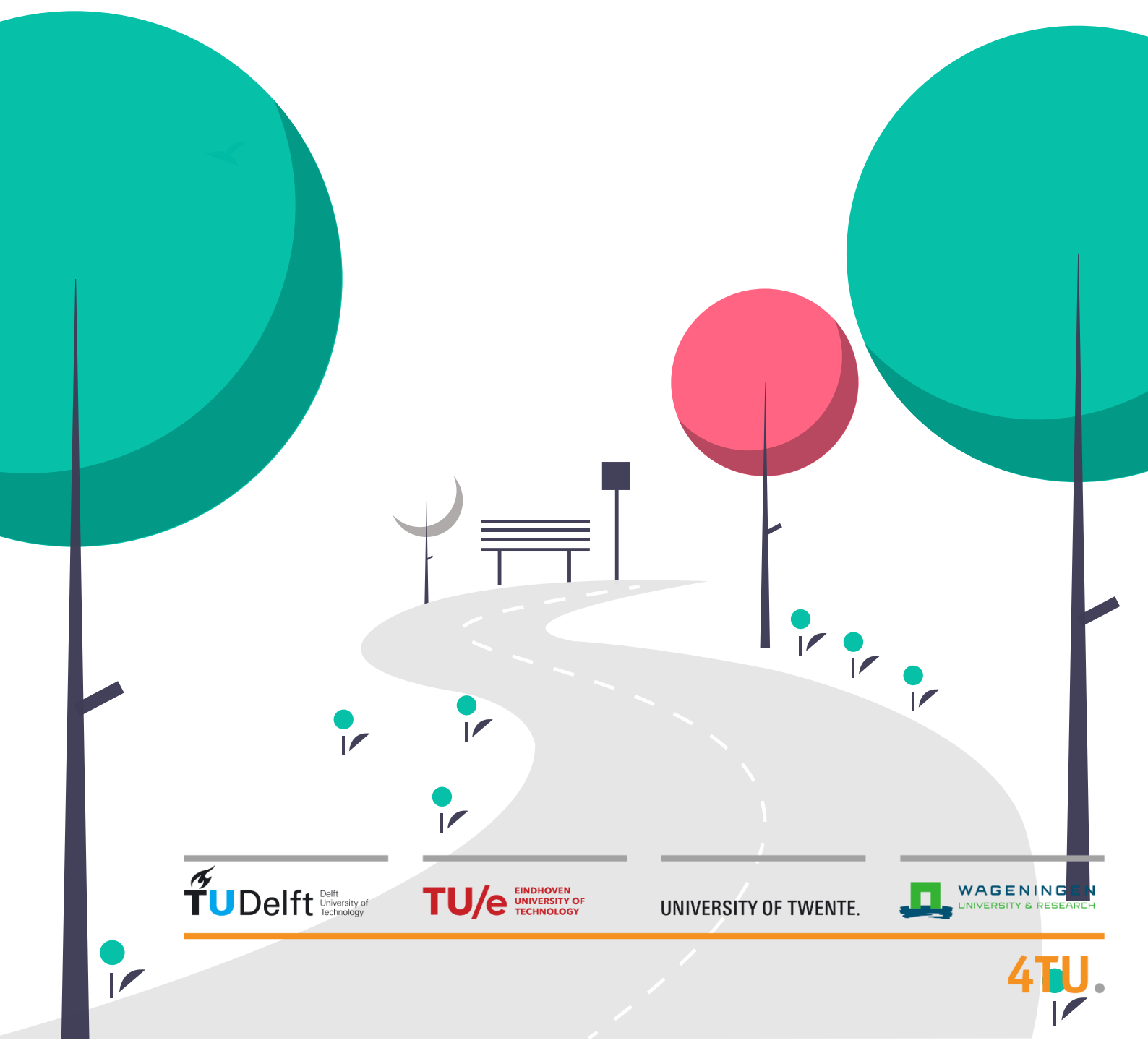


# **4TU.RESPONSIBLE SUSTAINABILITY CHALLENGE**

**TRACK SYLLABUS  
2023 - 2024**



**TU Delft** Delft University of Technology

**TU/e** Eindhoven University of Technology

UNIVERSITY OF TWENTE.

**WAGeningen** UNIVERSITY & RESEARCH

**4TU.**

# 1 Course Description and Learning Goals

This syllabus is intended for the 4TU.Responsible Sustainability Challenge (4TU.RSC). This track is aimed at motivated and ambitious Master's students from the technical universities of Delft, Eindhoven, and Twente. It is an initiative of the 4TU. Centres Energy, High-Tech Materials and Ethics & Technology to provide students with the opportunity to gain a broad set of transversal skills, such as professional skills, such as multi-disciplinary team working; intercultural competencies; challenge-based thinking and research; and various communicative and leadership skills. This syllabus is complemented by the <https://canvas.utwente.nl/courses/10386> Canvas page of this programme.

The shared part of this track (organised by the universities of Delft, Eindhoven and Twente) runs from the **16th of November 2023** until the end of **June 2024**. The entire programme encompasses a study load of 15 ECTS, to be followed extracurricular to the 'regular' study programme of its participating master students.

This programme requires a Bachelor's (BA or BSc) degree to participate. Students applying for the programme are selected based on their motivation, CV and (possibly) an interview. For this programme, no fee is charged to its participating students.

## 2 Learning outcomes

After completing the track, the student...

1. is able to reformulate ill-defined research/design problems, taking into account the system boundaries in this and is able to integrate the new interpretation of involved parties;
2. chooses the appropriate level of abstraction in problem (re)formulation, given the process stage of the research/design;
3. is able and has the attitude to, where necessary, draw upon other disciplines than their own in their research/design;
4. has a systematic approach, characterised by the development and integration of theories, models and interpretations from different disciplines;
5. is able to analyse, communicate and discuss, both verbally and in writing, about research, solutions to problems and societal consequences (e.g. economic, social, cultural) with colleagues, non-colleagues and other involved parties across disciplines;
6. is able to perform challenge-based work on so-called 'wicked' problems, is pragmatic and has a sense of responsibility, is able to deal with limited resources, is able to deal with risks, and is able to compromise;
7. is able to work within a multidisciplinary team;
8. is able to analyse and discuss the ethical and the normative aspects of the consequences and assumptions of scientific thinking and acting with colleagues and non-colleagues (both in research and in design) and integrates these ethical and normative aspects into scientific work.

	IDENTIFY YOUR MAIN CHALLENGE & STAKEHOLDERS	CHOOSE YOUR INVESTIGATION METHODS	EXECUTE/ GIVE AN IMPLEMENTABLE PROPOSAL
CHALLENGE WORK 10 ECTS	ENGAGE	INVESTIGATE	ACT
individual growth	SET LEARNING GOALS THROUGH REFLECTION	REFLECT ON YOUR LEARNING AND WHAT IS NEEDED	REFLECT ON THE CHALLENGE PROCESS AND YOUR OWN ROLE IN THE IDENTIFIED CHALLENGE AND IN THE TEAM
team growth	ENGAGE AS A TEAM THROUGH COACH GUIDANCE	DIVIDE AND CONQUER THOROUGH COACH GUIDANCE	
societal growth	ENGAGE WITH STAKEHOLDERS AND THE CHALLENGE	INVESTIGATE THE CHALLENGE WITH EXPERT GUIDANCE	REPORT FINDINGS AND PROPOSE/ EXECUTE IMPLEMENTATION
INDIVIDUAL WORK 5 ECTS	<b>LEARN</b> <ul style="list-style-type: none"> <li>Sustainability Perspectives &amp; Models</li> <li>Stakeholder Management</li> <li>Group Management</li> <li>Challenge Based Learning</li> </ul>	<b>EXPERIENCE</b> <ul style="list-style-type: none"> <li>Flexible Investigation and Group Learning Path.</li> <li>We offer a teacher network for investigation support</li> </ul>	<b>DISCUSS</b> <ul style="list-style-type: none"> <li>Your Experience on Sustainability</li> <li>Your Group Dynamics</li> <li>Managing Stakeholders</li> </ul>
	REFLECT ON WHAT YOU WANT TO LEARN AND HOW	CHOOSE KNOWLEDGE SPECIALIZATION TRACK	REFLECTION ON SPECIALIZATION ROLE AND TEAM/ CHALLENGE CONTRIBUTION
	REFLECT ON GROUP DYNAMICS AND EXPERTISE	COACH SUPPORT ON HOW TO INTEGRATE KNOWLEDGE AS A GROUP	
	REFLECT ON WHAT KNOWLEDGE IS NEEDED	EXPERT SUPPORT ON HOW TO INTEGRATE KNOWLEDGE ON THE CHALLENGE	MINI- ASSESSMENT ON SPECIALIZATION
	<b>LEARN</b> <ul style="list-style-type: none"> <li>What do you want to learn?</li> </ul>	<b>EXPERIENCE</b> <ul style="list-style-type: none"> <li>Choose from our Specialization tracks and content               <ul style="list-style-type: none"> <li>mini-lecture material (online or recorded)</li> <li>discussion sessions and talks with experts</li> <li>relevant to the project and self-chosen</li> <li>reading material</li> <li>potential mini-assignment (P/F)</li> </ul> </li> </ul>	<b>DISCUSS</b> <ul style="list-style-type: none"> <li>How did your new broadening or specialized knowledge help you?</li> </ul>

Figure 1: Track Overview and tasks per module

### 3 Programme Contents

This 4TU.RSC track follows a 'Challenge-Based Learning' (CBL) methodology outlined further below and in Figure 1. This methodology uses a central challenge (based on a real-life 'case') on which students work throughout the programme, with additional educational activities supporting the challenge. The method makes the students responsible for their own progress and learning journey, which requires leadership, responsibility and good communication from the students. This also provides the freedom and support to execute the challenge to the vision of the team. Aside from the challenge, there are several supporting components to help you structure your work as you complete your challenge.

#### Challenge-Based Learning methodology

The CBL methodology consists of the following phases, which help you to structurally build towards the project outcome.

##### A. Phase 1 - *Finding your challenge*:

1. Formulating your own challenge within the 'Big Idea' of the European Union Green Deal which is relevant for your challenge stakeholder. The 'Big Idea' is the central theme you wish to work on, with your challenge being a specific issue that relates to this overarching theme. Keep in mind that, while your challenge stakeholder already has a specific topic for you to work on, it is up to you to evaluate the context and to analyse what the actual issue at hand is.
2. Formulate the essential questions you need to answer to understand your challenge and to get to a (more specific/better formulated) design or research question. Within this step, you investigate the

challenge topic to understand the context, stakeholders and other influences and to determine what information is needed to formulate a clear design or research question.

3. Formulate the actionable challenge that you will focus on. This is the design or research question that you will address within the continuation of your challenge and should be well-motivated and clearly formulated.

**B. Phase 2 - *Analysing the context*:**

1. Formulate guiding questions to structure the continued search for information needed to complete your challenge. In this phase, you try to understand the issue better by formulating those questions that will help you address the actionable challenge (e.g. what information is needed and which stakeholders/experts should be involved? How can we get this information and how do we make sure the information is valid?).
2. Gather the learning resources to gain the information and skills you need to address the actionable challenge. The learning resources can be your own information sources (from literature or invited experts), the workshops and learning paths provided within this track and any others you may find useful (e.g. micro-modules, MOOCs, books). Make sure that in this step you integrate academic knowledge with societal knowledge (i.e. information you can receive from/through your challenge stakeholder) to avoid a too theoretical outcome of your challenge.
3. Analyse the research completed within this phase. This analysis integrates all the tools that you need to address your actionable challenge and reflects on their quality (e.g. is there information that cannot be known? Are there many different perspectives to consider?). This final step structures and evaluates the information from this phase to determine which considerations are important (e.g. economic, social, cultural) and how each fit together to form one coherent story.

**C. Phase 3 - *Formulating the outcome*:**

1. Determine the outcome of the challenge. This may be a solution to the presented actionable challenge, or it may be a structured assessment of the resulting state of the challenge that can promote further work. Make sure that your final outcome properly integrates the different scientific disciplines you have been analysing. The resulting outcome should be formulated and communicated in a way that fits with your challenge stakeholders (e.g. a formal report, academic paper, promotional campaign). Feel free to be creative and physical prototypes are also very welcomed and supported!

## The Core Challenge and Assignments

The core challenge is based on the CBL methodology described above. For the core challenge, you will complete the first two CBL phases (the 'Engage' and 'Investigate' phases) fully, as well as the first step of the 'Act' phase (i.e. we complete the 'Determining the outcome of the challenge' as the final step). The project, therefore, concludes with a full overview and presentation of the outcome of the challenge. This outcome should also be presented and defended to the stakeholders, track assessors and your fellow students during the final session of this module.

The challenge is provided by a 'challenge stakeholder', a representative of the organisation with whom you co-create and execute the challenge. The organisation, and the challenge stakeholder, are your partners in the team and provide the context of your challenge. However, while the organisation provides a general topic, it is part of the CBL process to identify the underlying actionable challenge and involve other stakeholders if necessary.

The challenge is executed within groups of students from different educational backgrounds and universities. Your team is joined by your challenge stakeholder and a student coach. The stakeholder works with you to first

define the challenge at hand and then move towards a suitable outcome. Within the dynamics of your team, it is important to consider your stakeholder and coach as equal partners within your team. The stakeholder and coach will not have the time to participate as much in the challenge as the students, but they are an integrated part of the team.

Groups are created during an initial stakeholder matching event following the Kick-off on the **16th of November**, during which all students can individually orientate themselves on the different general organisations that are involved in the programme. Students can then select those challenges that seem most interesting to them, based on which groups will be formed by the organisation. For group creation, students will be mixed between universities and educational backgrounds. After matching, **please make sure to appoint one team member to be the point of contact with the stakeholder and coach**, as the students will be in charge of maintaining regular contact.

Throughout the track, students should work to include the perspective of their stakeholders to allow the stakeholders to become integrated members of the team who can provide answers and new viewpoints. The frequency of meetings with the stakeholder may depend on the availability of the team and the stakeholder, but (certainly at the beginning of the track), a high frequency of meetings is advised (at the beginning, bi-weekly meetings are recommended). The entire team is responsible for initiating structured meetings (and planning them timely). Further internal contact (with the stakeholder) should be discussed. We expect a minimum of 3 meetings per module with your main stakeholder.

### 3.0.1 Individual Level

On an individual level, we will evaluate your reflection within a multidisciplinary team and knowledge acquisition. This is done through reflection in the following way:

#### *Engage*

1. **Meetings Portfolio** : This is a reflective logbook of every significant meeting held. This is checked with your coach to see your progress and challenges faced during Module 1. It is a guide to your soft skill development in the upcoming modules.

#### *Investigate:*

1. **Development of Personal Development Plan (PDP):** This is your actionable and reflective development of learning goals for the second module. It should refer to the group investigation plan, but it should focus on your learning path and how you will contribute to the group. The PDP should include soft skills as well as the choice of your specialisation.
2. **Individual Reflection:** At the end of the module you will reflect on an individual level on your development and progress throughout the Investigate phase. You can do this by referring to the PDP or major events in your group and workshops.

#### *Act:*

1. **Individual Reflection:** At the end of the module you will reflect on an individual level on your development and progress throughout the Act phase as well as the whole challenge.

### 3.0.2 Group Level

At a group level, we focus on your group dynamic, workload, and task division. For this reason, we provide a student coach, as well as two group reflections at the end of the Investigate and Act phase. *This coaching is different from your project coaching, for which a teacher/ supervisor is assigned*

For each module, you are expected to meet **at least twice** as a group with your coach, at the start of the challenge and the end. These are spaces of reflection and guidance to develop as a group and discuss the dynamics within a multidisciplinary challenge. The coach can also aid with tools and personal experience. If you need more meeting times with the coach to help with soft skill development, you can reach out.

### 3.0.3 Societal Level

On a societal level, the workload focuses on the challenge and your progress with it. The final deliverables of your work at the end of each module showcase your knowledge development. It is important to always argue and motivate your choices in an academic manner and link to the big idea within Sustainability. Additionally, we provide workshops to guide and develop your learning journey. Due to the freedom of learning, you can contact your supervisor to reach out to our expert network and request particular workshops that might be relevant to your group and help with the challenge. *This is highly encouraged, particularly during the end of the Investigate phase and the Act phase.*

The specialization tracks start in February. This year we will focus the choice for specialization on:

- 1 *Life Cycle Analysis*
- 2 *Circular Economy | Social Innovation*
- 3 *Energy Access | Energy Systems*

## 3.1 Main Activities

### Workshops

Within the course, workshops will be offered to provide you with the knowledge and tools needed to bring your challenge forward. These workshops will be organised, where possible, outside of office hours to avoid interference with your studies. The workshops will be hosted online, to accommodate the students at each location to participate. These workshops require your *active* participation, so make sure to join each session with your camera and microphone *enabled*. The workshops are connected to the different phases of the challenge. The planning of the workshops per phase can be found on Canvas. *Please make sure to check this page regularly and at least before the start of each new quarter to find the upcoming workshops!*

Aside from the required set of workshops offered by the programme, students may request topics of their interest or which are relevant to their challenge. The course teachers will try to accommodate your needs where possible and put you in contact with relevant experts or organise team-based experts to which other teams may be invited. Students may also be asked to host sessions with invited experts for their fellow students on topics related to their challenges and from which other students may also benefit.

While the majority of workshops will be offered online, meet-ups at each location will be organised to help you get to know your group members and the other members of your track. On-site meetings will be planned far in advance to help accommodate schedules. Please refer to figure 2 for preliminary dates of these events. Additional sessions per university may be hosted for convenience or track-based networking. Some stakeholders can also facilitate a learning environment for you.

### Coaching activities

Aside from the content-based workshops that guide you through your challenge, your team will also be coached to further stimulate your teamwork and increase your efficiency. At the start of the track, your team will be connected to your coach. As are the challenges for the stakeholders, **please appoint one team member to be the main contact with your coach**. This may be the same person as for your stakeholder. Your team

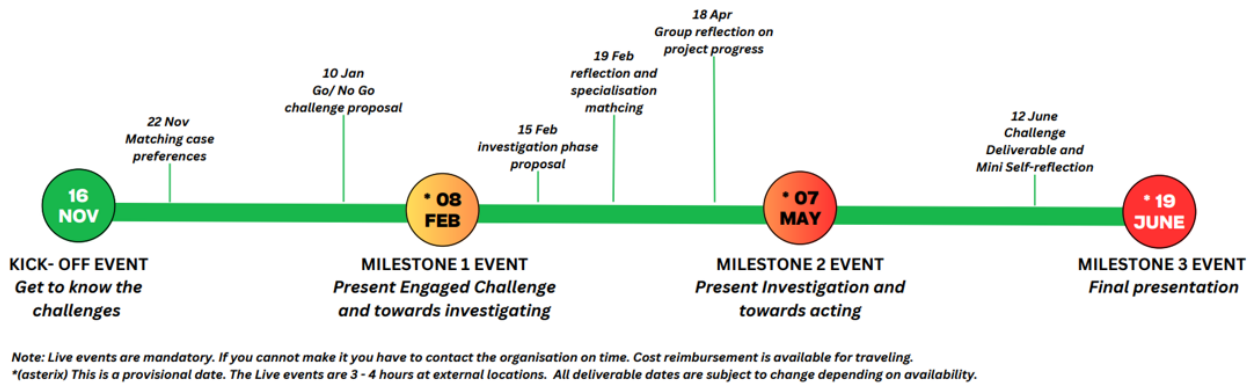


Figure 2: Timeline

should plan your meetings with your coach ahead of time. Per quarter, the coaching moments will be discussed and planned with your coach depending on the needs of the team and the availability of the coach.

The coaching sessions of your team are centered around its dynamics and group work. With your coach, you can discuss your process with the challenge and your project management. Your coach may provide insights regarding the contents of the challenge (e.g. where to look for information), but is primarily focused on the process of the challenge. Process-based questions (e.g. regarding the planning of workshops or on-site events) can be asked to the instructors of the course; content-related aspects of the challenge are to be discussed with the stakeholder (e.g. when pertaining directly to the challenge) or with the instructors (e.g. when specific knowledge is needed). The coach takes on the role of 'socratic grandmother' in the team, by challenging what your team is doing and the structure that you have chosen, while all the same making sure that everything is going well and no issues occur.

### Reflection and peer feedback

Two key elements of this module are individual reflections and peer feedback sessions. First, the individual reflections allow students to work on their personal development by setting goals for their work on the challenge and within the team. The reflection assignments are meant to support students in considering their personal learning goals and determining how they will (continue to) address them. Within the reflections, the process is structured with targeted questions or elements to be addressed by the student. The reflection process is guided by a coach, who can use the outcomes of the assignments to further structure the coaching sessions. Second, the peer feedback concerns the group work of the teams. As the module can be very group-centred, peer feedback can help the teams to step outside of their own project and switch up their work process by gaining the perspectives of their peer groups. The feedback sessions also allow students to get familiar with the work, organisation and team dynamics of the other teams. During the peer feedback sessions, the two teams present their progress to another team. Afterwards, the teacher or coach will guide a discussion on the presentations to let the students provide feedback.

One specific moment of peer feedback is the 'project switch weeks' event during the second phase (after gathering the learning resources). During these two weeks, each group is taken from their own project and switches with another. Beforehand, the two groups meet to discuss their current process and settle on what the group can take over within the two weeks of the switch. This agreement is documented and, upon completion of the project switch weeks, handed in together with a reflection of the work that was done. During the project switch weeks, student groups may offer a fresh perspective or take over a part of the research of their peers and further it. This can involve evaluating the richness of the gathered learning resources or providing new insights that were not yet included. It is not, however, intended that the project switch weeks are used as a 'proofreading session' of any drafts. During these two weeks, the stakeholders do not play a role. Rather,

the two teams are each others' stakeholders for the weeks, as they provide context whenever it is lacking. The two teams, therefore, have to communicate closely about what issues they are facing and how they have addressed it so far. It is also advised that teams plan towards the project switch weeks to make sure they can give their switching group a clear task to provide new insights for.



## 4 Milestones and Deliverables

The following milestones and deliverables are required for the separate phases of this programme. For each deliverable, an assignment will be created on the <https://canvas.utwente.nl/courses/10386Canvas> page along with its criteria and deadline.

### Group deliverables - Phase 1

The first phase consists of creating a well-motivated and precisely formulated actionable challenge that forms the core of your continued work.

#### Group deliverable 1: Challenge proposal

Write a proposal that motivates the actionable challenge you have chosen (within the 'Big Idea' and the context of your topic) and how you plan to address this challenge within the timeframe of the track. Please include the following aspects (max. 5 pages).

- Overview of your team members (educational background, expertise in the team, role). This includes both the student members as well as the coach and stakeholder.
- Background/context of your actionable challenge within the organisation.
- Clear description and motivation for the actionable challenge in the form of a motivated research or design question.
- An overview of any additional stakeholders that may be involved with your project (excluding your main challenge stakeholder).
- Proposed strategy and planning for the subsequent phases.

### Group deliverables - Phase 2

The second phase consists of formulating guiding questions; gathering learning resources and analysing the outcomes of the phase. *Please keep in mind that the first deliverable is an investigation plan at the start of the module.*

#### Group deliverable 2: Investigation plan

In this assignment, you have to hand in a plan of investigation and learning goals on a group level. This signals an end to your Engage phase and move toward Investigating. Be critical and evaluate your current knowledge as a group and individually. Additionally, we advise the usage of a CTA (cognitive task analysis) or some SMART goals. Here is how a CTA is structured:

- List the activity related to each investigation step
- Break each activity down into steps
- For each step rate the complexity and difficulty: 1 ( low) to 3 (high)
- For each activity create a work division and preferably a timeline.
- Make a comment per activity or step to talk about how you can overpass it and what measures are necessary for your success (as detailed as you would like)

#### Group deliverable 3: Reflections on the project switch weeks

Hand in the agreements made before the project switch weeks and reflect on the subsequent execution of the other group's challenge. Include a reflection on the work of the experience of the project switch weeks (i.e.

what did you learn from the process and the work structure of the opposite team; what can your team take with you to your own project?). Write a separate document with clear feedback for the other team to further improve their work. The latter reflections will also be shared with the other team and will be assessed for its feedback quality. You will also receive a workshop on structuring peer feedback of this kind. Write max. 3 pages for the reflections and 2 pages for the feedback to the other team. *Please note that the feedback to the other team is not the 'only' outcome you should have from the project switch weeks. During these two weeks, you will further the work of the other team, the assignment is merely a reflection of this process.*

#### **Group deliverable 4: Analysis of challenge research**

Provide an analysis of the entire research conducted within this phase. Make sure to include the following aspects (max. 7 pages).

- Summarise the outcomes of the first phase (specifically the 'actionable challenge', how it fits within the context of the organisation and how it relates to the Big Idea) and indicate whether any adaptations were made compared to the first deliverable.
- Describe and evaluate your approach within the second phase, including the guiding questions you formulated, learning resources you utilised, why you chose these resources (and not others), and your overall process.
- Describe the outcomes of the second phase. Highlight discrepancies, common themes or noteworthy elements moving forward. Make sure to answer all your formulated guiding questions and provide academic validation for your work.
- Provide your approach for the final phase to move towards a clear outcome and a suitable presentation of this outcome. What is needed for you to complete this challenge and how will you achieve it (please note that only a written - albeit thorough - explanation of the outcome is asked within the final phase, the solution does not need to be implemented at the organisation).
- Include a team reflection on your work within the first two phases and the division of tasks/roles. Reflect on whether this division was productive or whether you will make changes for the final phase. You can base this reflection on outcomes of a guided Buddycheck evaluation.

#### **Group deliverables - Phase 3**

The final phase for this project consists of determining the outcome of the overall challenge analysis and execution.

#### **Group deliverable 5: Final report of challenge**

Within the final group report, the entire process of your challenge should be incorporated. Make sure to write an academic report with consistent citations (APA reference is preferred but not required) and suitable headers. Include the following elements (max. 10 pages).

- Introduce the topic, organisation and context in which your challenge is centred, including any relevant stakeholders.
- Summarise your actionable challenge as a research and/or design brief.
- Summarise the challenge analysis done in the second phase and its main outcomes as background to your final work.
- Provide a detailed description of your proposed solution to your actionable challenge, taking the context of the organisation (and other relevant stakeholders) into account. Ensure that your outcome has a transdisciplinary character and integrates the different elements related to your challenge.

**Group deliverable 6: Presentation and defense of challenge outcome**

At the end of the track, the group gives a 15-minute **group** presentation and 15-minute defence during a closing conference to present the outcomes they found within their challenge. The outcome of your challenge should be presented in such a way that both your challenge as academic stakeholder(s) can utilise the outcomes in their continued work on the topic. The presentation session is further meant to let all teams come together to discuss each other's projects and outcomes. Within the defense of your work, other teams and the course teachers can ask questions to evaluate the practicality and logic of the proposed outcome. For this purpose, a highly interactive session can be held, mimicking a real (poster/video) session on-site. The presentations can be held in any format and way that matches with the challenge and the stakeholder's organisation. The use of interactive and creative formats is encouraged. The presentation will be peer-reviewed during the session by members from other teams to determine the most innovative or impactful outcome. Furthermore, an assessment committee with (expert) representatives judge the different outcomes and give insightful feedback to the teams.

## 5 Assessment

The assessment consists of group deliverables, individual reflections, and attendance and active participation. The entire track has a pass/fail structure. Students should pass all components to pass the entire track. If the student fails a component, a repair may be offered. For each assessment, the assignment information (e.g. rubric, deadline, or contents) communicated on Canvas is leading.

## 6 Useful Information and Links

Contact information for the course instructors.

- **TU Delft:** Shoshan Abrahami (s.t.abrahami@tudelft.nl)
  - university contact page:  
<https://www.tudelft.nl/staff/s.t.abrahami/?cHash=6d1083dc97ef4cafb5fc0f05b179d19here>
- **TU/Eindhoven:** Maja Rücker (m.rucker@tue.nl)
  - university contact page  
<https://www.tue.nl/en/research/researchers/maja-ruecker/>
- **University of Twente:** Mina Shahi (m.shahi@utwente.nl)
  - university contact page  
<https://people.utwente.nl/m.shahihere>

Useful links.

- Course <https://canvas.utwente.nl/courses/10386>Canvas page.
- 4TU.HTM <https://www.4tu.nl/htm/education/responsible-sustainability-challenge/webpage>.
- European Union [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_nl)  
 nlGreen Deal webpage.