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# CODECO

Cognitive Decentralised  
Edge Cloud Orchestration

## D28: CODECO Innovation and Research Community Engagement Programme – Final Version

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## Executive Summary

The CODECO Deliverable D28 - *Innovation and Research Community Engagement Programme Final version* documents the overall experience of the programme IRCEP, presenting statistics and lessons learned. It is produced as a result of the activities held in *Task 7.2 - Innovation and Research Community Engagement Programme* in Work Package (WP) 7 – *CODECO Ecosystem Development and Exploitation*.

IRCEP was designed to foster collaboration and innovation among SMEs, academia/research, and early developers across multiple domains within CODECO's target areas. By targeting these diverse groups, the program aimed to cultivate a dynamic and inclusive ecosystem where varied talents and perspectives converge to drive the expansion of CODECO's ecosystem. Stakeholders express their interest through a structured application process, which included a submission of a form, provision of a contribution, an evaluation process and communication of results. This streamlined approach ensured an efficient and alignment with the programme's objectives.

The execution and implementation of IRCEP was a joint effort of the whole consortium, namely with technical partners supporting participants in the experimentation of the CODECO framework. Also, IRCEP diffusion was supported by tailored measures for promoting and disseminating each activity offered within the programme, including a dedicated section on the project website, local events, social media publications, etc.

By the end of the CODECO project, a total of six awards were granted in the scope of IRCEP, to four researchers who contributed with presentations to the workshops and to two developers who carried out validation and experimentation activities within the CODECO framework.

**Keywords:** IRCEP challenges, collaboration, experimentation, validation, community engagement, outreach, dissemination.

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## List of Acronyms and Definitions

Acronym	Meaning
AGV	Automated Guided Vehicle
AI	Artificial Intelligence
ATH	Athena Research Center
CODECO	Containerised, Decentralised Orchestration
CODEF	CODECO Experimentation Framework
CONASENSE	Communications, Navigation, Sensing, and Services
CPU	Central Processing Unit
CRD	Common Resource Description
D27	CODECO Deliverable 27 – IRCEP Intermediate Version
DUTH	Democritus University of Thrace
ECA	Eclipse Contributor Agreement
EC	European Commission
EUCEI	European Cloud, Edge and IoT Initiative
FOR	Fortiss GmbH (project partner abbreviation)
GDPR	General Data Protection Regulation
HiPEAC	High Performance and Embedded Architecture and Compilation (conference)
ICOM	INTRACOM TELECOM (project partner)
IETF	Internet Engineering Task Force
INO	INOVA+ (project partner abbreviation)
IoT	Internet of Things
IRCEP	Innovation and Research Community Engagement Programme
K8s	Kubernetes (container orchestration platform)
KPI	Key Performance Indicator
ML	Machine Learning
ML4ECS	Machine Learning for Edge-Cloud Systems (workshop)
MTTR	Mean Time To Repair
PDLC	Policy-Driven Lifecycle Controller
RAM	Random Access Memory
RL	Reinforcement Learning
SDG	Synthetic Data Generator
SIE	Siemens AG (project partner abbreviation)
SMART	Specific, Measurable, Achievable, Relevant, Time-bound (goals framework)
SME	Small and Medium-sized Enterprise
SWM	Seamless Workload Migration
TID	Telefónica I+D (project partner abbreviation)
UC3M	Universidad Carlos III de Madrid
UGOE	University of Göttingen
UPM	Universidad Politécnica de Madrid
UPRC	University of Piraeus Research Center
VRU	Vulnerable Road User
WP	Work Package

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# 1 Introduction

D28 consists of the final report about the overall experience of the CODECO Innovation and Research Community Engagement Programme (IRCEP), presenting statistics and lessons learned. This deliverable is developed in the context of WP7 - *CODECO Ecosystem Development and Exploitation*, Task 7.2 - *Innovation and Research Community Engagement Programme* which started in April 2024 (M16) and lasted until the end of the project (M39).

IRCEP consisted in a mechanism via which diverse stakeholders entered CODECO's ecosystem and were able to contribute to it by building applications, services, and extensions of its framework. These diverse stakeholders included SMEs, early developers, researchers, and students in areas of close scientific proximity to the project's main action areas.

By fostering a culture of inclusive innovation, IRCEP encouraged a broad base of stakeholders to engage in the creation and dissemination of new knowledge, thus promoting equity in the benefits derived from research and technological advancements.

Despite the challenges faced when implementing IRCEP, the programme has proved its value in extending the CODECO community and in engaging external stakeholders in discussions on the relevant topics on Edge-Cloud continuum and on the validation of proposed solutions.

## 1.1 Dependencies

D28 is a final report on the implementation of the IRCEP within the lifespan of CODECO and, as such, is dependent on its initial plan - Deliverable D27, which provided guidance on its practical application and presented the initial steps taken in its development.

## 1.2 Document Structure

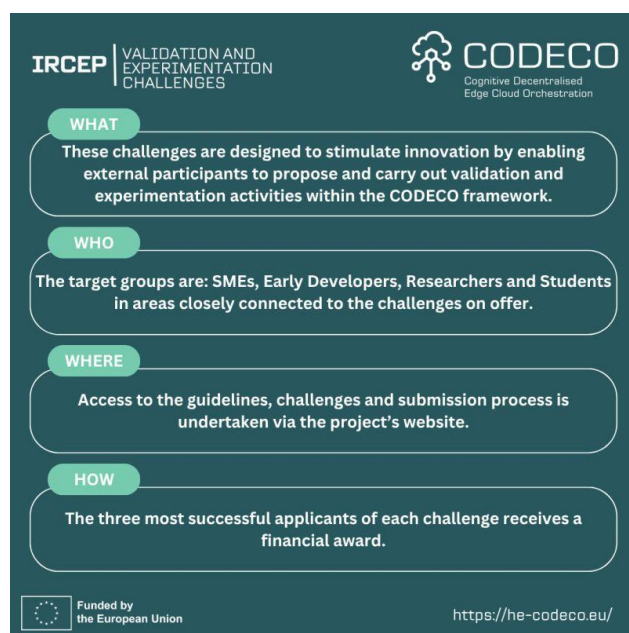
The deliverable is organized as follows:

- **Section 1**, where the document's introduction and structure are elaborated upon.
- **Section 2** provides an overview of the IRCEP concept, initially described in D27 [1].
- **Section 3** documents the activities implemented within IRCEP.
- **Section 4** presents the results and the awards resulting from the IRCEP activities.
- **Section 5** covers the processes for data management and ethics.
- **Section 6** presents lessons learned and summarizes the deliverable.

# 2 IRCEP Overview

The *Innovation, Research, Challenges and Experimentation Programme* ([\*IRCEP\*](#)) was established within the CODECO project as a structured mechanism to broaden the project's impact beyond the consortium itself. By opening the CODECO ecosystem to external participants, IRCEP aimed to stimulate innovation, foster community engagement, and validate the framework's applicability across a diverse range of real-world scenarios. Targeting SMEs, early developers, researchers, and students, the programme offered two complementary pathways for participation: involvement in CODECO-organised events and engagement in hands-on experimentation and validation challenges built around core components of the CODECO framework. Through a combination of online dissemination, local events, and a dedicated webinar, IRCEP sought to maximise awareness and accessibility, ensuring that the opportunities it offered reached a wide and relevant audience across Europe.





IRCEP, whose principles are provided in Figure 1, was proposed as a set of activities that would allow to validate and disseminate CODECO to the different stakeholder groups, and in particular to SMEs, academia and research. The experimental and validation challenges proposed by IRCEP were designed by different partners and connected to the four categories of use-cases across the domains of Smart Cities, Manufacturing, Energy and Smart Buildings.

The targeted stakeholder groups are shown in Figure 2: (i) Small and Medium Enterprises; (ii) Early Developers; (iii) Researchers and (iv) Computer science students.

IRCEP entailed mainly two types of activities: 1) contributions to events organized or co-organized by CODECO,

Figure 1: the IRCEP programme principles.

such as presentations and papers; and 2) contributions to CODECO framework by the experimentation and validation challenges. All activities were designed and implemented with the support of the consortium partners, either responsible for the organization of the event or those in charge of specific components of the CODECO framework on which the challenge was focused. Activities implemented are detailed in section 3.



Figure 2: IRCEP Target Groups

## 2.1 Dissemination and Engagement

To enable access to the information about the programme, a dedicated section was created on the project website (see Figure 3) and regular updates on the programme were shared within the social media channels of the CODECO project. The IRCEP Website and associated challenges remain open beyond the project lifetime and are addressed in terms of sustainability as well.



Figure 3: IRCEP section on project website<sup>1</sup>

<sup>1</sup> <https://he-codeco.eu/ircep/>

IRCEP has been promoted through a dedicated section on the project website, which attracted over 1,500 visitors 78% focused on the IRCEP Challenges with peak traffic between September and December 2025 (Figure 4). LinkedIn was used regularly for promotion, with posts shared across partner networks and relevant thematic groups. Additional reach was achieved through the EUCI Monthly News Digest and community platform.

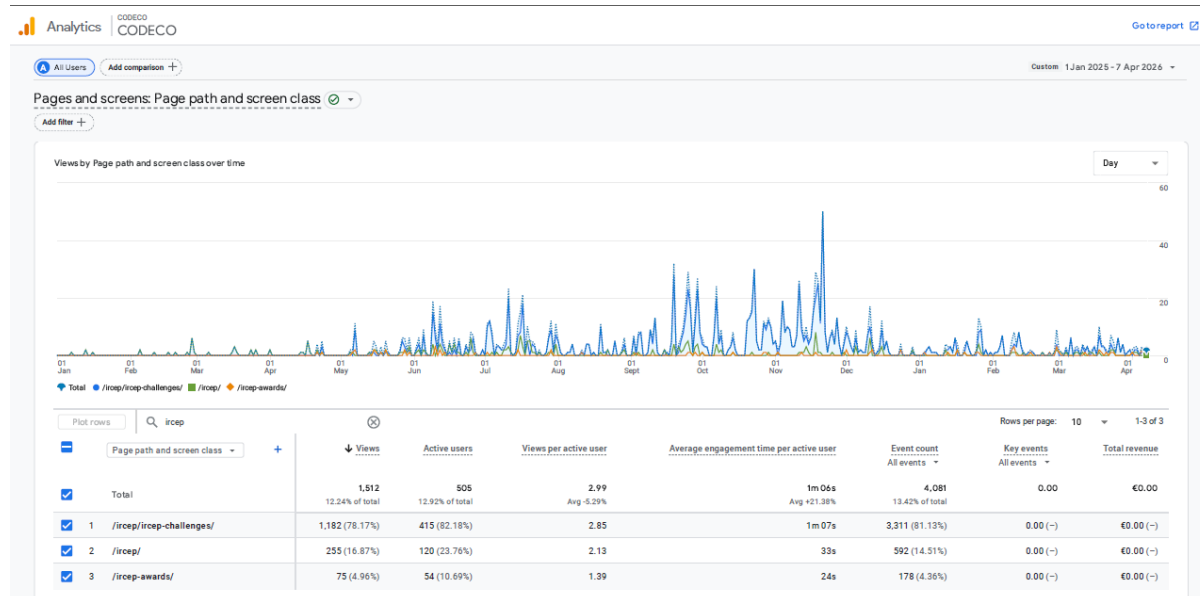


Figure 4: Analytics on visits to IRCEP section on project website

On social media, the programme has been advertised on CODECO's LinkedIn page<sup>2</sup> regularly since its launch. Between June 2025 and February 2026, the team increased the publication of posts regarding IRCEP to properly diffuse information about the IRCEP Challenges initiative, details on specific challenges, and also targeted posts (Figure 5) to announce the local events organised by partners (see section 2.2). Besides the project channel, these posts were also shared in relevant thematic groups, with all partners also re-sharing content across their own networks to maximise reach.

Additionally, between September 2025 and February 2026, the IRCEP challenges and local events were also promoted through the EUCI Monthly News Digest and the EUCI community platform, extending visibility beyond the project's own networks to a wider European audience.

<sup>2</sup> <https://www.linkedin.com/company/codeco-project>



Figure 5: Sample of advertisement posts of IRCEP Local Events

## 2.2 Local Events

The *IRCEP Local Events* were devised to inform potential participants about the specific challenge, answer questions, and encourage them to take part, with the hosting partner providing direct technical context and support. A total of seven local events, listed in Table 1, were organised between November 2025 and February 2026, each hosted by the consortium partner responsible for the corresponding IRCEP challenge. Five events took place successfully, while two were cancelled due to insufficient participant turnout.

Table 1. Local events organized under IRCEP.

Event #	Date	IRCEP Challenge Focused	Host
E1	21 November 2025	CODECO Data Generator #1	UPRC
E2	24 November 2025	CODECO Intelligent Recommender	i2CAT
E3	26 November 2025	CODECO Data Generator #1	UGOE
E4	28 November 2025	CODECO Data Generator #2	UPRC
E5	28 November 2025	CODECO CODEF	ATH
E6	11 December 2025	CODECO Demo Camp: Energy / Resilience / SWM	FOR
E7	16 February 2026	All Challenges	UPM

**UPRC** hosted two events (**E1** and **E4**) on 21st and 28th November 2025, respectively, at the University of Piraeus, Greece, each attracting 50 participants (100 in total, students). Both sessions introduced the overall CODECO architecture, with a focus on the PDLC component and the *CODECO Synthetic Data Generator* [challenges 1](#) and [2](#). Participants followed guided hands-on exercises, were briefed on the challenge KPIs, and were encouraged to continue developing their solutions independently after the workshop.

**i2CAT** hosted event **E2** on 24th November 2025 at its premises in Spain, with approximately 25 participants (students, researchers). The session covered the *CODECO Intelligent Recommender challenges* [1](#) and [2](#) and included a live demo of use-case *P2 — Vehicular Digital Twin for Safe Urban Mobility*, illustrating how CODECO can support the safety of Vulnerable Road Users in urban environments.

**ATH** hosted event **E5** on 28th November 2025 at the Intersys Labs, Democritus University of Thrace, Greece. Although ten students had expressed interest, only three attended. The six-hour session covered the CODECO project, the CODEF experimentation methodology, and the related IRCEP CODEF [challenges](#), with participants working directly on five pre-configured Kubernetes clusters in a Q&A and hands-on format.

**FOR** hosted event **E6** on 11th December 2025 in Germany in a hybrid format, with 15 external registrations and 3 external participants attending in person. The event featured a demo of use-case *P5 — Wireless AGV Control for Flexible Factories* and presented three FOR-led challenges: [CODECO Energy Awareness Strategies](#), [CODECO Resilience Strategies Evaluation](#), and the [CODECO scheduler benchmarking](#), with detailed technical guidance provided for each.

**UGOE** (E3, 26 November 2025) and **UPM** (E7, 16 February 2026) had planned local events that were ultimately cancelled due to insufficient interest from local stakeholders.

## 2.3 Webinar

With the objective of maximising reach about the opportunities offered by IRCEP, the consortium has agreed on promoting a [webinar](#) dedicated to this subject (Figure 6).



Figure 6: Advertisement post of IRCEP Challenges Webinar

A dedicated webinar was held on 16 December 2025 to present the IRCEP technical challenges to a wider audience. The session covered the CODECO Data Generator challenges (#1 and #2), the CODECO Intelligent Recommender challenges (#1 and #2), the CODECO Energy Awareness Strategies challenge, and the CODEF and Benchmarking



challenge. The recording was subsequently made available on both the IRCEP section of the CODECO website and the CODECO YouTube channel, ensuring the content remained accessible to those who could not attend live.

## 3 IRCEP Implementation

This section describes the events and activities organised in the CODECO to which IRCEP initiatives were associated and awards were envisaged.

### 3.1 HiPEAC 2025

Within the involvement of CODECO in the co-organization of Machine Learning for Edge-Cloud Systems (ML4ECS) Workshop<sup>3</sup> during HiPEAC 2025 held in Barcelona from 20th to 22nd of January, it was planned IRCEP to provide a Best Talk Award to recognize outstanding contributions to the field of cloud-edge computing. The ML4ECS workshop focused on academic and industrial innovation and research on developing and deploying AI/ML models to enable optimized system management and application execution on the continuum. It counted with a total of 50 participants, among researchers; students; SMEs.

The workshop had a call for papers for external contributors and IRCEP supported three (3) “Best Talk” Awards, each of which the equivalent to a monetary value of 2800€ (see section 4.2). The awards were selected by the audience, based on a poll that has been set by partner INOVA.

### 3.2 IETF Hackathon 2025

Held between 19<sup>th</sup> and 20<sup>th</sup> of July 2025, the Internet Engineering Task Force (IETF) organised a hackathon<sup>4</sup> aimed at bringing together developers and experts to exchange ideas, work together, and build tools, prototypes, and solutions that demonstrate real-world uses of IETF standards.

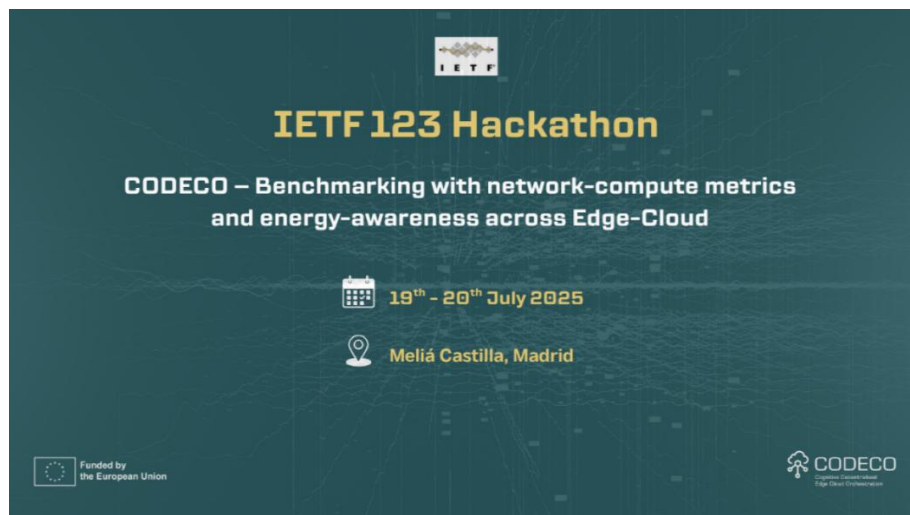


Figure 7: IETF 123 Hackathon – CODECO Challenge.

CODECO (Figure 7) presented three focused challenges during the IETF Hackathon<sup>5</sup>:

<sup>3</sup> <https://www.hipeac.net/2025/barcelona/#/program/sessions/8194/>

<sup>4</sup> <https://wiki.ietf.org/en/meeting/123/hackathon>

<sup>5</sup> The Hackathon results are available in the Eclipse CODECO Gitlab: <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/hackathon>

- [Challenge 1: Green Network Observability and Reporting](#)
- [Challenge 2: Joint Exposure of Compute and Network Metrics for Path Selection](#)
- [Challenge 3: Benchmarking Network-aware Edge-Cloud Orchestration with CODEF](#)

IRCEP planned to engage in this activity, by awarding the three best participants in each of the challenges, with a financial award of 2800€<sup>6</sup>. The evaluation for each of the challenges, was carried out by the CODECO experts, according to the technical quality of the submitted results. Overall, two (2) contributions were received, one for Challenge 1 and one for Challenge 2. Upon the technical assessment by CODECO partners, it was agreed that none of the contributions resulted in code that could be used by CODECO, and therefore no awards were offered following this activity. Both contributors were informed of the evaluation outcome and provided with written feedback from the relevant CODECO technical experts, identifying the specific gaps between their submissions and the integration requirements of the framework.

### 3.3 CONASENSE 2025

The 15th Communications Navigation, Sensing, Services (CONASENSE) Workshop<sup>7</sup>, co-located with IEEE WPMC 2025, took place on 10th November 2025 in a hybrid format hosted by FOR (in Munich, via MS Teams) and TU Sofia, Bulgaria. The event focused on cognitive, energy-efficient IoT-Edge-Cloud resource orchestration, aligning with the evolution toward a sustainable, AI-enabled 6G ecosystem.

The workshop counted in total with 33 attendants in average: 15 attendants in TU Sofia, and with 18 attendants via Ms Teams. The participants have a background on networking, Edge-Cloud, and are affiliated with industry and academia.

Attendees were invited to vote on the “Best Talk Award” (audience-voted, see Figure 8), which would receive an IRCEP award equivalent to a monetary value of 2800€ and would be invited for publication in the CONASENSE Open Access Series (River Publishers). The author of the contribution on “Designing for 6G Adoption” was the one selected (see section 4.2).

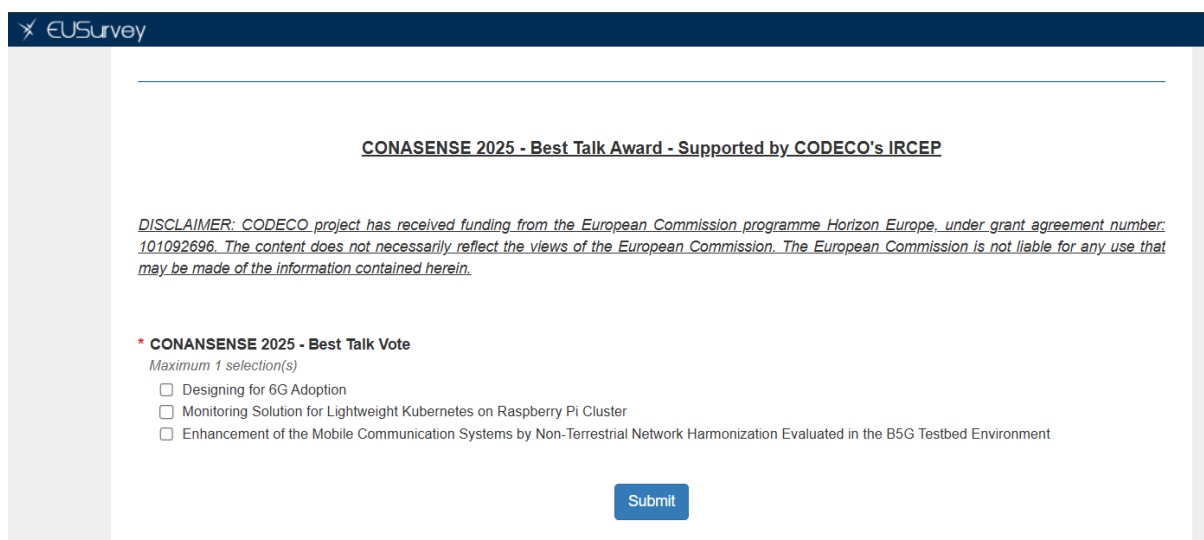


Figure 8: Online voting form provided in the CONASENSE Workshop 2025.

6 <https://he-codeco.eu/hackathon/>

7 <https://www.conasense.org/conasense-2025/>

### 3.4 IRCEP Challenges

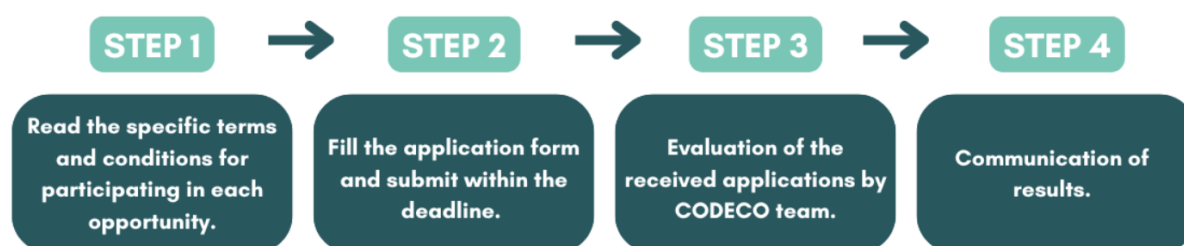
CODECO's Experimentation and Validation Challenges were designed to stimulate innovation by enabling external participants, including SMEs, researchers, developers and students, to propose and carry out validation and experimentation activities within the CODECO framework. Open for submissions between July 2025 and February 2026, it provided a structured opportunity for participants to engage with cutting-edge technologies and concepts defined by CODECO partners.

Overall IRCEP offered 12 challenges (Table 2), each led by a technical partner within the consortium, covering areas such as deployment and scalability, scheduling, data generation, placement strategies, benchmarking, secure connectivity, energy-awareness, and resilience. Also, the challenges spanned CODECO's main domains of Smart Cities, Manufacturing, Energy, and Mobility.

*Table 2. List of Experimentation and Validation Challenges and Lead Partners.*

Designation of the Challenge	Lead Partners
CODECO Data Generator #1	UPRC
CODECO Data Generator #2	UPRC
CODECO Energy Awareness Strategies	FOR
CODECO Intelligent Recommender #1: Load balancing with cross-layer RL optimization	i2CAT
CODECO Intelligent Recommender #2: Benchmarking across diverse vertical workloads	i2CAT
CODECO Resilience Strategies Evaluation	FOR
CODECO Secure Connectivity	UC3M and TID
[CODEF and Benchmarking] Dynamic Stress Testing	ATH and UPRC
[CODEF and Benchmarking] Security Mechanisms for CODEF	ATH and UPRC
[CODEF and Benchmarking] Testing, Debugging and AI-powered assistant	ATH and UPRC
Evaluate the CODECO SWM Scheduler	FOR
Deployment and Scalability of CODECO	ICOM

Stakeholders interested in participating in the IRCEP Challenges and in exploring and contributing to one (or more) of the Experimentation and Validation Challenge had to go through a structured, entirely online, [application and evaluation process](#) composed of four steps (Figure 9).



*Figure 9: IRCEP Challenges Application and Evaluation Process.*

In **STEP 1**, those interested had to read carefully the scope and instructions of the specific challenge(s), which were available at the dedicated page of IRCEP in project website<sup>8</sup>. Then, once decided to participate, **STEP 2** consisted in filling in an application form available in EUSurvey<sup>9</sup> (Figure 10), in which applicants had to provide their details and identify the IRCEP Challenge they were applying to, information about their relationship with CODECO and the

<sup>8</sup> <https://he-codeco.eu/ircep/ircep-challenges/>

<sup>9</sup> [https://ec.europa.eu/eusurvey/runner/CODECO\\_CHALLENGES](https://ec.europa.eu/eusurvey/runner/CODECO_CHALLENGES)



envisaged use of its framework. Besides, in order to access the CODECO Research Labs<sup>10</sup> where the challenges were hosted and be able to provide their contribution, applicants were required to sign and upload the Eclipse Contributor Agreement (ECA)<sup>11</sup>.

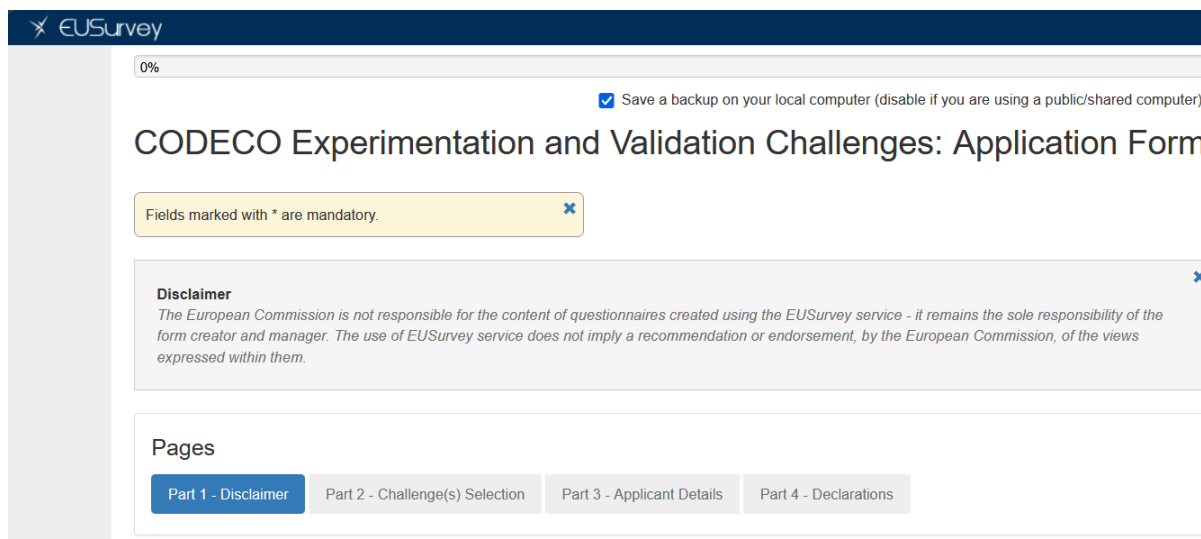


Figure 10: Header of the Application Form to participate in the IRCEP Challenges.

Then, upon the provision of their contribution and submission of their results, **STEP 3** focused on the assessment of the contributions in what concerns (i) Relevance; (ii) Impact and (iii) Expertise (Table 3) by the lead partner, which would then be validated by the project coordinator (FOR) and another independent member from the consortium. Lastly, in **STEP 4**, results were communicated to participants, including if they would receive an award on their contribution.

Table 3. Evaluation Areas of Experimentation and Validation Challenges.

Evaluation Area	Description
<b>Relevance</b>	Should assess how well the submission's design, methods, and outcomes align with the core objectives, questions and/or hypotheses of each challenge. This ensures the results will provide meaningful insights that are directly applicable.
<b>Impact</b>	Should assess the potential outcomes and long-term effects of the submission, focusing on how the results could influence the challenges' target areas. It considers the significance of the findings in terms of advancing knowledge or improving practices, as well as the scale of those effects.
<b>Expertise</b>	Should assess the level of knowledge, skill, and experience demonstrated to conduct, and interpret the challenge effectively. It evaluates whether the applicant possess the necessary technical and subject-matter expertise to ensure the validity, reliability, and credibility of the results.

For each IRCEP challenge, a maximum of three submissions would be awarded, with each selected submission receiving a financial award of €2,800. Next a brief description of each one of the challenges is provided.

### 3.4.1 CODECO Data Generator #1

UPRC invited participants to take part in the IRCEP Challenge focused on enhancing synthetic data generation for CRD (Common Resource Description) models. Participants would work with version 1 of the Synthetic Data Generator (SDG v1) in combination with the main version

<sup>10</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges>

<sup>11</sup> <https://www.eclipse.org/legal/ecla/>

of the Data Generator. The objective is to develop an improved version that integrates the synthetic data generation capabilities of SDG v1 with the real CODECO CRDs provided by the main Data Generator. The goal is to produce synthetic data that accurately mirrors the structure and content of real CODECO CRDs. Participants were expected to submit a comprehensive set of results, including validation metrics and supporting evidence, demonstrating the fidelity and effectiveness of the enhanced synthetic data generation process.

This challenge received five (5) registrations. Although three (3) participants had proceeded in the challenge and their projects were created in CODECO Research Labs<sup>12</sup>, they ended up not submitting any contribution, and therefore no awards were offered.

### **3.4.2 CODECO Data Generator #2**

In this challenge, participants were invited by UPRC to explore, install, and rigorously evaluate the CODECO Data Generator alongside other comparable workload data generation tools. The objective was to perform a detailed, hands-on comparison that highlights the strengths, weaknesses, and limitations of each tool.

Through this process, participants would contribute with valuable insights into the performance and capabilities of CODECO within real-world or simulated environments.

This challenge received twelve (12) registrations, and eleven (11) participants proceeded in the challenge with their projects being created in CODECO Research Labs<sup>13</sup>. At the end, only one (1) participant has submitted a contribution, which was assessed as being worthy of an award (see section 4.2).

### **3.4.3 CODECO Energy Awareness Strategies**

This challenge was defined and provided by FOR. It focused on the evaluation of the effectiveness of proposed energy-aware scheduling strategies within the CODECO framework, across several SMART goals.

Participants were tasked with comparing their solutions against two key baselines: i) the standard Kubernetes (K8s) scheduler and ii) KEIDS or similar energy-aware scheduling approaches.

This challenge received one (1) registration. Although the participant project had been created in CODECO Research Labs<sup>14</sup>, she ended up not submitting any contribution, and therefore no awards were offered.

### **3.4.4 CODECO Intelligent Recommender #1: Load balancing with cross-layer RL optimization**

This challenge focused on evaluating the generalization capabilities of the CODECO intelligent recommender by applying its core logic to the critical use case of application workload balancing across a cluster of nodes. The foundation for this work is the established multi-objective Reinforcement Learning (RL) solution, developed by the i2CAT Foundation, which models the task allocation problem using cross-layer performance metrics collected via Prometheus.

Participants would be tasked with three key objectives: (i) modeling the load balancing problem using the collected metrics, (ii) fine-tuning the existing RL model to improve the

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<sup>12</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-data-generator-1>

<sup>13</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-data-generator-2>

<sup>14</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-energy-awareness-strategies>



generated recommendations, and (iii) evaluating their optimized solution against the default Kubernetes scheduler.

This challenge received two (2) registrations. Although the participants projects had been created in CODECO Research Labs<sup>15</sup>, they ended up not submitting any contribution, and therefore no awards were offered.

### 3.4.5 CODECO Intelligent Recommender #2: Benchmarking across diverse vertical workloads

Proposed by i2CAT, this challenge was designed to assess the applicability and adaptability of the CODECO intelligent recommender when exposed to varied simulated workloads corresponding to applications from multiple sectors. The challenge leverages the core *Reinforcement Learning (RL)* model that drives the recommendation engine, coupled with a highly configurable simulated workload generator.

Participants were required to: (i) model the resource requirements (such as CPU and RAM usage) for applications mirroring at least two distinct domain verticals, and (ii) evaluate the quality and accuracy of the RL model's generated recommendations in comparison to a predefined set of baseline experiments.

This challenge received one (1) registration. Although the participant project had been created in CODECO Research Labs<sup>16</sup>, he ended up not submitting any contribution, and therefore no awards were offered.

### 3.4.6 CODECO Resilience Strategies Evaluation

This challenge was defined and provided by FOR. It aimed to evaluate the resilience strategies integrated into the CODECO framework, focusing on measuring resilience across several SMART goals.

Participants would assess the effectiveness of their proposed solutions by comparing them against two key baselines: i) CODECO without resilience and ii) the vanilla Kubernetes (K8s) scheduler.

This challenge received one (1) registration with the applicant proceeding in the challenge with the project being created in CODECO Research Labs<sup>17</sup> and submitting a contribution, which was assessed as being worthy of an award (see section 4.2).

### 3.4.7 CODECO Secure Connectivity

In this challenge, proposed by UC3M and Telefónica, participants were invited to explore and evaluate the CODECO Secure Connectivity module, focusing on ensuring secure, reliable communication in Edge-Cloud environments.

The goal is to assess its strengths and limitations by testing various configurations and strategies, ultimately contributing insights into the module's performance in real or simulated scenarios.

This challenge received one (1) registration. The applicant proceeded with the experimentation and validation of the challenge, yet she did not follow the procedures to

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<sup>15</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-intelligent-recommender-1-load-balancing-with-cross-layer-rl-optimization>

<sup>16</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-intelligent-recommender-2-benchmarking-across-diverse-vertical-workloads>

<sup>17</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-resilience-strategies-evaluation>

submit the contribution in the CODECO Research Labs<sup>18</sup>, which resulted in that no formal contribution was received, and therefore no awards were offered.

### **3.4.8 CODEF and Benchmarking Dynamic Stress Testing**

This challenge, coordinated by ATH and UPRC, aimed to rigorously evaluate the resilience and adaptability of CODECO-managed deployments under adverse conditions. The objective was to assess how effectively CODECO responds to disruptions proposed by participants, reconfigures resources, and maintains optimal service levels under pressure.

Participants would introduce artificial failures and resource bottlenecks using stress testing and chaos engineering tools - such as killing pods, saturating CPUs, or throttling network bandwidth.

This challenge received two (2) registrations. Although the participants projects had been created in CODECO Research Labs<sup>19</sup>, they ended up not submitting any contribution, and therefore no awards were offered.

### **3.4.9 CODEF and Benchmarking Security Mechanisms**

Proposed by ATH and UPRC, this challenge asked participants to focus on proposing and implementing comprehensive end-to-end security mechanisms for the CODEF framework. The objective was to enhance the security posture of CODEF by designing and deploying robust solutions that protect data, services, and system communications across the entire lifecycle.

Participants would evaluate and refine their security strategies to ensure that CODEF is resilient against potential vulnerabilities and attacks, while maintaining the integrity and availability of system operations. This challenge presented a unique opportunity to push the boundaries of security within dynamic, distributed environments.

This challenge received one (1) registration. Although the participant project had been created in CODECO Research Labs<sup>20</sup>, she ended up not submitting any contribution, and therefore no awards were offered.

### **3.4.10 CODEF and Benchmarking Testing, Debugging and AI-powered assistant**

The third challenge led by ATH and UPRC, aimed at participants exploring how the integration of AI/ML can enhance the CODEF framework's ability to perform testing, live debugging, and self-healing in real-time. The goal was to leverage intelligent automation to improve CODEF's robustness, enabling faster detection and resolution of issues.

By optimizing these capabilities, participants would work towards reducing the Mean Time to Repair (MTTR), ultimately increasing the overall reliability and efficiency of the system. This challenge invites participants to experiment with innovative AI/ML approaches that can transform how CODECO handles system failures and operational anomalies.

This challenge received one (1) registration. Although the participant project had been created in CODECO Research Labs<sup>21</sup>, he ended up not submitting any contribution, and therefore no awards were offered.

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<sup>18</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codeco-secure-connectivity-group>

<sup>19</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codef-and-benchmarking-dynamic-stress-testing>

<sup>20</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codef-and-benchmarking-security-mechanisms-for-codef>

<sup>21</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/codef-and-benchmarking-testing-debugging-and-ai-powered-assistant>

### 3.4.11 Evaluate the CODECO SWM Scheduler

This IRCEP Challenge<sup>22</sup>, proposed by FOR, was designed to assess the performance of CODECO's graph-based scheduling approach, specifically Seamless Workload Migration (SWM), by comparing it against two key baselines: the vanilla Kubernetes (K8s) scheduler and the Kubernetes network-aware scheduler. **No registrations were received to this challenge.**

### 3.4.12 Deployment and Scalability of CODECO

Provided by ICOM, this IRCEP Challenge<sup>23</sup> related to the deployment and scalability of CODECO in Kubernetes single-cluster environments of varying sizes. Evaluation was expected on deployment times, workflow execution times, and component-level latency analysis across different topologies, establishing a baseline comparison with plain Kubernetes equivalents. The analysis on scalability patterns should result in proposition for improvements for CODECO decision-making and scheduling in large clusters. **No registrations were received to this challenge.**

## 4 IRCEP Results and Awards

### 4.1 Results of IRCEP

Following the work undertaken in Task 7.2 to motivating external stakeholders in taking active participation in the IRCEP activities, Table 4 presents a summary comparison of planned versus actual outputs across the main dimensions of IRCEP.

*Table 4: IRCEP Planned vs. Actual Outputs.*

Output Dimension	Planned/Actual
Events with IRCEP awards	3 (HiPEAC, IETF, CONASENSE)
Local events organised	7 planned, 5 held, 2 cancelled
Experimentation and Validation Challenges	4 planned, 12 offered
Total challenge registrants	18 (27 individual selections)
Contributions to challenges formally submitted	2
Awards granted (Challenges)	2
Awards granted (Best Talk)	4 (3 at HiPEAC, 1 at CONASENSE)
Countries represented (challenge applicants)	4 (GR, ES, DE, NG)
Applied budget	16,800€ (16.8%)

The programme was able to gather the engagement of six (6) researchers in submitting a talk/presentation for events and 18 registrations of actors from various backgrounds to the IRCEP Challenges.

When analysing the registrations collected for the IRCEP Challenges, and because applicants were allowed to express interest in more than one challenge in the same submission form, the 18 registrations correspond to a total of 27 individual challenge selections, reflecting that each applicant has chosen in average of approximately 1.5 challenges. The registrations came from four different countries. Greece accounted for most of applicants, with 13 registrations (72%), followed by Spain and Germany with two (2) registrations each (11% each), and Nigeria with

<sup>22</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/swm-benchmarking>

<sup>23</sup> <https://gitlab.eclipse.org/eclipse-research-labs/codeco-project/ircep-challenges/deployment-and-scalability-of-codeco>



one (1) registration (6%). The geographic concentration in Greece is explained by the active involvement of the UPRC in IRCEP dissemination activities, which generated significant interest among its student community.

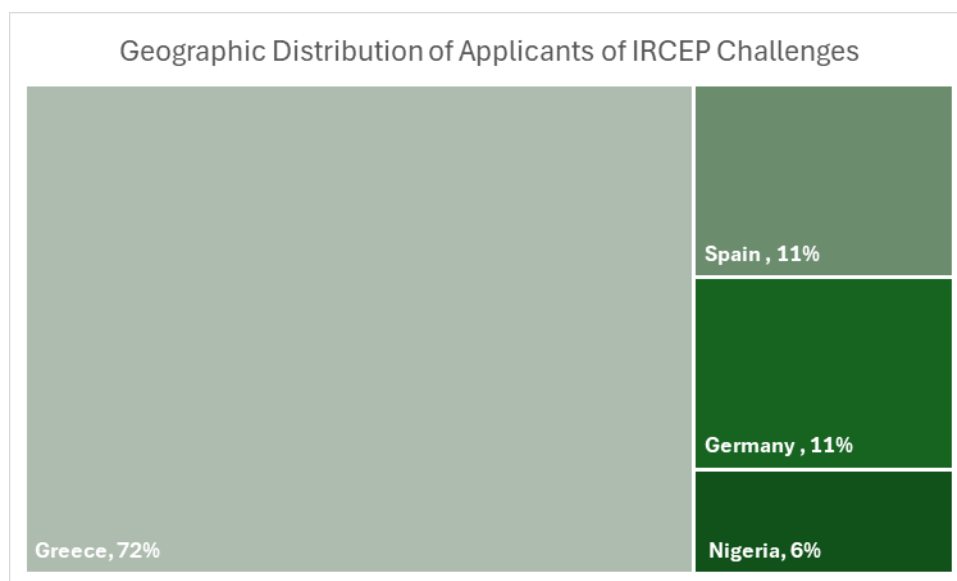


Figure 11: Geographic Distribution of Applicants of IRCEP Challenges

Concerning the applicant's relation to the main stakeholders of the CODECO project (Figure 12), it is verified that Developers were represented by six (6) applicants (33%), followed by Researchers with three (3) applicants (17%). Most of applicants came from nine (9) applicants that selected "other" (50%) and, as implicit above, indicated to be students.

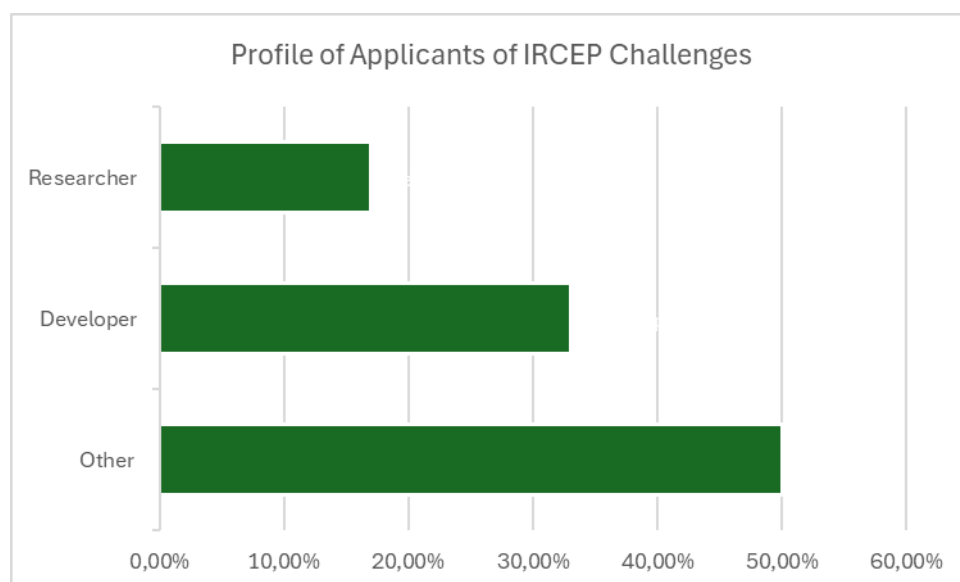


Figure 12: Profile of Applicants of IRCEP Challenges

The interest across challenges was clearly uneven (Table 5). The **CODECO Data Generator #2** challenge gathered by far the highest number of registrations, with 12 applicants selecting it, with the second most selected challenge, with five (5) applicants choosing it, was CODECO Data Generator #1. The remaining ten (10) challenges collectively received ten (10) selections. Two (2) challenges received no registrations: Evaluate the CODECO SWM Scheduler and Deployment and Scalability of CODECO.

Table 5. Registrations by Experimentation and Validation Challenge.

Designation of the Challenge	Number of registrations*	% of registrations
CODECO Data Generator #1	5	18,5%
CODECO Data Generator #2	12	44,4%
CODECO Energy Awareness Strategies	1	3,7%
CODECO Intelligent Recommender #1: Load balancing with cross-layer RL optimization	2	7,4%
CODECO Intelligent Recommender #2: Benchmarking across diverse vertical workloads	1	3,7%
CODECO Resilience Strategies Evaluation	1	3,7%
CODECO Secure Connectivity	1	3,7%
[CODEF and Benchmarking] Dynamic Stress Testing	2	7,4%
[CODEF and Benchmarking] Security Mechanisms for CODEF	1	3,7%
[CODEF and Benchmarking] Testing, Debugging and AI-powered assistant	1	3,7%
Evaluate the CODECO SWM Scheduler	0	0%
Deployment and Scalability of CODECO	0	0%

\*Number of registrants selecting each challenge (multiple selections allowed)

In terms of how applicants envisioned using the CODECO framework, and as multiple selections were allowed (Figure 13), the most frequently selected option was **"Interested in the architectural design"** (10 selections, 45%), followed by "Will reuse or contribute to a specific component" (5 selections, 23%), "Other" (4 selections, 18%), and "Interested in reusing the framework" (3 selections, 14%). These results suggest that most of applicants were in an exploratory phase, seeking to understand the CODECO architecture, rather than having a fully defined use case ready for implementation.

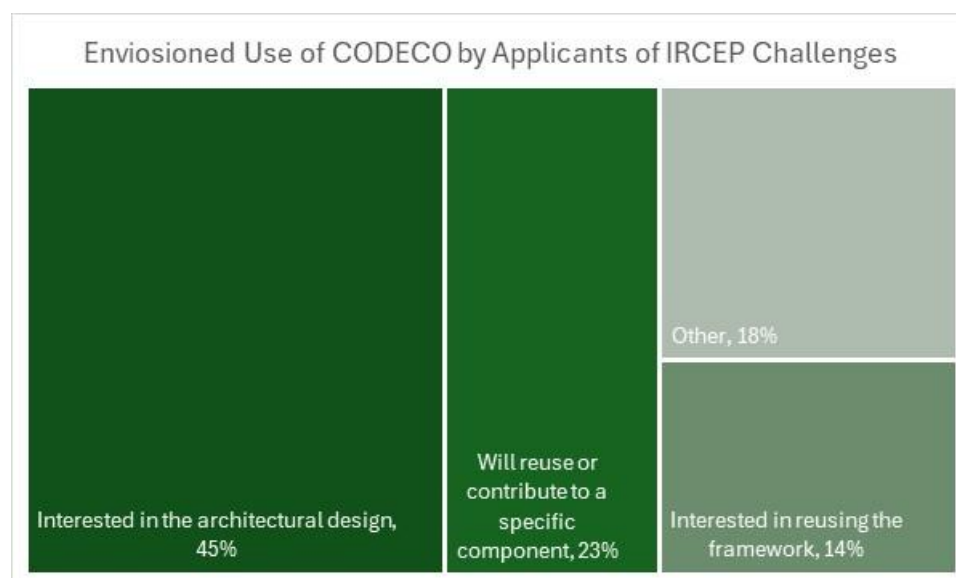


Figure 13: Envisioned use of CODECO by Applicants of IRCEP Challenges

Despite the 18 registrations received, the conversion rate from registration to completed and formally submitted contribution was low. Of all registered applicants, only 2 successfully submitted a contribution that met the evaluation criteria and was judged worthy of an award. This represents a completion rate of approximately 11%. **With an initial budget allocation of 100.000€, by offering six awards throughout its implementation the IRCEP programme has provided a total of 16.800€, which represents 16.8% of the overall funds available.** The remaining 83,200€ was not used, as the number of award-worthy contributions



across all activities fell substantially below the maximum number of awards the programme was designed to support. This unspent allocation was not redirected but remained within the project budget; the consortium acknowledges this outcome and highlights it as a key input to inform the sizing and design of similar initiatives in future projects.

Table 6 summarizes the participant journey through the IRCEP Challenges as a conversion funnel, from initial registration through to award. Of the 18 unique registrants who collectively selected 27 individual challenges, 16 (~89%) proceeded to create a project in the CODECO Research Labs. However, only three (3) participants attempted to submit a contribution, of whom two (2) completed a formal submission meeting the evaluation criteria — yielding a challenge completion rate of approximately 11%. This drop-off between project creation and submission is the most significant gap in the programme's performance and reflects the combined effect of technical complexity, insufficient mentoring continuity, and the late-stage timing of the initiative.

*Table 6: IRCEP Challenges Participant Conversion Funnel.*

Step	Stage	Count	% of Registrants	Drop-off
1	Registered and submitted application form	18 registrants / 27 selections	100%	—
2	Created project in CODECO Research Labs	16 registrants / 24 projects	~89%	-2
3	Produced and attempted to submit a contribution	3 (incl. 1 informal submission)	~17%	-13
4	Formal submission received and evaluated	2	11%	-1
5	Awarded	2	11%	n.a

A process vulnerability is illustrated by the Secure Connectivity challenge, where one (1) participant completed the experimentation work but did not follow the formal submission procedure in the CODECO Research Labs. As a result, no contribution was formally received, and no award could be granted. This is a distinct failure mode from lack of effort: the participant engaged substantively with the challenge but was lost at the submission stage. Future programmes should implement active submission reminders, a deadline confirmation step, and a brief submission guide to prevent this type of drop-off.

Regarding the two challenges that received no registrations — Evaluate the CODECO SWM Scheduler (FOR) and Deployment and Scalability of CODECO (ICOM) — the absence of interest warrants analysis. The SWM Scheduler challenge required familiarity with a highly specialised graph-based scheduling approach and comparison with a network-aware Kubernetes scheduler, representing a significant technical threshold for external participants unfamiliar with the CODECO internals. The Deployment and Scalability challenge, while broader in scope, was led by a partner (ICOM) that did not organise a local event, which, given that locally hosted events were the primary driver of registrations (as evidenced by UPRC's success), may have been a contributing factor. Both challenges should be reviewed for accessibility and promotion strategy in any future iteration.

## 4.2 Awards provided

In total and as provided in Table 7, IRCEP provided a total of six awards, each of an amount of 2.800€, within the scope of three activities promoted during the lifespan of CODECO project. Four (4) researchers were awarded with the Best Talk Award within two events held by CODECO, as described next.

*Table 7. Recipients of the IRCEP Best Talk Award.*



Event	Awardee	Contribution
ML4ECS, HiPEAC 2025	Georgia Christofidi	Talk on <i>CaRE: Towards Carbon and Resource Efficient Orchestration at the Cloud-Edge Continuum</i>
	Francisco Alvarez Terribas	Innovative approach in <i>Scheduling Inference Workloads on Distributed Edge Clusters with Reinforcement Learning</i>
	Anastassios Nanos	Presentation on <i>Scalable and Lightweight Cloud-Native Application Sandboxing</i> .
15th CONASENSE Workshop	Paulo Sergio Rufino Henrique	Paper: “ <i>Designing for 6G Adoption: A Market-Driven Framework for Trustworthy, Personalized, and Inclusive Next-Gen UX</i> ”

Two (2) young developers were awarded with the IRCEP Challenge Award based on their contribution to two technical challenges proposed by CODECO consortium (Table 8), as described next.

Table 8. Recipients of the IRCEP Challenge Award.

Challenge	Awardee
CODECO Resilience Strategies Evaluation	Pia Röttcher
CODECO Data Generator #2	Ilias Georgiou

**Pia Röttcher – CODECO Resilience Strategies Evaluation (FOR).** Pia Röttcher (undergraduate student, Applied Sciences University of Munich, Germany) engaged with the CODECO Resilience Strategies Evaluation challenge, which was designed to assess the effectiveness of resilience mechanisms integrated into the CODECO framework across a set of SMART goals. The challenge required comparing proposed solutions against two baselines: CODECO without resilience enabled, and the vanilla Kubernetes (K8s) scheduler. Her contribution demonstrated measurable improvements in system recovery behaviour and resilience performance within the CODECO environment, and her submission was assessed by the lead partner (FOR) as meeting all three evaluation dimensions: Relevance, Impact, and Expertise. This contribution represents the only validated technical output of the FOR-led challenges within IRCEP and provides a concrete external evaluation of one of CODECO’s key scheduling capabilities.

**Ilias Georgiou – CODECO Data Generator #2 (UPRC).** Ilias Georgiou participated in the CODECO Data Generator #2 challenge, which invited participants to install, explore, and rigorously benchmark the CODECO Data Generator against comparable workload data generation tools. His contribution involved a detailed, hands-on comparative analysis highlighting the strengths, limitations, and performance characteristics of the CODECO tool in real-world or simulated scenarios. He was the sole participant among eleven who created a project in CODECO Research Labs to complete and formally submit a contribution for this challenge. His submission was evaluated by UPRC as producing valuable and credible insights into the performance of the CODECO Data Generator relative to alternative tools.

## 5 Data Management and Ethics

All data gathered during the implementation of IRCEP was processed and stored according to the conditions set out under the project’s official Data Management Plan [2][3]. Data provided and shared by applicants was only used for the purpose of analysing the received forms and proceeding with the evaluation procedures as well as being stored and preserved for reporting purposes directly connected to IRCEP and CODECO project. Moreover, only the data needed to carry out the defined purpose was utilized and only for the strictly needed

period for such. Data that was collected during the IRCEP implementation was handled in line with the highest ethical standards and the applicable EU, international and national law on ethical principles. Procedures described in CODECO *D1 - Handbook and Gender-Neutral Guidelines* [4] were applied.

To ensure GDPR compliance, no data was collected or used without the explicit informed consent of the subjects (e.g., users) concerned. In this direction, users/subjects providing data signed a proper informed consent form. The form made explicit for what purpose data was being collected, who had access to the collected data, as well as for how long the data would be securely stored and subsequently deleted. Users/subjects are also free to access their own data whenever they like (or even revoking it). This empowered the participants involved to make a voluntary informed decision about whether to participate in CODECO processes based on knowledge of the scope, purpose, procedures, and outcomes of the project.

Moreover, the Code of Conduct for IRCEP established guidelines to ensure ethical, respectful, and productive collaboration among all participants. Core principles included respect, integrity, and inclusivity. Participants must respect diverse perspectives, backgrounds, and expertise, fostering an environment where every voice is valued. Integrity is crucial, requiring participants to adhere to honest and transparent practices in their research, reporting, and interactions. Inclusivity mandates the active engagement of all community members, ensuring that the benefits and burdens of innovation and research are equitably shared. Confidentiality is also emphasized, with participants expected to protect sensitive information and intellectual property, respecting the privacy and contributions of all parties involved. Finally, the Code encouraged the dissemination of findings in accessible formats (open source), promoting broad understanding and the potential for real-world applications.

## 6 Lessons Learned and Summary

IRCEP was conceived as a mechanism to extend the project's ecosystem beyond the consortium, fostering collaboration and experimentation among SMEs, researchers, early developers, and students. Over the course of its implementation, from April 2024 (M16) through March 2026 (M39), IRCEP delivered a set of activities across two main paths: contributions to events and participation in technical experimentation and validation challenges.

The dissemination strategy for IRCEP, combined a dedicated website, social media posts, webinars, and partner-driven promotion, helping reach audiences across multiple geographies and research domains. The programme's dedicated section on the project website attracted over 1,500 visitors, with 78% of visits focused on the IRCEP Challenges, reflecting interest from the wider community. Social media engagement was also significant, with posts reaching relevant professional communities through LinkedIn and the networks of all consortium partners. Organisation and participation in events, in which IRCEP was diffused and explained (e.g., HiPEAC 2025, the IETF 123 Hackathon, and the CONASENSE 2025 Workshop), proved to be effective measures to creating direct, in-person connections with the target communities. These events enabled meaningful scientific exchange, provided visibility for the CODECO framework, and were instrumental in identifying and attracting potential participants for the IRCEP opportunities.

Concerning the design and structure of the IRCEP Challenges initiative, the consortium, under the lead of INO, has conceived a well-structured application and evaluation process, supported by a dedicated form, evaluation criteria, and the CODECO Research Labs environment. Yet, the conversion rate from registration to completed contribution was low, as from all the registrations received in this initiative, only two (2) that proceeded with a formal submission of a contribution were awarded. This result brings lessons learned that are relevant to express:



- **Timing:** the initiative was launched in July 2025, when the CODECO framework was considered “ready” for experimentation by external parties. It remained open for eight (8) months, benefiting from the extension of the project duration. By the time the initiative was gaining traction among the CODECO communities, the project ended. Launching similar initiatives earlier in the project, even if the experimentation settings are not fully “ready”, could have resulted in additional registrations, as well as a higher number of actual contributions to the CODECO framework.
- **Technical complexity:** the challenges required participants to set up and interact with the CODECO framework, which presented a learning curve for external participants with no prior experience with the components and technologies. More structured onboarding materials and closer (and longer) mentoring from technical partners in charge of the challenges could improve completion rates.
- **Clear participation and submission process:** one (1) participant in the CODECO Secure Connectivity challenge completed the experimentation work but did not follow the formal submission procedure, resulting in no contribution being received and no award being granted. Although a submission guide was available from the launch of the initiative, the programme would have benefited from proactive reminders near the deadline or from a check-in by the lead partner to confirm participants have formally submitted their contribution.
- **Targeted dissemination and outreach:** despite the promotion made by the project on this initiative, two (2) challenges did not receive any registration, and most received only one (1) application. Enhanced targeted and strategic outreach, such as through academic networks or direct approaches to research groups, could contribute to increase interest and engagement of external stakeholders.

By the end of the project, IRCEP awarded a total of six (6) prizes, each valued at 2,800€, across different activities. Four researchers received the Best Talk Award at two CODECO-organised events (ML4ECS at HiPEAC 2025 and the 15th CONASENSE Workshop 2025), while two developers were recognised with the IRCEP Challenge Award for their technical contributions to the CODECO Resilience Strategies Evaluation and CODECO Data Generator #2 challenges.

IRCEP demonstrated that EU-funded research projects can create structured, replicable mechanisms for external community engagement that meaningfully extend a project’s ecosystem beyond its consortium. The programme successfully reached stakeholders across four countries, attracted over 1,500 unique visitors to its dedicated website section, and fostered direct technical engagement through seven local events, an online webinar, and participation in internationally recognised venues such as HiPEAC and the IETF Hackathon. These activities stimulated scientific exchange on Edge-Cloud continuum topics and raised the visibility of the CODECO open-source framework among SMEs, early developers, researchers, and students.

While the overall conversion rate from registration to awarded contribution was modest – reflecting the inherent complexity of engaging external participants with an advanced research framework within the constraints of a fixed project timeline – the programme nonetheless produced tangible results: two validated technical contributions to the CODECO framework and four recognised research presentations, for a total of six awards valued at 2,800€ each. The low utilisation of the available budget (16.8% of the total 100,000€ allocation) underscores the need for earlier programme launch, more sustained mentoring, and more targeted outreach strategies in future initiatives of this kind.

The four principal lessons for future community engagement programmes are: (1) launch the programme as early as possible in the project lifecycle, even before all experimentation environments are fully stabilised, to maximise the window of engagement; (2) invest in structured onboarding and sustained, hands-on mentoring from technical partners to reduce



the learning curve for external participants; (3) provide clear and transparent guidelines on procedures for participation, including reminders and check-ins throughout the process, and (4) adopt targeted, channel-specific outreach – including direct approaches to academic networks and research groups – rather than relying solely on broad dissemination to attract motivated and prepared contributors.



## References

- [1] Monteiro, P., Leal, A. S., & et, . al . (2024) D27: CODECO Innovation and Research Community Engagement Programme intermediate version. Zenodo. <http://doi.org/10.5281/zenodo.13839742>
- [2] Vitor Vieira (Ed.). (2023). CODECO D2: Data Management and Ethics Handling v1.0 (1.0). Zenodo. <https://doi.org/10.5281/zenodo.7940385>.
- [3] Leal, A. S., & et, . al . (2024). CODECO D3 - Data Management and Ethics Handling 2.0. Zenodo. <https://doi.org/10.5281/zenodo.13839640>
- [4] Rute C. Sofia (Ed.). (2025). CODECO D1 - CODECO Handbook and Gender-Neutral Guidelines. Zenodo. <https://doi.org/10.5281/zenodo.14973298>

