D 5.1 SWOT Analysis (Strengths, Weaknesses, Opportunities Threats) of responsibilisation instruments and co-creation communities at EuroTeQ partner universities

06 December 2022

Author: Lukas Fuchs, TU/e

Contributors:

Gunter Bombaerts (Tu/e), Carlos Cuevas Garcia (TUM), Shobhit Shakya (TalTech), Corinna Nathalie Voll (DTU), Maja Horst (DTU)

Project start date: 01.09.2021

Duration: 36 months

Date of issue of this report: 31.12.2022

Contact:

Lukas Fuchs (Tu/e), Work Package Lead WP5: l.fuchs@tue.nl

Lisa Hasenbein (TUM), Project Manager: lisa.hasenbein@tum.de

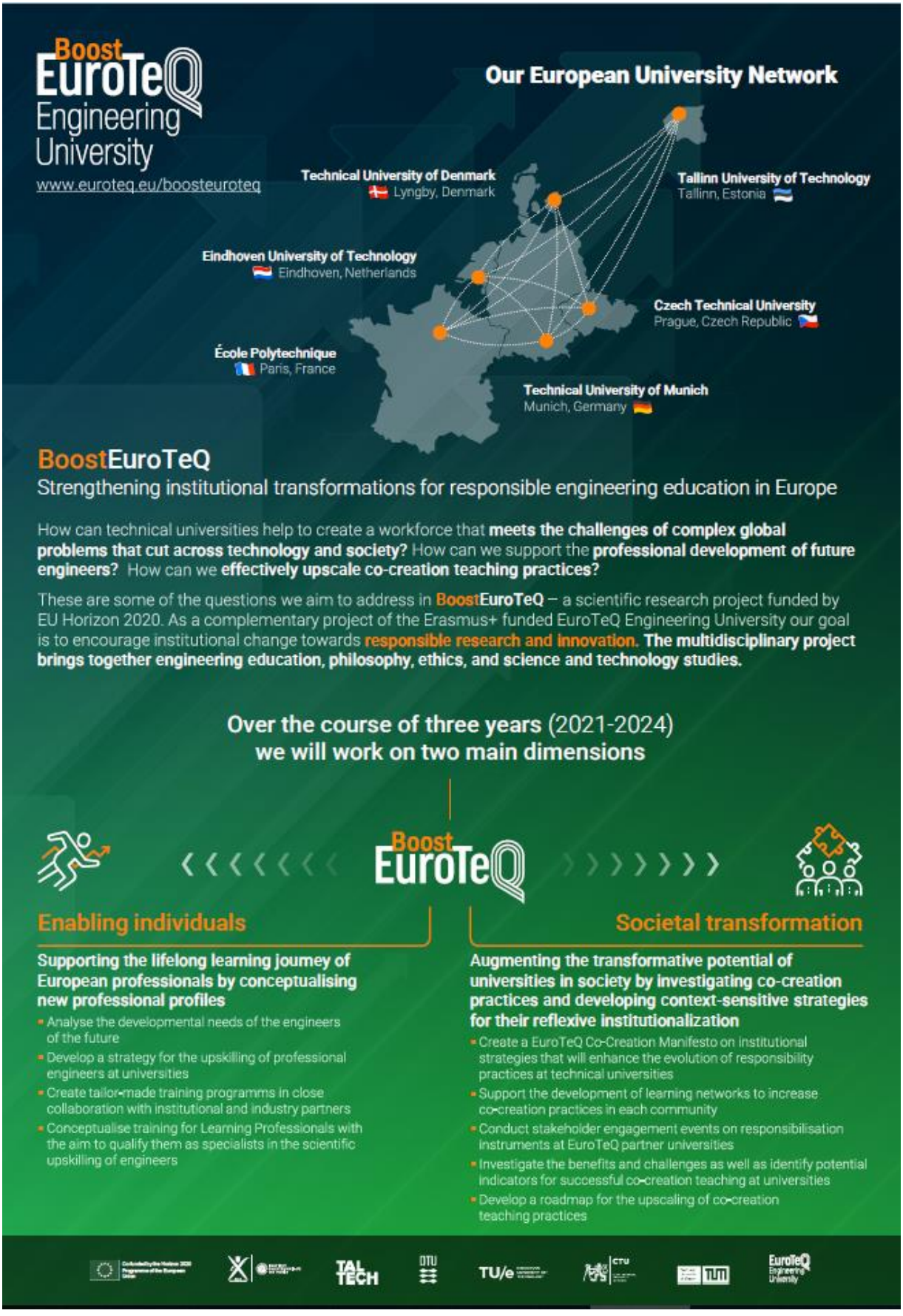
Boost EuroTeQ Engineering University
www.euroteq.eu/boosteuroteq
Our European University Network
Technical University of Denmark
Lyngby, Denmark
Tallinn University of Technology
Tallinn, Estonia
Eindhoven University of Technology
Eindhoven, Netherlands
Czech Technical University
Prague, Czech Republic
École Polytechnique
Paris, France
Technical University of Munich
Munich, Germany
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
TAL TECH
DTU
TU/e
CTU
TUM
EuroTeQ Engineering University

TABLE OF CONTENTS

1. INTRODUCTION

Work packages 4-6 of the BoostEuroTeQ project are aimed at developing a “strategy for reflexive institutionalization of co-creative teaching and research practice”. For this purpose, we first explore and observe current institutions and practices at EuroTeQ universities. In the next steps, we will carry out interventions and try to exploit and scale up the lessons learnt from these observations and interventions. This SWOT analysis of responsibilisation instruments and co-creation communities (D5.1) is the result of the observation phase. We present our results from collecting publicly available information, conducting interviews and our joint reflections on their strengths, weaknesses, opportunities and threats for the future development of responsibilisation instruments at EuroTeQ universities.

In the context of WP4 and WP5 we distinguish between large-scale responsibilisation strategies, such as long-term organisational plans by universities; medium-level responsibility instruments, such as collaborations or institutions within universities; and finally, co-creation initiatives that go beyond the classroom. In a previous milestone document (M4.1 “Project guideline on theoretical foundation”) we established demarcation criteria that guide our selection of relevant cases.

WP5 (and thus the present SWOT analysis) analyses information about the medium-level practices and institutions in the implementation of responsibilisation instruments and co-creation initiatives. The most relevant for our purposes are those that combine elements of aiming for larger responsibility and co-creation. We include innovation and entrepreneurial initiatives (“third and fourth mission units”) that are likely to promote co-creation activities (SkyLab at DTU, UnternehmerTUM at TUM, Mektory at TalTech and Innovation Space at TU/e). Furthermore, we include the EuroTeQ Collider in this category because it is envisioned to bring together issues of responsibility and co-creation in teaching.

The BoostEuroTeQ project defines co-creation as “a variegated innovation practice whereby diverse actors gather in a joint innovation activity to achieve a mutually beneficial outcome. Co-creation may take many different forms, follows different rationales, and is deployed in a variety of contexts”. To the above definition, we include *dialogue* as an important dimension, and we are especially keen to remain attentive whether self-branded co-creation activities are truly “mutually beneficial”. This raises questions about the responsibility that is enacted in co-creation practices. Questions of responsibility can be raised at different levels, such as university-level[1], research and innovation practices or individual academics. The "responsible research and innovation" literature has been highly influential in the context of EU innovation policy. Von Schomberg defines responsible research and innovation as “a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper

[1] Miller, S. (2019). Whither the university? Universities of technology and the problem of institutional purpose. Science and Engineering Ethics, 25(6), 1679-1698.

embedding of scientific and technological advances in our society)"[2]. These definitions of co-creation and responsibility will guide us in this document.

Our database of responsibility instruments and co-creation communities (milestone M5.1) described in detail the differences in approaches, experience and understandings of responsibility between the EuroTeQ universities. The European Universities Initiative was launched with the goal of linking and exploiting the great wealth of approaches (instead of imposing top-down practices). Our study of co-creation communities therefore took an open and appreciative approach, with a view towards allowing learning and sharing of practices between the partner universities.

WP5 focuses on four "constellations" of cases (see the milestone 4.2 for an explanation of these constellations and the division between work packages 4 and 5). The four constellations are "EuroTeQ Collider", "third and fourth mission units", "teaching and learning support units" and "student initiatives". We focus on cases for which we have already acquired deeper insights, most importantly through observations and interviews. Table 1 lists all cases that we are aware of that fall under these four constellations.

Table 1: Overview of cases relevant for WP 5 at five EuroTeQ universities

University	EuroTeQ Collider	Third and Fourth Mission Units and Initiatives	Teaching and learning support units	Student initiatives
DTU	EuroTeQ Collider			
		DTU Skylab		
			DTU Learning lab	
		FoodLab		
		Technology leaving no one Behind		
		OI-X ("open innovation X")		Ecotrophelia
		Students Hack Folkemodet	DTU Learn for Life	
TU/e	EuroTeQ Collider	Innovation Space	Bachelor College and Graduate School	TU/e Student teams
		The Gate		
		Intelligent Lighting Institute	Challenge based learning community	
		Brainport Smart District		
		Jour licht op 040		

[2] von Schomberg, R. (2013). A vision of responsible research and innovation. In: Owen, R. et al. (eds.), *Responsible innovation: Managing the responsible emergence of science and innovation in society*, (pp. 51-74). Wiley.

TalTech	EuroTeQ Collider	Mektory, tech transfer and entrepreneurship office / Mektory Hackathons	Student tech and innovation projects	
		TalTech Council and International Advisory Board		Formula Student
		Coordinaton groups of academic priority areas	Cosmolocalism as radical action-oriented research	
		Long-term industrial partnerships and funding relations (i.e. with Enefit, the national energy company)	*1.1.1.1*	
			Mektory Hackathons and Student initiatives	
CTU	EuroTeQ Collider			
			Eforce	CTU CarTech
TUM	EuroTeQ Collider	TUM Venture Labs Robotics	Junge Akademie	Referat fur Umwelt
		Center for Responsible AI Technologies	Junge Akademie Science Hackathon	Plant a Seed
		TUM Venture Labs Mobility	Sustainable living labs	TUM Business Game
		TUM Venture labs sustainability		
		Sustainability index TUMentrepreneurship		
		EIT Urban Mobility	SAP University Competence Center	
		Siemens centers		
		SAP centers		

2. THIRD AND FORTH MISSION UNITS

Overview

Universities are increasingly expected to contribute to society in forms other than its traditional forms research and education. In this context, scholars have described the third mission of universities, which encompasses all "activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments"[3]. A wide range of activities, such as public lectures and policy engagement fall under these third mission activities. In addition, some have argued that it is necessary to add yet another category to set apart entrepreneurship at universities.[4] Scholars have called these the fourth mission.[5]

In comparing the recent responsibilisation efforts of the EuroTeQ universities, we noted that four of them have set up units or have closely aligned with extra-university units dedicated to these third and fourth missions. It struck us that these seem to be the most dynamic places for activities that are aimed at co-creating with industry and other parts of society. In several of them, we have also found an openness to explore and re-think topics of university responsibility in the pursuit of these missions.

Skylab (DTU)

At DTU, a "Fablab" was started to be used as a center for student innovation and entrepreneurship in 2013.[6] This center had technical equipment that could be used by students for prototyping and experimentation in a "garage" setting. The next stages in its evolutions were Skylab 2.0 (2014-202) and, since 2020, Skylab 3.0. In these stages, Skylab expanded both spatially and in terms of its network, building up university-industry partnerships. Skylab referred to itself as the "the Innovation Hub of DTU"[7] and as the "Living Lab for innovation and entrepreneurship"[8]. The services it provides to the university include providing teaching space and offering courses, especially organizing design challenges, discussion events and hackathons. Another key role it plays is as incubator of entrepreneurial ventures, especially for research-based innovation.[9]

---

[3] Molas-Gallart, J., & Castro-Martínez, E. (2007). Ambiguity and conflict in the development of 'Third Mission'indicators. *Research Evaluation*, *16*(4), 321-330.

[4] Siegel, D. S., & Wright, M. (2015). Academic entrepreneurship: time for a rethink? *British journal of management*, *26*(4), 582-595.

[5] Kretz, A., & Sá, C. (2013). Third stream, fourth mission: Perspectives on university engagement with economic relevance. *Higher Education Policy*, *26*(4), 497-506.

[6] DTU Skylab (2021). The journey of an innovation hub. Isuu portfolio URL= https://issuu.com/dtudk/docs/dtu_skylab.

[7] DTU Skylab, URL = https://www.skylab.dtu.dk/.

[8] DTU Skylab (2022). Website: About DTU Skylab. URL = https://www.skylab.dtu.dk/about/about-dtu-skylab.

[9] Özkil, A. G., Skovgaard Jensen, L., Arndt Hansen, C., 2020: "What difference does an academic makerspace make? A case study on the effect and outreach of DTU Skylab". *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 34 (3). 327-340.

The key initiator of DTU was H.C. Ørested, who envisioned DTU to be an engineering university that acts for the benefit of the whole society. This mission also seems to be mirrored in Skylab's endeavours. On the other hand, Skylab's narrative in presenting itself heavily focuses on its role as a startup incubator. There are several programmes to help students and academics with startups in the business world. There is, however, also explicit effort to address societal concerns more directly, for example in the form of programs that do not aim to establish business ventures. Environmental sustainability is already a key concern permeating most projects, with an expert on the circular economy employed at Skylab. The topic of social inclusion, by contrast, is not as prevalent yet. Two examples of these activities that are aimed at societal value have inclusion as its core concern. "Open Innovation X", addresses sustainability issues as has subthemes such as "gaming for all" and "festivals for all". Another example is "Technology leaving no-one behind", whose object is to improve inclusion in entrepreneurship and educational practices, specializing on physical and mental disabilities.[10]

UnternehmerTUM (TUM)

At TUM, UnternehmerTUM is a center for academic and student entrepreneurship that is loosely associated with the university but is more autonomous than the other three units we compare in this analysis. UnternehmerTUM was founded by 2002 by an entrepreneur named Susanne Klatten. Currently, it has 300 employees and consists of 6 GmbHs. In addition to offering advice and help to TUM students and academics, there are also services offered to people not affiliated with the university. The website states that every year its events attract some 5,000 participants and some 50 startups are created under its auspices.

UnternehmerTUM offers a great diversity of events and activities, only a small fraction could be actively observed. One key regular event is the "Hack n' Talk", where entrepreneurs meet and exchange stories of success and failure. The "TUM Venture Labs" are a set of startup and spin-off incubators that are dedicated to different domains, such as AI, built environment, additive manufacturing and robotics.

The leading narrative at UnternehmerTUM is the creation of business-startups, whose main contribution to societal value consists in economic value. There are narratives that these technological and economic innovations hold value to society, but the idea that these directly address societal problems is less developed compared to the other third and fourth mission units we observed. The unit is also different to the other three in that it does not contribute to the core curriculum of the university. There is another education center ("Junge Akademie") which engages with Challenge-based learning activities, but its role on campus seems to be limited at the moment.

Mektory (TalTech)

At TalTech, Mektory is commonly seen as 'innovation and entrepreneurship center' by those affiliated with the University. The term Mektory is an acronym for "Modern Estonian Knowledge Transfer Organization for You" and the center was established with the goal bringing students,

[10] For instance, "Skylab Incubator", "Book a Startup coach", "Pizza and Pitches"

scientists and entrepreneurs together to solve practical problems and generate new ideas. Since its establishment in 2013 the center has functioned as TalTech's in-house incubation hub also providing a platform for co-creating new knowledge.

As a start-up center, Mektory runs different start-up and spin-off programs as well as start-up competitions and challenge-driven hackathons. It also participates in international project activities (such as, organizing different international hackathons or hosting visits to university). There is often involvement of with external stakeholders (e.g. banks, start-up communities, public sector etc.) within the activities organized in Mektory. The facility also provides space for several students-led projects, for example the space program where TalTech students, their supervisors and private companies are working with two nano-satellites - Koit ('Dawn') and Hämarik ('Dusk'). The center is also a venue for meetings, conferences, and similar events either for entrepreneurs or students/teachers. There are also various laboratories and spaces for student learning within the center.

A primary emphasis of Mektory is on enhancing "business cooperation and innovation". It exists as a potential bridge between the business sector and the University where there is a two-way benefit-sharing between business sector and academicians. While Through Mektory, there is the opportunity for the business sector to "take part in the working process of a science team and benefit from the contacts with qualified university members and motivated students" (Branten & Purju, 2015). It creates avenues for turning technical research ideas into bankable commercial ides, all whilst enhancing the learning experience of the students as well. Activities that are supported by Mektory are challenge-based and experimental, tackling contemporary challenges several sectors whilst also providing room to showcase the activities of the University's research making better communication with the external stakeholders, including community actors.

Innovation Space (TU/e)

At TU/e. Innovation Space is a center that hosts expertise on Challenge-based Learning and that introduces this learning format into the TU/e curriculum.[11] Its foundation was part of a greater reformation of the education system within the university. Around 2010, it was found that the course programmes need to be diversified and oriented more strongly towards societal problems.[12] As a response to this perceived need, the "Bachelor College and Graduate School" was founded to give students the chance to select more courses according to their interests and goals. Innovation Space was initiated in 2015, with Prof. Isabelle Reymen as Scientific Director aiming to cement the role of co-creative education on campus, including interdisciplinary courses in the Bachelor College and Graduate School. The vision document for the year 2030 for the whole university underlined this role for Innovation Space by mandating that courses should also address "real-life challenges"[13].

[11] TU/e Innovation Space (2020). Vision 2020-2025. URL = https://assets.tue.nl/fileadmin/content/TUe_Campus_website/TUe_Innovation_Space/202001_TUe%20innovation%20Space%20Vision.pdf. TU/e Innovation Space (2021). From dream to demo. URL = https://assets.tue.nl/fileadmin/user_upload/brochure%20innovation%20space%20website.pdf.

[12] Meijers, A., & den Brok, P. (2013). Engineers for the Future. *An essay on education at TU/e in*, *2030*.

[13] TU/e (2018). TU/e strategy 2030. Driver of change. Eindhoven University of Technology.

In addition to this service to education, innovation space hosts a community with diverse stakeholders, such as researchers, students, industry, as well as societal stakeholders. Access to this community and relationships to external stakeholders is a key requirement for engaging in challenge-based learning. Stakeholders from the ecosystem can be engaged as challenge-holders in the student education. This ensures that the challenges that students work on are needed, connected to the local environment and allows students to build their own professional network. The exchange also promises to the strengthen the relationship between the university and its ecosystem, allowing the flow of people, ideas and resources in both directions. Innovation Space also hosts an active community of scholars researching best practices for challenge-based education (the community will host the international conference on challenge-based learning in June 2023).[14] Innovation space currently facilitates some 40 courses. Every year, some 3500 students take courses related to Innovation Space.

Innovation Space is also the host of student teams in Eindhoven. These are groups that are initiated by the students but recognised and supported by the university that aim to address societal problems, most in the form of technology-based innovation and entrepreneurship. These groups receive recognition and support from the university, with an annual budget. There are at the moment approximately 50 such teams, with some 700 students.

Table 2: Overview of SWOT Analysis of third and fourth mission units

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Some universities have co-creative teaching experience	Some universities have little co-creative teaching experience	Universities can learn from each other through alliances	Taking over teaching model without attention to context
Some universities have strong ecosystem collaboration	Some universities have weak ecosystem collaboration	Alliance may help build ecosystem collaboration	Taking over co-creation model without attention to context
Responsibility discourse is emerging	Responsibility discourse is fragile	Re-define societal role of university	Responsibility discourse is susceptible to business interests

[14] Lazendic-Galloway, J., Reymen, I. M., Bruns, M., Helker, K., & Vermunt, J. D. (2021). Students' experiences with challenge-based learning at TU/e innovation Space–overview of five key characteristics across a broad range of courses. In Blended Learning in Engineering Education: challenging, enlightening–and lasting?: Proceedings of the SEFI 49th Annual Conference (pp. 1005-1015). Technische Universität Berlin.

Valencia, A., Bruns, M., Reymen, I. M. M. J., Pepin, B. E., van der Veen, J., van Hattum-Janssen, N., ... & ten Dam, I. (2020). Issues influencing assessment practices of inter-program challenge-based learning (CBL) in engineering education: The case of ISBEP at TU/e Innovation Space. In SEFI 48th Annual Conference Engaging Engineering Education: Proceedings Twente University (pp. 522-532).

Strengths

Some of these units have developed remarkable skills and experience in conducting co-creative activities with societal stakeholders, engage in co-creative teaching, engage their business ecosystem and develop notions of responsibility for these activities. Skylab has developed already a robust understanding of its societal responsibility, going beyond the mere creation of business ventures and aiding economic enterprises (as demonstrated by initiatives such as “technology leaving no one behind”). Innovation Space has been successful in implementing the challenge-based learning format in a significant proportion of courses at TU/e and is host to a learning community that further develops this educational format. UnternehmerTUM has an enormous strength through its sheer diversity and size, becoming a major hub for entrepreneurial activities in Munich. Another strength is seen in the case of Mektory, which works closely with its industrial ecosystem and engages in themes that are relevant and context-sensitive for the Estonian context.

Another key strength of some of these units is that they have strong connections with their ecosystems, both to industry and other parts of society, such as civil society and politics. TU/e, for example, has a long historical legacy of cooperating with its ecosystem (the company Philips was a key strategic partner for most of TU/e’s history).

While these strengths often are partly the result of a historical legacy, many of these skills and experiences were developed only in the last years. The transformations towards challenge-based learning teaching have occurred within a few years. Similarly, Skylab was only founded in 2013 and has nevertheless already established itself as a leader in this field, especially in using living labs for research.

The third strength that we identified is that our four third and fourth mission units seem to have been pioneers in a field whose significance is now increasingly recognised by local, national and international actors. They are therefore in a very strong position to establish themselves as leaders in these activities, which may generate additional funding and may create useful interlinkages with their other activities, such as research and education. Furthermore, we expect that the discourse on responsibility of universities will become more relevant in the next years and due to their pioneering work, these universities may have a good advantage in this development.

Weaknesses

We also identified significant weaknesses in these respects among our universities and their third and fourth mission units. Some units and their universities have relatively little experience in carrying out co-creative teaching and research and in linking them to their ecosystem collaborations in a meaningful way. There seems to be significant resistance in all universities from staff who prefer education that is focused on a more traditional model of teachers transmitting knowledge through lectures. As a result, the efforts of these units to introduce co-creative teaching into their universities is sometimes limited and met with resistance.

While all these units declare that their activities are intended to serve society, some understand that more narrowly in terms of creating new business ventures (this was also an important insight from Collider observations). For example, the autonomous nature of

UnternehmerTUM (not formally part of TUM), means that it seems to be more closely aligned with business activities. Here, it also seems that a coordinated effort to rethink the responsibility of these units to society has not taken off yet.

Opportunities

The EuroTeQ alliance presents an opportunity for the units in all four units to develop and strengthen their co-creative activities. In this respect, it may be useful to think of European University alliances in terms of learning networks[15]. By engaging with each other, universities in the EuroTeQ alliances may share know-how, institutional strategy and engage in moral reflection.[16]

The most important opportunity in this respect is to exchange knowledge and experience about how to pursue co-creative teaching and how to engage a university ecosystem for that purpose. The Collider is a key opportunity for this (see below), but through the creation of co-creative learning communities, the exchange may go significantly beyond the Collider.

Third and fourth mission units may also learn from stronger engagement with others, for example from EuroTeQ, how to foster and maintain relationships with its ecosystem, not just for educational purposes, but also for research and valorisation purposes.

Through this process, engineering universities may be able to re-define their role in society and overcome a possible overemphasis on technical solutions in favour of a conception of the university that includes the value of social entrepreneurship and co-creation activities.

Threats

The most important threat we identify is that universities uncritically adopt a model of entrepreneurship without attention to the specific local context. While there is growing recognition that attempts at emulating Silicon Valley is a fraught goal, there may be dangers of such imaginaries taking over in the EU context.[17] It is important to recognise the national and local traditions in terms of education, research and societal collaborations and to gradually improve on them by means of EuroTeQ alliances.

This applies to co-creative teaching, where educational philosophies have shaped the expectations of teachers, students and employers. Introducing completely new learning formats within short time may lead to rejection or merely nominal adoption, without serious engagement and incorporation into existing practices. The same goes for the collaboration with industry and other parts of ecosystems. For example, some of our universities have closer connections with their national policy systems (partly owed to the size of their countries). DTU and TalTech are the only technical universities in Denmark and Estonia, respectively, which

[15] Gunn, A., & Mintrom, M. (2013). Global university alliances and the creation of collaborative advantage. *Journal of Higher Education Policy and Management*, *35*(2), 179-192.

[16] Fuchs, L., Cuevas-Garcia, C., Bombaerts, G. & Mottl, P. (2022). 'University alliances as learning networks: towards responsible European engineering universities?' Frontiers of education 2022 conference proceedings.

[17] Pfotenhauer, S., & Jasanoff, S. (2017). Panacea or diagnosis? Imaginaries of innovation and the 'MIT model'in three political cultures. *Social studies of science*, *47*(6), 783-810.

explains their dominance in policy collaborations. By contrast, TU/e is only one of four technical universities in the Netherlands and TUM, while one of the largest and most influential universities in Germany, still faces significant competition from other technical universities in Germany. In this context, the success of one unit in collaborating with policy makers and industry should be emulated only with great caution.

Finally, a key threat to the future development of co-creative activities at these units is the susceptibility to the dominance of business interests. All units have significant interactions and collaborations with industry, but some of these are more dependent on some industrial partners and may therefore also more likely to engage in co-creation that is not mutually beneficial. Importantly, all these units seem to have significant research collaborations with major international oil companies and the details of these collaborations are not fully transparent. There is a threat that the dependence on these collaborations hampers an ambitious rethinking about the role and responsibilities of universities in society, for example in the context of sustainability issues.[18]

[18] We explore the issue of co-creation and sustainability efforts at the EuroTeQ universities in the SWOT analysis D4.1.

3. EUROTEQ COLLIDER

Overview

The EuroTeQ Collider initiative is a co-creative teaching course that is implemented at all six EuroTeQ universities. The planning consisted of the following steps: first, a committee formed by strategic partners and staff from all the universities decids on a general theme. A 'call for ideas' came to the three topic domains: cities, energy and consumption. Second, a call for specific challenges on the selected general topic is launched, in which external public and private organizations, academic units and student teams can submit challenges for student to develop possible solutions. Third, multidisciplinary groups of students were recruited across the challenges to work on their solution. Fourth, a challenge-based learning activity is implemented in each university, where students teams are selected for the next step. Fifth, the winning teams of each university are brought together to refine their pitch presentations and participate in one final competition (the "EuroTeQathon"). Sixth, the winners of this final competition travel to Brussels to present their ideas to the European Commission.

In the first edition of the EuroTeQ Collider in the spring semester 2022 the main coordination of the initiative was put in the hands of staff from École Polytechnique in Paris (L'X). The selected theme was "Leave no waste behind" and focused on the categories of "Cities", "Energy", and "Consumption". Although the initial plan was that all universities would share the same duration, due to calendar disparities and the assumed workload of staff and students the local Colliders were assigned different timeframes in each partner university (see figure 1). Three universities gave 8 weeks to the teams to work on their solution, one university gave 3 weeks, and two universities gave only one week. The local pitching events were all held in May, and the EuroTeQathon took place on the 10-12 of June 2022. We have conducted multi-sited ethnographic research and interviews on the EuroTeQ Collider. We conducted formal and informal interviews with organizers of the local Colliders at all six EuroTeQ universities, observed the local pitching events, as well as the EuroTeQaThon competition. Since the second round of Collider courses were still in progress at the time of writing (autumn 2022), we are only focusing on the first round, which took place in spring 2022.

CTU

At CTU, the Collider was offered by three faculties (architecture, civil & machine engineering). Students received 5 ECTS points. The best three teams were selected for the EuroTeQaThon. There seemed to be relatively little interest in the study body for the course. 24 students initially registered for the course, but only 12 came to the launch event. Students worked in two groups from multiple faculties. Two challenges were chosen: Reachable charging infrastructure and PV on every rooftop. In the second round of the Collider, several improvements were implemented which led to a significant increase in student participation (50 students from 6 faculties) as well as much better engagement of participants. The mentoring activities were boosted and due to abscence of epidemiological restrictions the students could make use of on-site work.

L'X

L'X offered the Collider programme to all three of its streams (BA, MA and Engineering). It lasted 8 weeks. No credits were awarded, only an extra-curricular qualification. L'X experienced a range of problems with the implementation of the Collider.
There were a range of challenges that were prepared for the students to work on (biofuels, carbon capture, charging of electric cars), but it seems that these challenges were not intended to be worked on with external stakeholders. 'Co-creation' is a central idea for them in working on the course. However, the learning culture at the university may be a barrier to meaningful co-creation. Students are not used to play an active part in their education.

DTU

At DTU, the Collider was organized through SkyLab (the office for research, advice and innovation). No credits were awarded for this course, it was an extracurricular activity. The course was planned to be a 5-day course in May 2022. The pool from which students could be recruited was ca. 150. However, the course did not take place as planned because of insufficient student registration; instead, student teams for the EuroTeQaThon were acquired through personal communication and selection. One possible way to improve the next round of the Collider is to combine it with an existing course (for instance, with the "Innovation Pilot") and to advertise more.

TUM

TUM made a call to recruit a Professor who would be interested in organizing the Collider locally. The selected was a Professor of Policy Analysis from TUM School of Governance, who, had experience with challenge based learning and student projects. This professor was supported by two postdocs and a project manager. The course received 3 ECTS points. 17 challenges in the categories "cities", "consumption" and "energy" were taken up by students. 4 were discontinued due to lack of student interest or mentors.

There is potential to see student project competitions such as the Collider help flatten differences between usual university partners and members of their ecosystem (e.g. TUM-Siemens) and other organizations. In principle, all challenge givers get the same amount of attention from university students, jury members and other competitors to address the challenge. In this way, some of the ways of working of a university ecosystem are *to a certain extent* democratized.

Some projects worked on a well-defined challenge already shaped by many constraining factors and a longer trajectory. Here students may have less scope to present ideas that might sound too dreamy for their mentors. And yet, those projects were questioned and challenged by the judges that are already familiar to them.

TalTech

Several university departments were involved in implementing the Collider at TalTech. Mektory, which is the innovation hub of the TalTech was largely relevant for the entire Challenge event and also the courses that were part of it. 36 students participated in the final challenge.

Including the main course “EPX5020 Startup Entrepreneurship for Built Environment” there were five courses in total which formed the part of the first Collider challenge event. Two were open to everyone (MMJ5240 Social Entrepreneurship and EPX5020 Startup Entrepreneurship for Built Environment). Three courses (ITB1706 Information Systems Development Team Project: procurement, UTT0055 Course Project and EMD0053 Design Studio 2: Context) were available to students from Business Information Technology (BA), Integrated Engineering (Msc), and Design and Technology Futures (Msc) programs respectively. MMJ5240, EPX5020 and UTT0055 were awared 6 ECTS points each. ITB1706 and EMD0053 received 12 ECTS each. Disciplinary backgrounds were varied, with most from Civil, industrial and software engineering.

Companies were the Challenge owners and provided the problem for which the students looked for solutions. They also provided feedbacks and mentorship to the students. The course “EPX5020 Startup Entrepreneurship for Built Environment” collaborated with companies Ülemiste City, Liven, Nordecon, Welement and Merko. It included lectures on legal and financial matters and prototyping. The focus of the course was on startup incubation and this also determined the structure of the courses. The project is also part of the “Problem based learning” vision of TalTech.

TU/e

TU/e hosted the Collider at Innovation Space. The course was offered to MSc students; 16 students started and 12 completed the 8-week course. 5 ECTS were awarded for successful completion. External stakeholders (“Challenge Collaborators) introduced themes from their work to the students.

At the initial meeting between students and challenge collaborators, the challenges were left very broad and vague. Challenge collaborators gave the students at least more than one direction to work. Some of these challenge collaborators seemed to have a lot of experience with this format. A team of approximately 4 students formed for each of three challenges (a fourth one was offered but met insufficient student demand).

During the internal presentations, students “pitched” their projects. This resembled the “start-up” culture, with the focus on being able to show the problem and the potential solution very quickly. Students had 180 seconds for the initial pitch. Questions took up much more time. There was Intense collaboration between challenge collaborators and students. Challenge collaborators had met with students several times by the time of internal presentations. Students have autonomy in picking the focus. Students received feedback on matters such as technical feasibility, economic feasibility and how to improve their pitching.

EuroTeQaThon

One observation for the EuroTeQaThon competition is that there were different levels of closeness between student teams and companies. For instance, there were 2 teams working almost for companies (Viesmann, Siemens). One jury member also once asked: what is your idea, and what is from the company? This did not make their case weaker, but the question is how much creativity and influence students can really bring in here to a co-creation project, or if the agenda is totally set by the companies.

A few pitches also explicitly included the inclusion of stakeholders in their roadmap (such as Asura from TU/e, who also won). There were a few occasions when it became clear that the students focus on the technical aspect mainly (like team from CTU on ecar charging, and team on construction site AI from Estonia team) – here it became obvious that the solutions are not so much co-created with a lot of different perspectives (expect e.g. Prague municipality)

The overall theme was “leave no waste behind”, so sustainability in terms of saving up resources was meant to be the guiding theme. However, the EuroTeQaThon, mainly seemed like a “pitching workshop”. One student expressed surprise, as he thought it is not so much about developing your idea anymore, but about how to pitch. The jury (mainly engineers) reinforced a more technical evaluation of the cases, through questions about “technological readiness” or “how much time does it need?”.

Table 3: Overview of SWOT Analysis of the EuroTeQ Collider

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Some universities have much relevant experience with real life challenges	Some universities have little experience	Universities and students can learn from each other	Taking over model without attention to context
Responsibility discourse is emerging	The integration of the Collider into the wider educational infrastructure	Alliance may help build ecosystem collaboration, learn from each other, Re-define responsibility	Challenge owners may define challenge too narrowly
Collaborative organisers across EuroTeQ	Many expectations on student projects creates confusion	Re-define societal role of university	Responsibility discourse is susceptible to business interests

Strengths

Many of the strengths that we identified for the third and fourth mission units at our universities materialized in the implementation of the EuroTeQ Collider. Some universities already had extensive networks, skills and experience conducting co-create teaching and used them for the Collider.

At some universities, launching the Collider was “business as usual”, with some teachers and challenge-holders having already participated in similar courses at their respective universities (for example at TU/e). The broad theme of the Collider (“leave no waste behind”) ensured that most universities found an angle to make adequate use of their existing networks. TUM could show its resources and networks by offering around 20 challenges to students, thus covering a wide range of topics within the theme. CTU could use its existing strengths in the development of cars by hosting a challenge on charging infrastructure.

Another strength of the Collider was that it was possible to connect neatly to a wide range of discourses on responsibility within the respective universities. At some universities, the Collider fit neatly into an emerging discourse of “engineers of the future” (TUM) or “Heroes like you” (TU/e) and existing realization that engineers play a vital political role in their home countries (L’X). The jury members for the local Colliders at all universities were provided with a list of categories to pay attention to, namely scalability, communication, inclusiveness and others. These seem to have been partly inspired by the SCALINGS roadmap on co-creation. It is likely that the expectations created in this way by the jury members strengthens the connection to this emerging responsibility discourse.

All universities managed to recruit dedicated people who organized the Collider courses and proved resilience despite having to juggle the expectations of the alliance building, the educational setting of their universities, as well as the expectations of students, teachers and stakeholders. The organisers of the Collider courses met bi-weekly and worked together on a common to implement the Collider. This seemed to have been particularly helpful to those organisers based at universities with less experienced in co-creative teaching formats.

Weaknesses

Our interviews and observations showed that launching this format in the different partner universities posed great challenges to some. One of the EuroTeQ partner universities struggled to get students to sign up to the course, because the format was new and unfamiliar in that institutional context. The fact that they did not receive credits for their overall degree programmes was a major factor why some students dropped out after signing up. One of the other universities — one of the more experienced implementing Challenge Based Learning — also struggled to run a local competition, and instead only one team from another format was sent to participate in the EuroTeQathon.

At L’X, there did not seem to be a history of similar educational formats. There seemed to be organisational and institutional barriers to a successful implementation of such a course. Changes in personnel also created significant problems for the organisers. The Collider course set up was a course that students from all three L’X streams (Bachelor, Master, Engineering)

could attend, but there seems to be little precedent for that and the streams usually do not coordinate with each other.

Another key weakness of the Collider was the unclear integration of the course into the wider educational offering of the universities. On the one hand, at some universities students did not receive ECTS points for taking the course. This may have contributed to the low number of students signing up in these two universities. Given the many course-like attributes of the Collider project, it would have been difficult to convince students to join this as an extra-curricular activity.

In addition, the amount of work that is needed to complete the course seems not to have been transparent to all students when deciding whether to sign up. At L'X, a few PhD students registered in the second registration phase (April 2022), hoping that they could thereby complete a mandatory training element of their PhD programme. However, when they understood the amount of work needed to complete the Collider, they dropped out to complete that mandatory element through a much less time-intensive training.

At DTU, the Collider course did not take place due to low student interest. There may be several reasons for this: first, the main organiser working on this left at a crucial time and the new organizer needed time to re-orient. Second, at the time the new person took over, there were few resources invested into student awareness. Third, timing: May is exam period. The deadline for signing up fell into a stressful period for students. Fourth, student mentality: It seems to be more difficult than before the Covid pandemic to recruit students. This has also been observed in other such events. Previously, it was no issue for SkyLab to recruit people for extracurricular activities.

Overall, L'X and DTU seemed to have experienced very low student interest because the Collider was offered as a separate course that was not fully integrated into the broader educational offering (and no ECTS points were awarded). Yet other reasons, such as a still generally low attendance rate of students after the Covid-19 pandemic has also been named as an influencing factor for low student participation. At CTU and TU/e, there were average-sized student numbers (2-4 teams). At both universities, students received credits, but it might have been unclear to students how it relates to similar courses offered (TU/e) and what the extra work effort included (CTU). TalTech and TUM experienced particularly high levels of student numbers. In the case of TalTech, the explanation seems to be that the Collider was an umbrella institution for five different courses. This ensured that different departments could have "their own" collider and integrate it into their degree programmes.

Finally, the fact that students were asked to focus on their project, this led to different levels of engagement with the teaching staff. At CTU, students were offered much teaching support during the course, but students made relatively little use of that. Most of the work of the students was conducted online and this may have impacted the quality of the student projects. While this problem is inherent in co-creative teaching, where students are given a high degree autonomy, it seems to be particularly strong in the case of the EuroTeQ Collider where instructions and expectations are given by many different sides and the teaching staff may only appear as one of many resources to consult.

Opportunities

The most important opportunity presented by the Collider is the rapid transmission of co-creative educational formats and discussions about societal responsibility from some universities to others. The regular online meetings by the course organisers already played an important role in sharing knowledge and strategic insights into how to build such a course and implement it. Those universities with more experience, too, can reflect and improve their existing practices.

The Collider may also present an important opportunity to share know-how on how to interact with ecosystems. Some universities seem to be focused on collaborations with industry, with little connections to other parts of society. Knowledge on how to include other challenge holders into the education may be shared by those universities who have collaborations with municipalities and civil society.

The conversation about co-creative teaching brings up important questions about responsibility when students interact with stakeholders. One question that has come up and that has been discussed among those involved in the Collider is to which extent are students autonomous in defining their problem and how closely they must stick to the instructions by the challenge-owner, even if the students disagree with the challenge-owner's framing. Another question concerning the question to which extent the work of student teams is mutually beneficial is the question whether students own the intellectual property derived from their projects.

The Collider offers the opportunity to re-orient not just this course, but the larger educational offer of the six EuroTeQ universities. Engineering universities may be able to re-define the "engineer of the future" and include elements of co-creation in education which would not have featured in a traditional engineering education. Future improvements of the mentoring activities based on experiences from other universities can be obtained. This may significantly affect the experience of students in co-creative education.

Threats

On the biggest threats is that the Collider teams are meant to fulfill expectations from too many sides. At final competition at TUM, for example, it became clear the jury members had different expectations on what the student teams were meant to achieve. Some were disappointed that the presentations did not correspond to a start-up pitch, without a clear business case. However, the organisers emphasized that they did not encourage the teams to come up with a business idea or a product that could be taken to the market. Some projects worked on a well-defined challenge already shaped by many constraining factors and a longer trajectory. Here students may have less scope to present ideas that might sound too dreamy for their mentors. And yet, those projects were questioned and challenged by the judges that are already familiar to them.

At TU/e, there also seems to have been conflicting expectations on the groups. The initial meeting focused on how technologies can be used to tackle societal problems (for example in the case of lighting). There was little talk about commercialisation at this initial stage (except for the photonics challenge). Towards the end of course, all teams had shifted

towards seeing their work as a business. Notably, at the internal presentations to challenge collaborators all had (initial) answers how their projects can be made economically viable.

Similarly, at TalTech, the final competition had the character of “tech-startup idea pitching” including some solutions presented in the final event without relevance for green transition. At least two of the 5 solutions presented in the first of the three areas, “cities” focused on efficiency of construction work solving logistics and time tracking issues, instead of green issues. In the solutions presented under the third area, consumption, there were more than two occasions in which a jury members asked whether there was “green washing” of solutions. At the same time judges were often asking about “who gets the money?” or “what is the revenue model?” showing tensions regarding how much of the focus was on “responsibilization” and ethical concerns and how much on having a profitable solution. Also, the general tendency of “solutionism” applied as one or another app was presented as being the solution to the problem in hand that the students saw solvable through their envisioned startup. Larger questions like those concerning broader economic transitions, rebound effects and environmental footprint of supply chains were hardly tackled.

At TalTech, The students primarily thought of the competition as a “sandbox” version of a real “tech-startup pitching” competition as well, with at least two of the participants not entirely feeling the competition would result in real-life solution. Two of the students also expressed the difficulty to involve industry partners and gather data required for their proposed solution. However, some students we talked to felt they learnt significantly about agile management processes and skills to work in a team through the course. Some students complained about the unclarity regarding some of the rules and requirements about the courses.

With the second rendition of Collider challenge at TalTech, the format was largely changed with students joining the Collider through a specific course “EAX6040 Green Deal Collider: Sustainable Futures”. Challenges presented were gathered from various ongoing projects from amongst the different research teams within the university. Technical or marketization challenges related to the ongoing research projects were presented to the potential students making the second Collider much less of a “tech-startup pitching” competition and closer to already active research portfolio of the university. But this was at the potential risk of not getting sufficient students, which the organizers were willing to take.

Another threat to the success of the Collider format as a learning platform between alliance universities is to adopt co-creative teaching formats without attention to context. Existing formats that are successful may be only successful due to the existence of a traditional, experience and a network and it may be impossible to simply ‘transplant’ a successful format to another university.

4. CONCLUSION

Our comparison and SWOT analysis of responsibility instruments and co-creation communities demonstrates the great diversity of approaches, differences of experience and understandings of responsibility between the EuroTeQ universities. The European Universities Initiative was set up with the goal of linking and exploiting the great wealth of approaches (instead of imposing top-down practices). Our study of co-creation communities took an open and appreciative approach, with a view towards allowing learning and sharing of practices between the partner universities.

One of the most striking results of our comparative work is the difference in experience in working with external stakeholders in co-creative teaching. These differences became clear in the implementation of the EuroTeQ Collider at six partner universities. Some had relatively little experience in including external stakeholders and challenges, with students being unacquainted with teamwork and challenge-based learning approaches. The strengths of some of the universities in this regard may be translated into learning opportunities for others as part of the EuroTeQ project and further instalments of the Collider.

A further insight stems from the comparison of third and fourth mission units. Besides differences in the relationship between these units and the host universities, their role in teaching and their funding situation, we also observed the differences in understanding of their responsibility. A distinct threat of the responsibility discourse in this context is that it gets captured by a narrow understanding of responsibility in terms of business interests and economic viability. A particularly sensitive topic in this regard is the choice of co-creation partners, as well as the terms of co-operation. The tendency to move from “societal responsibility”, defined in terms of societal challenge, public values or other political ideals, towards profitability could also be observed in various forms in the EuroTeQ Collider.

One weakness that could be observed almost universally among the cases presented in this milestone was that reflection on the nature of responsibility at our universities was at a relatively early stage. Beyond general ambitions to be “innovative” and “entrepreneurial” in the service of tackling “grand challenges”, “sustainability” or “inclusivity”, we have found relatively little publicy-available material on some of the value trade-offs that co-creation communities face in their work. We believe that our comparison of co-creation practices and instruments will provide a richer base of experience to draw from when defining their responsibilities. We also hope to launch an inter-university dialogue on responsibility in co-creation practices.

In combination with the work carried out in work package 4 (on “responsibilisation practices and strategies”), it is therefore crucial that we analyse the role of engineering universities in society and their scope in driving social, economic and technical change through their co-creation activities. These opportunities must be analysed in conjunction with the threat that these discourses are captured by more narrow interests without tapping into the full potential that European engineering universities of the future may realise.