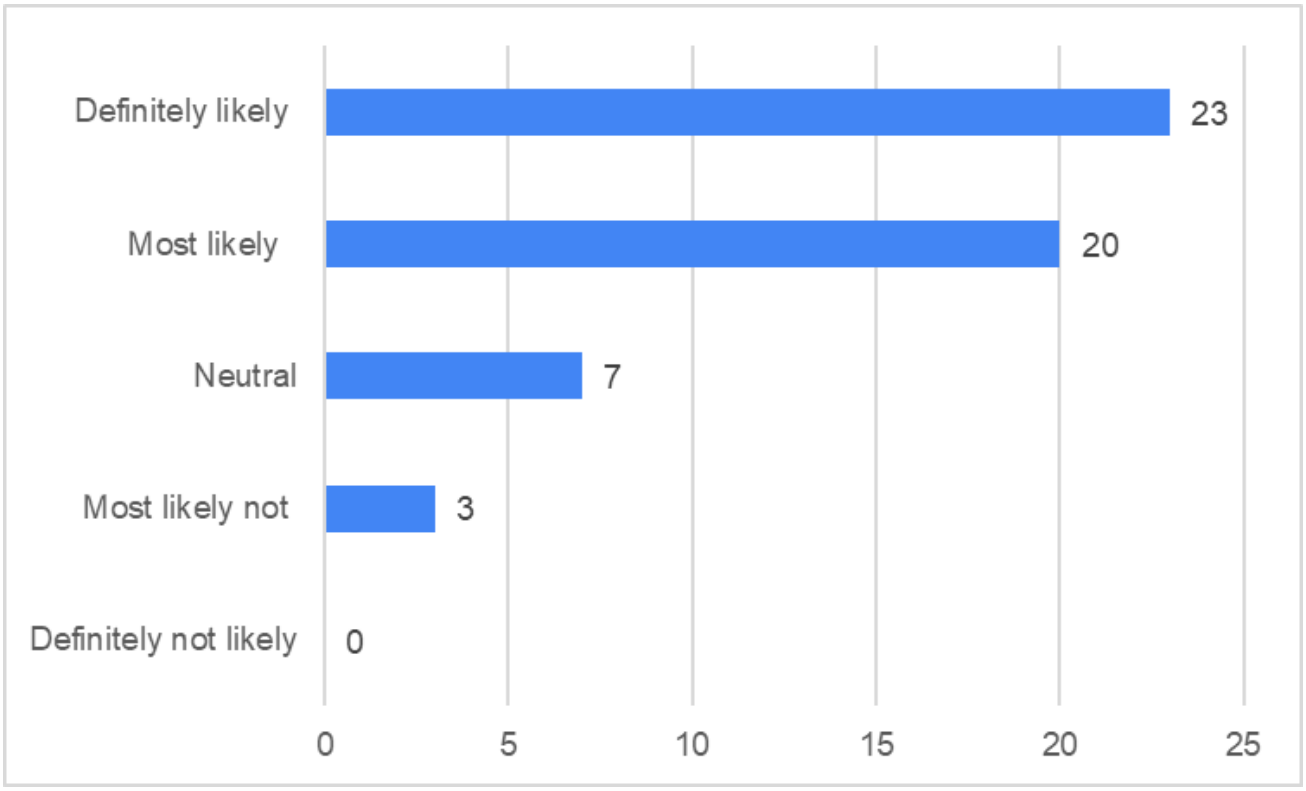

Figure 15. How useful would it be to have guides and resources related to digital twins in the higher education curriculum? (1 not useful-5 very useful)

The participants were asked an open-ended question about how digital twin technology could be useful in the construction industry, and then word groups were formed. Four areas stood out among the answers given: *predictability and decision-support*, *sustainable and eco-friendly design*, *building materials*, and *extreme weather* (Figure 15).

Figure 15. In which way does digital twin training become most beneficial in terms of the effects of climate resilience for the construction sector?

STATISTICAL EVALUATION

Participant profile: 56 % work/study in EU countries, 44 % outside of EU. Participants distributions is future professionals = 18, young professionals = 17 and stakeholders = 18.

The data collected from participants were evaluated by basic statistics approach where CI and p̂ were calculated as follows [1, 2] :

$$CI = \underline{x} \pm z \cdot \frac{s}{\sqrt{n}} \text{ (eq.1)}$$

where $\underline{x}$ is sample mean, z is the z score (taken 1.96 for 95%), s is standard deviation, and n is sample size.

$$\hat{p} = \frac{x}{n} \qquad \text{(eq.2)}$$

Where $\hat{p}$ sample proportion, x number of successes.

Digital-twin familiarity (for 95% CI) : 74 % of participants have heard of the concept range of 60 – 84 %, while only 38 % of them have used a digital twins tool (with CI: 26 – 51 %), and 26 % have taken any related course (with CI 16 – 40 %).

Climate-resilience based questions (for 95% CI) : only 8 % attendees have seen guidelines regarding to digital twins against climate resilience (with CI 3 – 18 %). One participant (2 %) has attended a training.

Table 1. Summary of Basic Statistics

Indicator	$\hat{p}$	95 % Wilson CI
Awareness of digital twin	0.74	0.60 - 0.84
Use digital twin	0.38	0.26 - 0.51
Attendance of a course	0.26	0.16 - 0.40
Climate resilience guidelines	0.08	0.03 - 0.18

Perceived usefulness for digital twins:

Access to case studies is **useful** for 77 %.
Basic learning material is **useful** for 83 %.
Guides & resources **useful** for 81 %

3. CONCLUSION

About 75% of respondents have heard of digital twins. However, only 38% of survey contributor have used, while only 26% of them have taken any related course. The differences between these numbers between knowing and applying of the technology indicate the need for more practical training for digital twins. 46 % of participants have never analyzed wind, thermal or other climate related effects, while the rest of group stated that they have, but only half of them have never used a digital twin application which reveal the need for practical skills in digital twins.

Most believed that having a guide and resources related to digital twin technology in higher education curricula would be beneficial. Participants thought that the following four areas related to the construction and engineering sector would be beneficial with digital twin technology: predictability and decision-support, sustainable and eco-friendly design, building materials, and extreme weather.

Open question responses indicate that the fundamental needs of useful tools for sustainable design, material optimization, and extreme weather analysis that are quite compatible with EU green awareness goals.

References

Wilson, E. B. (1927). Probable inference, the law of succession, and statistical inference. Journal of the American Statistical Association, 22(158), 209-212.

Brown, L. D., Cai, T. T., & DasGupta, A. (2001). Interval estimation for a binomial proportion. *Statistical science*, *16*(2), 101-133.