D5.3 Report on improvements made in the co-creation instruments

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BoostEuroTeQ
Strengthening institutional transformations for responsible engineering education in Europe
How can technical universities help to create a workforce that meets the challenges of complex global problems that cut across technology and society? How can we support the professional development of future engineers? How can we effectively upscale co-creation teaching practices?
These are some of the questions we aim to address in BoostEuroTeQ – a scientific research project funded by EU Horizon 2020. As a complementary project of the Erasmus+ funded EuroTeQ Engineering University our goal is to encourage institutional change towards responsible research and innovation. The multidisciplinary project brings together engineering education, philosophy, ethics, and science and technology studies.
Over the course of three years (2021-2024) we will work on two main dimensions
Boost EuroTeQ
Enabling individuals
Supporting the lifelong learning journey of European professionals by conceptualising new professional profiles
Analyse the developmental needs of the engineers of the future
Develop a strategy for the upskilling of professional engineers at universities
Create tailor-made training programms in close collaboration with institutional and industry partners
Conceptualise training for Learning Professionals with the aim to qualify them as specialists in the scientific upskilling of engineers
Societal transformation
Augmenting the transformative potential of universities in society by investigating co-creation practices and developing context-sensitive strategies for their reflexive institutionalization
Create a EuroTeQ Co-Creation Manifesto on institutional strategies that will enhance the evolution of responsibility practices at technical universities
Support the development of learning networks to increase co-creation practices in each community
Conduct stakeholder engagement events on responsibilisation instruments at EuroTeQ partner universities
Investigate the benefits and challenges as well as identify potential indicators for successful co-creation teaching at universities
Develop a roadmap for the upscaling of co-creation teaching practices

EXECUTIVE SUMMARY

The BoostEuroTeQ project's Work Package 5 (WP5) focused on enhancing co-creation instruments at EuroTeQ alliance universities. Aimed at fostering sustainable collaboration and learning networks, WP5 is concerned with enabling the development of "connecting communities" as long-term partnerships and involved activities such as workshops and a SWOT analysis of existing responsibilisation tools. The project emphasized engaging diverse societal segments in technology development and recognized the need for context-sensitive approaches due to varied societal structures across Europe. Activities were structured in three stages: observations, experimental interventions, and policy analysis. For the first stage, we studied existing educational activities related to co-creation to integrate the study into a comparative case study design with a constructionist version of the grounded theory (GT) approach and interpretive cultural and policy analysis. For the second stage of experimental interventions, we developed experimental interventions for selected cases, proposing tentative implementations based on prior comparative work across EuroTeQ institutions. Finally, for the third stage, we adopted an interpretive/deliberative policy approach, diverging from traditional policy-making models to focus on the impact of cultural diversity, socio-technical complexity, and transnational arrangements on national policy formation; the activity involved the publication of scientific publications. Key improvements included better stakeholder engagement, new tools, evaluation networks, and a focus on sustainability. The project advanced co-creation through flexible, inclusive approaches and grounded theoretical foundations, facilitating meaningful societal impact and collaboration.

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1. INTRODUCTION

The BoostEuroTeQ project, particularly Work Package 5 (WP5), aimed to enhance co-creation instruments within the partner universities of the EuroTeQ alliance. This involves fostering sustainable collaboration, creating learning networks, and developing long-term partnerships between universities and their surrounding communities. This report outlines the improvements made to co-creation instruments following insights derived from a series of dedicated workshops and a comprehensive SWOT analysis of existing responsibilisation instruments at EuroTeQ universities.

This work package was based on recognizing the importance of engaging all segments of society in technology value-creation processes, including developers, producers, users, civil society, and policymakers. Despite differing societal structures and traditions across our partner universities, we built on the power of a situated approach to navigating the science-society interface. While Europe shares common values, each country possesses unique features, necessitating a nuanced understanding of value-creation processes.

Our consortium's collective expertise allowed for comparative analysis and assessment of activities within the EuroTeQ Engineering University, shedding light on the benefits of international collaboration for diverse societies. Rather than forming an exclusive club to bolster individual strengths, our aim was to facilitate collaboration that serves as a catalyst for deeper societal understanding.

Through collaboration with our partner universities, we hope to have generated insights applicable to university networks across Europe and beyond, fostering cross-cultural dialogue and mutual understanding among national societies and societal layers. Our vision extends beyond traditional network models, aiming to foster a collaborative ecosystem that transcends boundaries and enriches societal discourse.

The Industrial Engineering & Innovation Sciences department at TU/e led WP5 of the BoostEuroTeQ project. The main objectives were to support sustainable collaboration and connect various communities, including citizens, companies, researchers, and public servants. Work Package 5 emphasizes supporting emerging or existing co-creative efforts within the Erasmus+ modules "EuroTeQ Collider" and "EuroTeQ Connector," with the goal of fostering sustainability and promoting long-term partnerships. A series of stakeholder workshops were fundamental to this process, with the following key objectives:

- Engage co-creation partners in discussions about co-creative instruments.
- Establish networks for exchanging evaluations between EuroTeQ partners.
- Explore possible improvements to the co-creation instrument.

This deliverable builds on the outcomes of Deliverable 5.1, which conducted a SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats) of responsibilization instruments and co-creation communities at EuroTeQ partner universities. Deliverable 5.1 identified various communities and instruments of co-creation and responsibilization and created a database that served as the foundation for Deliverable 5.2, in which we reported the various workshops and further co-creation activities of WP5. The workshops conducted as part of WP5 and its utilized framework were informed by the theoretical foundations established in Work Package 4.

2. THREE STAGES OF WP5

The WP5 advanced through three stages:

Stage 1: Observations

In the initial phase of the project, we adopted a standard research design for interpretative qualitative social science research, complemented by a comparative case study approach. The term "case study" refers to the study of specific instances of co-creative institutional practices in particular locations, such as how Erasmus+ instruments are implemented at TUM, or the existing educational activities related to co-creation. We integrate this comparative case study design with a constructionist version of the grounded theory (GT) approach and interpretive cultural and policy analysis. Mapping techniques aid in visualizing diverse aspects and elements in our cases to facilitate comparative thinking. Field access, data collection, and analysis were facilitated by direct cooperation with EuroTeQ partner universities involved. These observations were recorded in Deliverable 5.1, which provided a SWOT analysis of co-creation communities and instruments, identifying strengths, weaknesses, opportunities, and threats within these systems.

Stage 2: Experimental Interventions

Controlled experiments guided our research in Stage 2. Given that the engineering universities in our consortium are project partners, we engage in "co-laboration" to underscore both collaborative and laboratory relationships between social scientists and engineering partners. This approach ensures that translational co-creation is not only tested but also put into experimental practice. Emphasizing a pragmatist understanding of experimentation, our aim was to change practitioners' practices and knowledge. Building on Stage 1 findings, we developed experimental interventions for selected cases, proposing tentative implementations based on prior comparative work across EuroTeQ institutions. These experiments aim to improve translational co-creation instruments by demonstrating their effects under varying conditions. Social learning among involved actors and reflexivity to improve the experimentation process are central. Collective learning processes characterize co-experiments, and we assess the effects of interventions using qualitative analysis, entwining reflexivity and intervention in an empirical analysis-dialogue process. Deliverables 5.2 reported in-depth the various interventions conducted, most importantly in the form of stakeholder workshops. These workshops were conducted in two phases:

First Phase:

- Each university in the consortium conducted workshops within their institutions, with TU/e playing a leading role by providing tools and formats.
- Workshops aimed at engaging students, mentors, and other stakeholders involved in "EuroTeQ Collider" events. The approach sought to determine the unique aspects of the Collider and its potential as a CBL (Challenge-Based Learning) format for alliance building.

Second Phase:

- The approach became more flexible, allowing for diverse participant involvement. Opportunities were utilized to facilitate discussions aimed at improving mechanisms across EuroTeQ partner universities. This included organizing additional workshops and collaborating on those organized as part of other Work Packages.
- Other identified instruments from Deliverable 5.1 were incorporated into activities, including a workshop with four universities (TalTech, CTU, TUM, and TU/e).

First Phase Workshops Conducted:

- 22nd February 2023 (CTU): Discussed feedback among stakeholders in the EuroTeQ Collider.
- 20th March 2023 (TU/e): Set up templates for subsequent workshops using "5 bold steps vision" and "sun behind the mountain" templates.
- 18th April 2023 (DTU): Focused on integrating EuroTeQ initiatives and addressed visibility challenges.
- 21st April 2023 (TalTech): Evaluated the Collider and discussed improvements.

Second Phase Workshops:

- 15th June 2023 (CTU): Discussed opportunities and challenges in implementing CBL into curricula.
- 27th November 2023 (TU/e): Explored advantages of university alliances in co-creation and stakeholder engagement.
- 22nd February 2024: Online workshop involving Formula Student engineering design competition teams.
- 26th February 2024: Workshop to discuss a roadmap for co-creation teaching in EuroTeQ universities.

Stage 3: Policy Analysis

In this project phase, we adopt an interpretive/deliberative policy approach, diverging from traditional policy-making models to focus on the impact of cultural diversity, socio-technical complexity, and transnational arrangements on national policy formation. Our aim is to leverage the insights gained from policy analysis and co-creation studies to construct a Roadmap for 'Co-creative Teaching in EuroTeQ Universities' (WP6). Additionally, our scientific publications (see summaries below) contain an in-depth evaluation of the observations and interventions carried out.

The roadmap serves as a bridge between research and technology development outcomes and the systemic framework of policy-making and institutional change. Drawing from innovation policy road mapping (IPRM) and architectural frameworks for road mapping, we emphasize key elements, including overarching visions, drivers and barriers, policy instruments and regulatory changes, sectoral developments, temporalities, and resources. Specifically, we address questions such as the desired impact of co-creative education in EuroTeQ Universities, factors influencing successful implementation of co-creative teaching methods, policy instruments shaping co-creative learning, sectoral developments influencing dissemination of co-creative practices, the role of path-dependencies and expectations, and

resource allocation for co-creation initiatives. Through this comprehensive roadmap, we aim to inform forward-looking policy design and institutional change processes to promote co-creative teaching methods within EuroTeQ Universities.

3. ACTIVITIES

Observed Improvements in Co-creation Instruments

1. Enhanced Stakeholder Engagement

One of the significant improvements was the enhanced engagement of various stakeholders, including students, mentors, and external partners. The workshops provided a platform for these stakeholders to share their experiences and suggestions, leading to a more inclusive approach to co-creation. The diverse perspectives gathered during these workshops helped identify gaps and opportunities for enhancement.

2. Development of Evaluation Networks

The establishment of evaluation networks across EuroTeQ partners was another critical improvement. These networks facilitated the exchange of best practices and collaborative evaluation of co-creation instruments. This collaborative approach ensured the improvements were well-informed and broadly applicable across different institutional contexts. We conceptualised evaluation and learning networks in a scientific publication (The role of universities and their alliances: the case of the EuroTeQ alliance).

3. Adoption of New Tools and Frameworks

The workshops introduced and refined several tools and frameworks, such as the "Five Bold Steps Vision Canvas" and "Sun Behind Mountain Vision Canvas". These tools helped structure the co-creation processes and provided clear, actionable steps for stakeholders. Adopting these tools across different universities ensured a standardized approach to co-creation, making the process more efficient and effective.

4. Focus on Sustainability

A key focus of the improvements was on ensuring the sustainability of co-creation instruments. This involved integrating sustainability principles into the design and implementation of these instruments. For example, efforts were made to ensure that the collaborations formed during the workshops could continue beyond the project timeline, fostering long-term partnerships and ongoing innovation.

5. Increased Flexibility and Adaptability

The second phase of the workshops introduced a more fluid and flexible approach, allowing for diverse forms of engagement and participation. This adaptability helped in accommodating different schedules and availability of participants, thereby increasing the overall participation rate and the richness of the data collected. The flexible approach also enabled the incorporation of feedback from ongoing activities, ensuring continuous improvement.

6. Integration of Theoretical Foundations

The improvements were also guided by the theoretical foundations laid out in previous work packages. This ensured that the co-creation instruments were not only practical but also grounded in robust academic research. The integration of these theoretical insights helped in designing more effective and impactful co-creation processes. See in particular the scientific publications described below (Does entrepreneurship belong in the academy? Revisiting the idea of the Univeristy; Responsilibity in University Ecosystems and Challenge Based Learning).

Workshop: Compete or Co-create? Co-creation in the context of university alliances

How to improve co-creation instruments was the focus of discussion during a workshop held at TU Eindhoven on November 27th-28th, 2023. Throughout the meeting, attendees explored the role of university alliances within the broader European and global context. Prof. Paul Koenraad, dean of the graduate school at TU/e, emphasized the importance of collaboration among EuroTeQ universities, particularly in facilitating dialogue on stakeholder engagement. He highlighted the crucial role of entrepreneurial learning for students in such engagements and discussed the utilization of Challenge-Based Learning as an effective pedagogical approach to addressing contemporary challenges. Prof. Sebastian Pfotenhauer from TUM supplemented this perspective by emphasizing the need for empirically grounded research on stakeholder engagement activities. As universities are increasingly called upon to promote co-creation activities, there is a need to align practical approaches with research on addressing the key challenges associated with such activities. This includes considerations on how to sustain meaningful engagement with stakeholders and mitigate the risks of linear "scaling up," which may lead to the loss of contextual sensitivities.

These insights sparked thoughtful discussions among the audience. One participant from Eindhoven sought clarification on the distinction between co-creation, highlighted by Sebastian Pfotenhauer, and CBL. It was clarified that while CBL focuses on experiential learning with real-world cases to address contemporary challenges through multidisciplinary teamwork, co-creation stems from a different tradition. Co-creation is concerned with the challenges, pitfalls, and advantages of public participation in science and technology development, with a particular emphasis on social justice, responsibility, and inclusion.

Other participants raised questions about whether university alliances would replace competition. While some believed that international alliances offer exclusive benefits by eliminating national competition for funds, others questioned whether European alliance initiatives could fully address competition concerns. A central theme emerged regarding Europe's position in the face of growing technological competition between China and the US, with a desire for alliances to foster broader perspectives. Proposed pathways forward included fostering greater openness for mutual learning among EuroTeQ universities, viewing the "elite" label as a point of constructive exchange rather than a final goal, and advocating for collaborative efforts based on thematic alignment across universities.

Scientific Publication: Responsibility in University Ecosystems and Challenge Based Learning

Fuchs, L., & Bombaerts, G. (2022). Responsibility in university ecosystems and challenge based learning. In *2022 IEEE Global Engineering Education Conference (EDUCON)*. IEEE.

This article establishes the theoretical foundations for understanding the role of challenge-based learning (CBL) in co-creation activities at universities by emphasizing the collaborative nature and the societal impact of such educational practices. The authors discuss how CBL integrates complex, sociotechnical innovation challenges into the curriculum, aiming to address the global challenges of the 21st century. This pedagogical approach is seen as crucial for fostering responsible engineering education and innovation.

The article posits that university alliances, like the EuroTeQ Collider, serve as learning networks that enhance the co-creation process. These alliances facilitate the exchange of knowledge, strategies, and moral reflexivity among participating institutions, which is essential for adapting to new societal demands. The EuroTeQ Collider initiative, in particular, is highlighted as a case study demonstrating the practical implementation of CBL across multiple universities. This initiative involves students, academic staff, and external stakeholders working together to solve real-world problems, thereby illustrating the potential of CBL to foster interdisciplinary collaboration and innovation.

These insights reveal the challenges and successes of implementing CBL in different institutional contexts. For instance, the article notes that while some universities struggled with student engagement due to unfamiliarity with the format and lack of credit recognition, others with more experience in CBL saw higher participation and smoother implementation.

Scientific Publication: Does Entrepreneurship belong in the Academy? Revisiting the Idea of the University

Fuchs, L., Bombaerts, G., & Reymen, I. (2023). Does entrepreneurship belong in the academy? Revisiting the idea of the university. *Journal of Responsible Innovation*, *10*(1).

This publication explores academic entrepreneurship and co-creation within research-oriented universities and delves into the intricate balance between collaborative endeavors and the foundational principles of higher education. It scrutinizes how universities can maintain their core values while actively engaging in co-creative activities.

The discussion begins by dissecting the relationship between academic entrepreneurship and the traditional ideals of universities. It elucidates how “third mission activities,” initially perceived as an adjunct to the core functions of research and education, have evolved into a more integral aspect of university activities. By embracing a broader perspective of co-creation, universities can actively contribute to societal needs while staying true to their research-oriented mission. This evolution prompts a critical examination of the potential tensions between collaborative pursuits and the fundamental goals of universities, particularly in light of the increasing emphasis on societal impact and engagement.

The paper also discusses institutional requirements necessary for universities to successfully navigate the terrain of co-creation while upholding their research-oriented ethos. It underscores the significance of institutional agency in ensuring universities retain autonomy, discretion, and a long-term perspective in their collaborative endeavors. Autonomy allows universities to make decisions aligned with their research priorities, free from external pressures or short-term financial considerations. Discretion enables researchers to exercise their expertise creatively, fostering an environment conducive to innovation and exploration. Moreover, maintaining a long-term horizon acknowledges the inherent value of co-creation beyond immediate outcomes, emphasizing the importance of sustained investment and planning. Additionally, the discussion highlights the need for robust evaluation methods that go beyond simplistic metrics, acknowledging the multifaceted contributions of co-creation to research, education, and society.

The theoretical and practical challenge for Engineering Universities lies in reconciling the pursuit of co-creation with the enduring principles of research-oriented universities. It advocates for a nuanced approach that acknowledges the evolving landscape of higher education while preserving the integrity of academic research and scholarship. By fostering a research-oriented vision of co-creation, universities can leverage their unique position to drive collaboration, address societal challenges, and contribute meaningfully to the advancement of knowledge. This entails striking a delicate balance between collaborative activities and the core values of research, education, and intellectual inquiry that define the essence of universities.

Scientific Publication: The societal role of universities and their alliances: the case of the EuroTeQ Engineering University

Fuchs, L., Cuevas-Garcia, C., & Bombaerts, G. (2023). The societal role of universities and their alliances: the case of the EuroTeQ Engineering University. *Tertiary Education and Management*, *29*(3).

The role of universities has expanded beyond traditional education and research to include co-creation activities that involve collaboration with external stakeholders. This publication outlines the key improvements and strategies identified from the EuroTeQ Collider, emphasizing the importance of learning networks, stakeholder engagement, and adaptive strategies for co-creation.

One of the primary improvements highlighted is the establishment of learning networks within university alliances. These networks facilitate the sharing of knowledge, experiences, and strategies among partner universities, thereby enhancing the co-creation process. Regular online meetings among organizers from different universities played a crucial role in this regard. These meetings allowed for the exchange of best practices, discussion of thematic orientations, and overcoming local implementation challenges. Such interactions are vital for universities with varying levels of experience in co-creative teaching to learn from each other and adopt successful strategies.

Effective stakeholder engagement emerged as a critical component of successful co-creation. The EuroTeQ Collider project demonstrated that involving external stakeholders, such as companies and NGOs, in the challenge-based learning process enriches the educational

experience and ensures that the challenges addressed are relevant and impactful. However, the experience level in working with stakeholders varied significantly among universities. Those with extensive experience in stakeholder collaboration were able to implement the learning format more smoothly and attract higher student participation.

The EuroTeQ Collider also underscored the importance of adaptive implementation strategies to accommodate institutional differences. The project faced challenges such as varying student registration numbers and differences in local academic calendars, which necessitated flexibility in the competition timelines. For instance, while some universities allocated eight weeks for the challenge-based learning activities, others had to complete them within three or even one week. This flexibility ensured that all participating universities could engage in the project despite their unique constraints.

To improve co-creation instruments, it is essential to address barriers to student participation. In some universities, students were reluctant to sign up for new formats of challenge-based learning due to a lack of credit recognition towards their degree programs. Addressing such administrative and curricular issues is crucial for increasing student engagement and participation in co-creative activities. Moreover, providing incentives such as credits or certificates can motivate more students to take part in these innovative learning experiences.

The EuroTeQ Collider highlighted the benefits of cross-university collaboration. Events where students from different universities came together, such as the EuroTeQaThon, fostered a deeper appreciation of the collaborative nature of the educational format. These interactions not only enhanced learning outcomes but also built a sense of community and shared purpose among participants. Additionally, cross-university visits and joint events provided valuable opportunities for students to interact with diverse peers and challenge holders, enriching their learning experience.