Change toolkit for digital building permit

Deliverable number	D5.3
Deliverable name	Training sessions for different types of users
Work package number	WP5 - Upskilling/Reskilling the construction value chain
Deliverable leader	University of Minho
Dissemination Level	Public

Status	Final
Version Number	V2.0
Due date	M36
Submission date	06/10/2025

Project no.	101058559
Start date of project:	1 October 2022
Duration:	36 months
File name:	CHEK_101058559_D5.3 - Training sessions for different types of users_ Final_V2.0

Funded by the European Union

This project has received funding from the European Union under the Horizon Europe Research & Innovation Programme 2021-2027 (grant agreement no. 101058559).

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Document history

Release	Description	Date	Author
V0.1	Draft submission	02/09/2025	UMinho
V0.2	Second draft after review	17/09/2025	UMinho
V.0.3	Revised version after second review	23/09/2025	UMinho
V1.0	Final report	06/10/2025	UMinho
V2.0	Final revision	27/11/2025	UMinho

Contents

1. Executive Summary

The digital transformation of the construction sector is increasingly extending to regulatory processes. Within this context, the concept of the **Digital Building Permit (DBP)** has emerged: a system that, among other functionalities, enables the **automated verification of regulatory compliance** through the integration of technologies such as **Building Information Modelling (BIM)** and **Geographic Information Systems (GIS),** with the application of **machine-readable rules**. DBP aims to simplify and accelerate administrative procedures for building permits, while enhancing **transparency, traceability, and efficiency**.

The European project **CHEK – Change Toolkit for Digital Building Permit**, funded under the Horizon Europe programme (Grant Agreement No. 101058559), aims to develop and pilot an **open, modular, and interoperable platform** for digital building permit issuance. The CHEK toolkit leverages **open standards** like **openBIM and openGIS**, as well as **semantic technologies**, and is designed to be **scalable and replicable** across different national regulatory frameworks in Europe.

CHEK adopts a **use case-driven approach**, with pilot projects in **Portugal, the Czech Republic, and Italy**, which allow the proposed solutions to be tested and their impact assessed in real-world settings. The project also fosters collaboration among **public authorities, industry, software developers, and researchers**, with the goal of contributing to the definition of a **European framework for Digital Building Permits**.

In summary, CHEK aims to act as a **catalyst for change**, enabling a more **intelligent, digital, and sustainable regulatory environment**, in line with the objectives of the **European Green Deal** and the **digital transition** of the construction sector. In this regard, the CHEK **Work Package 5** main objective is to develop means of **upskilling/reskilling** the construction value chain, through the development of an open multidisciplinary knowledge base and training materials for building permit officers, designers, and other AECO (Architecture, Engineering, Construction, and Operation) stakeholders. In turn, **"Task 5.2 - Practice-oriented CHEK training",** as stated on the Description of Action (DoA), focuses both on the development of training materials addressed to building permit officers, designers (applicants), and other stakeholders in the construction value chain (D5.2); and, additionally, it also provides remote online training sessions for each audience (D5.3).

Deliverable D5.3 - Training Sessions for different types of users outlines the efforts of training the key actors in the construction value chain, describing the methodology adopted to disseminate the massive open online courses developed for three target audiences, as well as the results of Task 5.2 consolidated in the different training sessions.

This report, therefore, presents the final outcomes of Work Package 5 and consolidates the set of tools, guidelines, and training materials developed to support the implementation of DBP at the local level. The toolkit provides practical resources for automated project compliance checking, the definition of machine-readable rules, and integration into existing administrative workflows. Additionally, the technical documentation and training materials included in this deliverable aim to ensure the **scalability and European-wide uptake** of the proposed solutions, offering clear guidance to public administrations and professionals in their transition towards advanced digital practices.

2. Introduction

Each stakeholder in the AECO (Architecture, Engineering, Construction, and Operation) industry has distinct roles throughout the construction process. The successful implementation of Digital Building Permits (DBPs) is, therefore, a process that requires deeper involvement and active collaboration between these actors, in which the adoption of technological tools and new methodologies is necessary. Recognizing this need and focusing on the transition from paper-based building permitting approaches to a fully digitalized system, the CHEK project aims to fill the existing knowledge gap among these groups. To address this issue, beyond creating new tools to handle DBPs, CHEK also focuses on developing practices to capacitate key industry construction actors by disseminating the foundation knowledge behind DBP, enabling them to adopt the new set of toolkits developed.

Within this context, the municipal officers are responsible for verifying the compliance of the applicant's designs against building regulations, which state construction rules based on safety, sustainability, and good urban planning practices. On the other hand, designers and applicants focus on developing designs that meet their needs while complying with building regulations requirements. For this reason, considering the particularities involving each type of user, **Task 5.2 Practice-oriented CHEK training** focused on developing massive online courses addressed to municipality's building permit officers, designers (applicants), and other stakeholders in the construction value chain, while **Deliverable 5.3**, namely **"Training sessions for different types of users"**, reports part of the work developed in Task 5.2.

The D5.3 training sessions have been divided into three parts: (1) an online prologue webinar, in which the e-learning platform was made publicly available; (2) a middle asynchronous period of over 1 month that allow attendees to take the full courses; and (3) online Q&A training sessions that were done in September 2025, to address any questions or concerns the users might have regarding the e-learning platform functioning, as well as about the learning content provided.

3. Methodology

The methodology adopted in D5.3 consisted of a series of events. The Training Sessions were distributed along three phases: (1) **Prologue Webinar** held on **31st July 2025** to officially launch the CHEK e-learning platform for the general public; (2) a **middle asynchronous period** from **31st July to 8th September 2025**, enabling trainees to complete the courses they had enrolled in; and (3) **Q&A Sessions** for each audience, which were held on **8th September 2025**, allowing them to clarify possible questions or concerns.

Figure 1 below, adapted from the CHEK Consortium monthly meeting held on June 30, displays a Timeline containing this set of events, which are further described next.

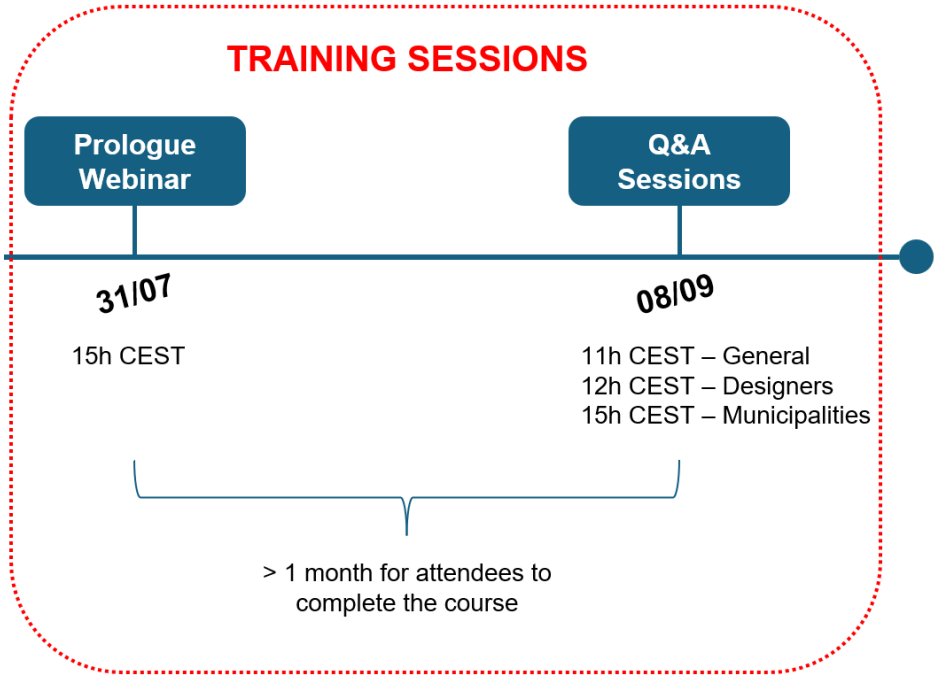

Figure 1 Timeline of dissemination events and training sessions adapted from the CHEK Consortium monthly meeting

4. Results: training sessions

The Training Sessions consisted of (1) a Prologue Webinar to disseminate the massive online courses developed in D5.2 and open to anyone interested in the CHEK e-learning platform; (2) an Asynchronous period; and (3) Q&A sessions for each specific audience-municipality technicians, designers and applicants, and other stakeholders in the construction value chain.

(1) Prologue Webinar:

In the first phase, an online **Prologue Webinar** was held on **July 31st 2025**, to officially launch the CHEK e-learning platform, which was made available for the general public. This 30-minute webinar consisted of an introduction to the CHEK e-learning platform. It was an open session in which, firstly, the CHEK project was briefly introduced, highlighting its main objectives, goals, and partners, and summarizing the project pillars as well as their interrelationships. Furthermore, all Learning Objectives were outlined, pinpointing the differences among the target audience's Learning Paths.

Most importantly, while navigating through the CHEK e-learning platform, the webinar provided a comprehensive overview of the e-learning functionalities, explaining step-by-step how to access the website, register on it, enroll in each course, and progressively explore its learning materials.

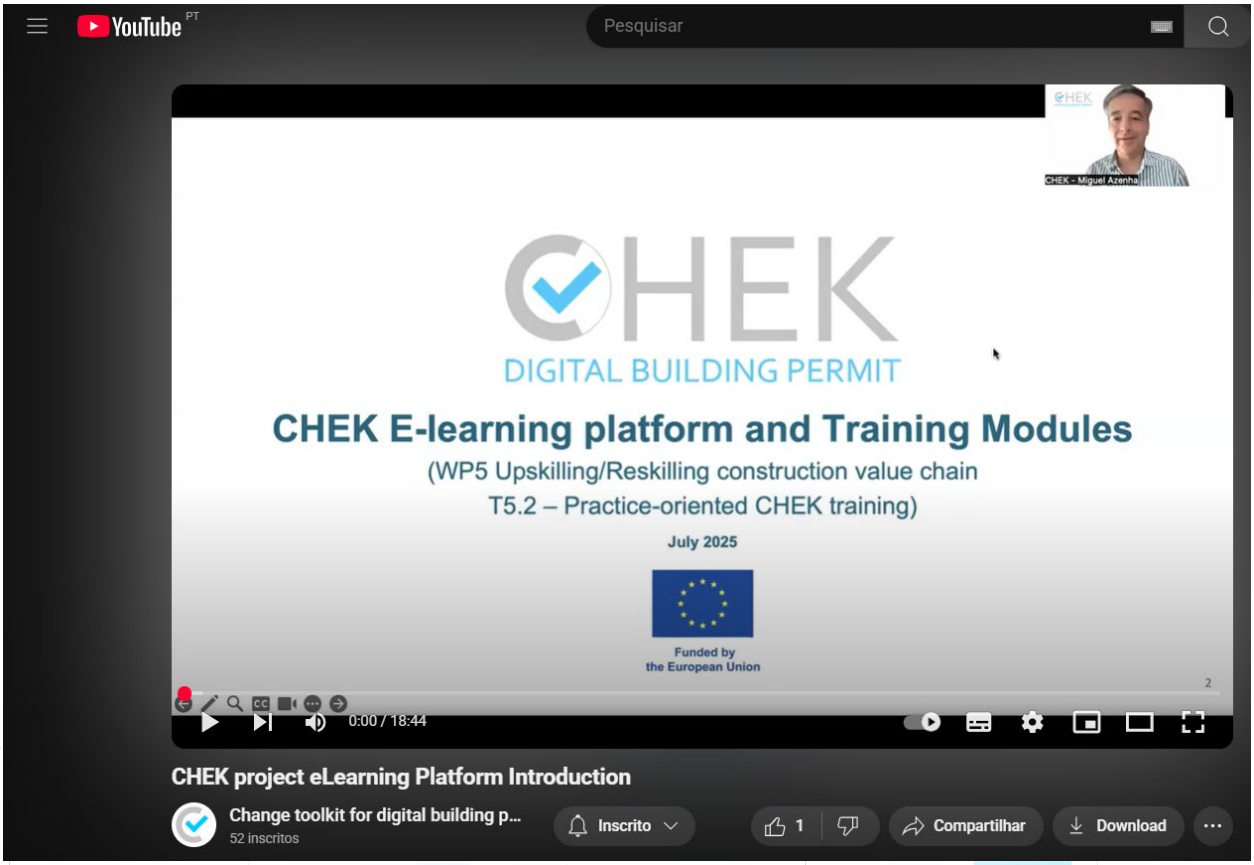

Figure 2 Recording of the Prologue Webinar held on 31 July 2025 to officially launch the CHEK eLearning platform

Then, an invitation to the Training Sessions was made, reinforcing the UMinho team's availability to clarify any doubts. Finally, some time was reserved for answering questions that users may have had during the prologue webinar, in which the chat meeting, as well as users' microphones and cameras, were unblocked. The prologue webinar session was recorded and uploaded to the CHEK YouTube channel (https://www.youtube.com/watch?v=DXOMcappmmk), allowing anyone to revisit it at their convenience.

(2) Asynchronous period:

The purpose of this second phase is to enable trainees to register for the CHEK e-learning platform and access the learning materials. Over one month was reserved between the Prologue webinar and the Q&A sessions - from **July 31st to September 8th 2025** - allowing attendees sufficient time to complete the courses they had enrolled in.

(3) Q&A Sessions:

In this final phase, three online Q&A Training Sessions were held on **September 8th 2025** (over a month after the prologue webinar) to address any questions regarding the learning materials and to assist trainees with any difficulties they may have had with the CHEK e-learning operation and materials. They have been separated into different sessions for each target audience, as further described next:

i. **Municipality's technicians** – 15:00 CEST;
ii. **Designers (applicants)** – 12:00 CEST;
iii. **Other stakeholders in the construction value chain** – 11:00 CEST.

Another objective of these Training Sessions was to help users get as familiar as possible with the platform, guide them through the course, and finally, collect their feedback. Hence, all Learning Paths were revisited, and the functioning of the e-learning was explained once more.

The global attendance for the three sessions consisted of **20 external individuals** from the consortium and 5 CHEK members. Participants' microphones and cameras were unblocked during the session to create an interactive environment, where everyone could ask questions and receive answers immediately.

The meetings **were not** recorded or uploaded to the CHEK YouTube channel due to concerns regarding **data protection** and **personal rights**. The overall feedback received from the sessions indicates that the audience is satisfied with the course, as the team was congratulated for the content development and the course's format. Additionally, the following main comments were collected:

1. Exchange Information Requirement (EIR) – during the other stakeholders' training session, it was mentioned that the course could provide more information regarding EIR.

The UMinho team pointed out that the course on Other Stakeholders in the construction value chain is the least comprehensive, and it's intended only to provide a general overview of DBPs. Additionally, it was explained that for further information on the topic, it's possible to enroll in other courses. Finally, it was noted that the EIR developed for the CHEK project is also available on the outcomes section of the CHEK website and can be accessed by anyone at any time.

2. Information Delivery Specification (IDS) – it was noticed, during the Designers and Applicants' training session, that the module "openBIM for DBP in practice" could explore other tools than Bonsai (BlenderBIM) to validate IFC models against IDS.

It was explained that, although there are many other possibilities, Bonsai had been selected because it's an open-source solution.

3. Quizzes – during the Municipality and Technicians' training session, a possible mistake was highlighted on the Digital Building Permits quiz, in which the drag-and-drop question could be ambiguous: the correct order in a typical building permitting process can be different across European countries, as is the case in Portugal. Besides, it was mentioned that the quizzes could contain more than three questions.

It was acknowledged that this ambiguity indeed exists, so the question was adjusted. Regarding the number of questions in each quiz, it was explained that it had been discussed and concluded that three questions is a middle ground to balance content assimilation and the course's level of difficulty and time spent on them.

These Q&A meetings were the final session for the training, where we addressed any remaining doubts and comments and provided a wrap-up of the courses.

Yet, it's worth noting the importance of the Q&A training sessions, in which trainees had the opportunity to outline their impressions and clarify their doubts. Moreover, their feedback was collected, and improvements have been made to the CHEK e-learning platform.

Moreover, in this last period of the project, as well as it is expected in the next few months, there are additional enrollments and course completions, also supported by further dissemination (e.g. in the CHEK final event held on 2nd September, at the buildingSMART summit in Berlin), besides the project outcomes reaching still wider audiences through the already initiated dissemination (website, social network, FAIR storage of datasets).

E-learning User Engagement and Feedback

Within one month after the CHEK E-learning Launch Event (Prologue Webinar), a data analysis was carried out to evaluate the effectiveness and scalability of the capacity-building training developed for each target audience, as well as to understand the profiles of users enrolled in each course. From a sample of 88 users who have registered on the e-learning platform — including CHEK developers and partners, as well as participants in the CHEK Summer School (reported in D5.4) — a total of **40 external users** started at least one course during the evaluation period.

As illustrated in Figure 3, the higher enrollment rate was among the Designers (Applicants) Course and the Municipality's Technicians Course, both accounting for 39% enrollment, while the other stakeholders' Course came right after with 22% enrollment. It's important to note that participants can enroll in multiple courses.

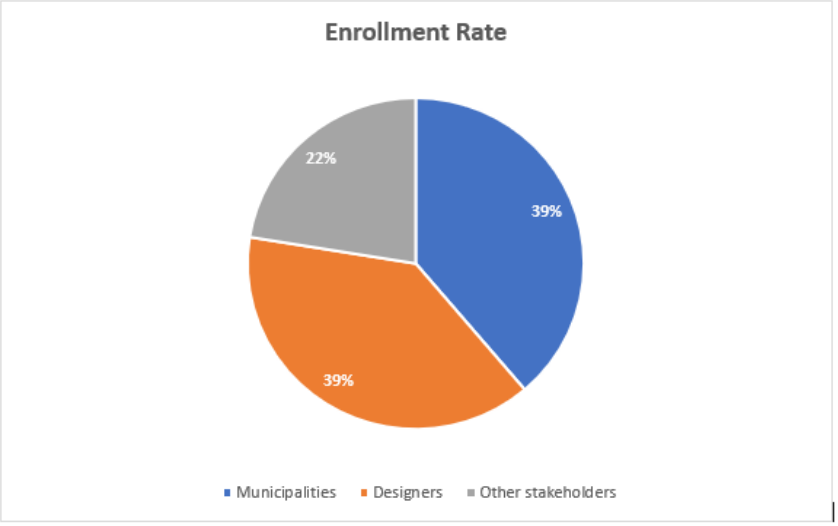

Figure 3 Enrollment rate

Additionally, Portugal led among the major origin locations (50%), followed by Belgium and Brazil (8%); while Sweden and 'Not Informed' came next (5%); followed by the United Arab Emirates, Nigeria, Taiwan, Finland, Romania and Germany (3%). Poland and the United Kingdom came next, all with 2%.

Besides them, another **6 trainees** from Romania, Turkey, Argentina, Belgium, Portugal and "Not informed" have registered for the platform, although they haven't yet enrolled for any Course.

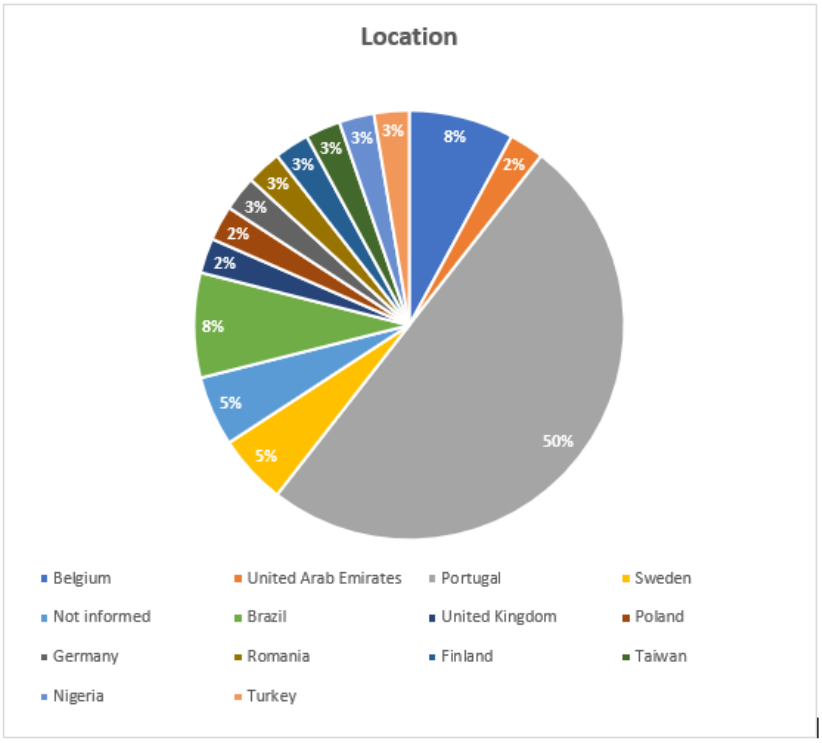

Figure 4 Origin location

A comprehensive validation of the e-learning platform was conducted following the pilot training sessions. The methodology involved a structured post-training evaluation targeting three distinct user groups: Municipal Technicians, Designers, and Other Stakeholders. A total of ten trainees (N=10) completed the full curriculum and the subsequent feedback instrument. The resulting dataset, detailed in Annex I, provides critical insights into platform usability, content relevance, and pedagogical effectiveness.

Quantitative Analysis of User Satisfaction

The quantitative results demonstrate a high degree of validation for the training methodology, with mean scores consistently exceeding 4.5 on a 5-point Likert scale.

- Content Clarity & Relevance: The instructional design proved highly effective. The content achieved a mean clarity score of 4.9/5.0, with 90% of participants awarding the maximum score. Similarly, the appropriateness of the learning materials was rated at 4.9/5.0, confirming that the technical depth was well-aligned with the target audience's professional requirements.
- Platform Usability: Navigation was rated 4.7/5.0, indicating a robust user interface. While 70% of users reported a "Very Appropriate" (5/5) experience, a minority (30%) noted minor friction points (rating 4/5), identifying specific areas for interface refinement.
- Difficulty Calibration: The difficulty level received a mean rating of 4.6/5.0. This suggests the curriculum successfully balanced accessibility with technical rigor, avoiding both over-simplification and excessive complexity.

Pedagogical Format Assessment

The evaluation compared the efficacy of the two primary content delivery methods: "Storytelling" (narrative-driven slides) and Video tutorials.

- Format Preference: Video content was the dominant preference, selected by 70% of users as the most helpful format for understanding complex topics.
- Intuitiveness: Both formats performed strongly in terms of usability.
    - 90% of participants found the Storytelling content "Intuitive and easy to follow," with only one user (Municipality) reporting initial confusion.
    - 90% similarly rated Video content as intuitive. Interestingly, the single report of "confusion" regarding video came from the same user who preferred the video format, suggesting the issue lay with specific technical segments rather than the medium itself.
- Knowledge Consolidation: There was unanimous consensus (100%) that the end-of-module quizzes were effective tools for reinforcing learning outcomes. Regarding the depth of knowledge acquired, 60% of participants felt the course provided a "Good level of detail and use cases," while 40% categorized the insight level as "Intermediate," pointing to an opportunity to introduce advanced modules in future iterations.

Qualitative Feedback & Remedial Actions

The open-ended feedback section provided actionable intelligence for continuous improvement (CI). Analysis of the text responses identified three primary clusters of user input:

- Technical Inconsistencies: As noted during the live Municipality session, specific discrepancies were flagged in the *DBP Quiz* logic and the workflow diagrams in the Storytelling cards (e.g., "Application" vs. "Compliance Checking" steps). Status: Corrective actions for the DBP Quiz have been implemented.
- Localization Nuances: Minor translation inconsistencies were reported (e.g., character names changing between "John" and "João"). While these did not impede learning, they impact professional polish. These changes have been made since then.

The pilot results confirm the e-learning platform's readiness for wider deployment, with a solid baseline satisfaction rate.

5. Conclusion

Deliverable 5.3 reported how the strategic approaches conducted by Work Package 5 improved the quality of the CHEK massive online courses and ensured successful dissemination and support for different types of users. All CHEK partners were actively involved in feedback actions on the courses. Relevant aspects were raised and valuable discussions were held. They were very important for improving the quality of the courses.

During the development of Task 5.2, the CHEK e-learning platform was designed as a **self-contained** program, meaning it does not require additional training. Therefore, the **Training Sessions** were strategically designed to assist the trainees in their Learning Paths. First, the **Prologue Webinar** introduced the platform to the general public. In this webinar, participants had the opportunity to understand how the e-learning platform operates through demonstrations on how to register and navigate the content according to each type of user, providing them with initial support to become familiar with the platform's functionalities. In turn, an **asynchronous period** of more than one month was reserved for attendees to access the learning materials that had been developed. Finally, the three online **Q&A Training Sessions** were mainly planned to clarify questions for those who have already enrolled and started the course. Additionally, another purpose is to review both the e-learning operation and the Learning Objectives, assisting each target audience (municipalities, designers and applicants, and other stakeholders) with any questions or concerns they may have.

The data collected and analyzed after the CHEK e-learning launch provided insight into the characteristics of the capacity-building training, revealing an audience primarily consisting of **Municipality Technicians** and **Designers** from **Portugal**. However, participants from all over the world have also registered and accessed the courses. Moreover, users' feedback indicated a **high average** for their overall satisfaction with the massive open online courses developed and demonstrated that the video-based format was more intuitive for assimilating the content than storytelling (Carousel). It should be noted, however, that the feedback was collected from a total of 10 respondents, as the course was only available for one month (August), which likely limited participation due to the vacation period. Yet, it also demonstrates that 25% of enrolled trainees have already completed the course.

In conclusion, it is important to mention that these training sessions were fundamental for: guarantee the alignment of the training courses with **CHEK project pillars**, by considering different point of views from other Work Packages' partners; disseminate the courses and ensure the general public participation by presenting and further explaining the courses and the CHEK e-learning platform; and assist the trainees in their initial steps as well as through their specific Training Paths, allowing them to interact with the teachers for further clarifications.

6. References

List of Figures

List of used abbreviations

AECO	-	Architecture, Engineering, Construction, and Operations
BIM	-	Building Information Modelling
CHEK	-	Change Toolkit for Digital Building Permit
DBP	-	Digital Building Permit
DoA	-	Description of the Action
EC	-	European Commission
EU	-	European Union
GA	-	Grant Agreement
GIS	-	Geographic Information Systems
WP	-	Work Package

Annex

Annex I – User's Feedback

Annex I – User's Feedback

	1st User – Municipality	2nd User – Municipality	3rd User – Municipality	4th User – Designer	5th User – Designer	6th User – Designer	7th User – Designer	8th User – Designer	9th User – Other stakeholder	10th User – Other stakeholder
How comfortable did you feel navigating through the platform? (On a scale from 1 to 5; 1 = Not appropriate, 5 = Very appropriate) (1-5)	5	4	5	4	4	5	5	5	5	5
How clear and easy to understand were the contents? (On a scale from 1 to 5; 1 = Not appropriate, 5 = Very appropriate) (1-5)	5	4	5	5	5	5	5	5	5	5
Were the learning materials appropriate and up to date? (On a scale from 1 to 5; 1 = Not appropriate, 5 = Very appropriate) (1-5)	5	4	5	5	5	5	5	5	5	5
Was the level of difficulty appropriate for your skills? (On a scale from 1 to 5; 1 = Not appropriate, 5 = Very appropriate) (1-5)	5	4	5	3	4	5	5	5	5	5
The storytelling contents (swipe-like materials) were:	Intuitive and easy to follow	A bit confusing	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow
The video contents were:	A bit confusing	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow	Intuitive and easy to follow
Which content format helped the most in understanding the topic?	Video	Video	Storytelling	Storytelling	Video	Video	Video	Video	Video	Storytelling
Did you find the quizzes helpful in consolidating the course content?	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful	Yes, it was helpful
Do you think the content provided:	An intermediate level of insight	An intermediate level of insight	A good level of detail and use cases	A good level of detail and use cases	A good level of detail and use cases	A good level of detail and use cases	A good level of detail and use cases	An intermediate level of insight	A good level of detail and use cases	An intermediate level of insight
Any further comments, suggestions, or feedback?	Some story cards contain character name translation inconsistencies. For example, in the first few cards, the character "John" is displayed as "João" (Portuguese version), which could be confusing. Additionally, there seems to be a minor issue with the DBP workflow shown in the cards ("Application > Compliance Checking > Approval > Inspection"), which may not align with the correct quiz answer. Overall, the content is solid. To further enhance the learning experience, adding more technical demonstration videos and providing one or two sample models for hands-on testing could serve as an effective next-level guide.	Thank you.	Higher quality of videos and sound.	-	-	Well done, thanks!	-	-	-	-