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UNIVERCITY ACTION LAB

CHALLENGE  
TEACHING TOOLKIT

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## 1. INTRODUCTION: CONCEPT AND VISION

UniverCity Action Lab Challenge Teaching Toolkit provides guidance for university lecturers and study programme managers to implement a hands-on, real-life, and problem-based course module in cooperation with city stakeholders: public authorities, relevant societal representatives, or industry partners. The Toolkit was developed as an intellectual output (IO3) within the framework of the UniverCity Action Lab project, co-funded by the Erasmus+ programme. This is a living document that can be continuously updated with experience from practice as UCityLab courses (City Challenge Programmes) will be piloted at four project partner universities.

As cities in Europe and beyond are faced with serious environmental, economic, and socio-cultural challenges, an engaged citizenship education is of growing importance. "Sustainability problems inherently have social, natural, and engineering science dimensions, and these problems cannot be understood or addressed without each dimension. To be successful, sustainability science will require experts working together from a range of scientific disciplines in a truly interdisciplinary fashion." (Knowlton et al. 2014: 9429). The UCityLab Teaching Toolkit (henceforth referred to as the Toolkit) responds to the need for developing and implementing a problem-based, hands-on course, which will provide the students with the necessary knowledge, skills, and competences to tackle urban challenges through collaborative, interdisciplinary research and project work. In this sense, the UCityLab course builds on the famous Chinese proverb "Tell me and I will forget, show me and I will learn, involve me and I will understand" (attributed to Xun Kuang, 312-230 BC).

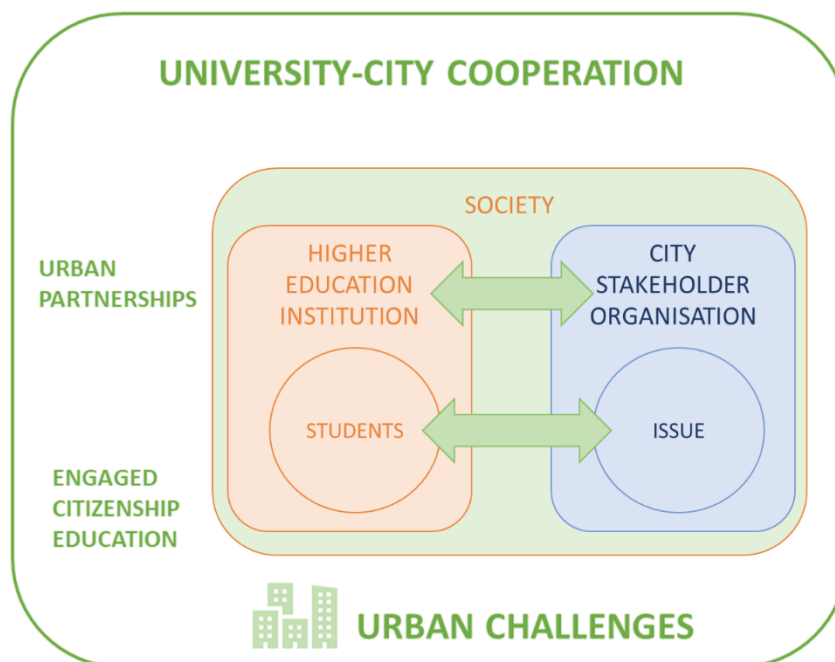


Image 1: UCityLab Challenge scheme

The key goals of the UCityLab project are:

- to support the establishment of urban partnerships by enhancing cooperation between higher education institutions and city authorities and other relevant urban actors, such as research and development institutes, various agencies, and NGOs;
- to develop and increase societal relevance of higher education curricula that will reflect the actual skills needs in the field of sustainable urban development;
- and to develop, implement, and test teaching and learning practices that are problem-based, expose students to real-life urban societal problems, and enable the students to address them with a relevant set of skills and competences.

The Toolkit reflects and incorporates these goals by providing **a wide set of guidelines for developing a City Challenge Programme and tools for its implementation**, including syllabus template, course and module structure, learning objectives, readings suggestions, and a selection of teaching and learning practices that support the delivery of the course. In this first chapter, we first provide an overview of how we envision the strengthened university-city cooperation through a challenge-based (problem- or project-based) teaching and learning course module.

### Vision: University - City cooperation in teaching and learning for an engaged citizenship

In the programme of the UCityLab project, four pilot City Challenge Programmes will be delivered at partner universities. In these programmes, integrated into the existing study curricula, students of different study fields will work on real-life urban sustainability challenges in various domains, such as energy, mobility, urban space or urban green areas. The UCityLab programmes will focus on **applying theory into practice and vice versa**. In doing this, they will lean onto the underlying theory and methodology, taught within the specific programme(s) at the partner institution.

As they will be embedded within four different higher education institutions, they will inevitably reflect the host institution, study programme, or preceding programmes' orientation, thus giving UCityLab programmes specific and individual "flavour" and perspective (e.g. business, engineering, or anthropology), ultimately shaping also the programme outcomes. However, the UCityLab teaching process will provide relevant **theoretical and practical insights** into the selected topics, **research and data management methodology** that will reflect the **interdisciplinary** nature of urban sustainability challenges, and equip the students with the necessary competences for tackling sustainability issues (for an analysis of sustainability competences, see e.g. Wiek, Withycombe and Redman 2011).

But for addressing complicated, real-world sustainability problems, interdisciplinarity per se does not suffice: active collaboration with various stakeholders throughout society must form another critical component of sustainability science (Yarime et al. 2012). However, the key differentiating factor of the proposed programme are its **project- and problem-based component and close cooperation with external partners**, intensively involved in the day-to-day

management of these challenges, policy-making, or designing innovative solutions, products or services. The theoretical and methodological lectures and hands-on workshops will intertwine with students' **team research projects**. The student teams will learn to identify research and/or development challenges, embed them within the wider theoretical framework, and develop their own research plans, with guidance and support from their HEI mentors and external organisations mentors. They will work with external organisations to frame research questions, to access the existing data, connect with external experts, or access citizen groups relevant for their research topics. The students will apply different research methods to **real-life urban sustainability challenges (problem-based learning)**, and experiment with design or development approaches that support co-creation and close involvement of city inhabitants in a bottom-up, user-centred innovation process.

Through the programme and through working in teams and with non-academic partners, the students will gain valuable and much needed knowledge and experience in conducting **collaborative research and communicating research results** to their peers and to an external audience. This will equip them with these increasingly required skills and competences in workplaces and in research settings, enhancing their employment opportunities within and outside of academia. Cities are particularly well-fitted to serve as the arena for this type of exploration, as they are faced with complex, multifaceted issues that can only be addressed successfully by incorporating multiple perspectives. Overcoming the challenges in communication, information sharing and relationship building that are an inherent part of collaborative research projects "requires that collaborative skills be developed in students, in the same way that technical skills such as field and laboratory methods, statistics, and writing are explicit parts of university science curricula" (Casson et al. 2018: 820).

Image 2 (below) charts the UCityLab teaching and learning process, where the theoretical part (lectures and workshops) on key topics are intertwined with practical, applied project work in order to achieve the key intended learning outcomes of the City Challenge Programme, i.e. relevant knowledge, skills and competences. Individual components of the teaching and learning process are described in more detail in chapter 3 (*Curriculum with Description of Modules*).

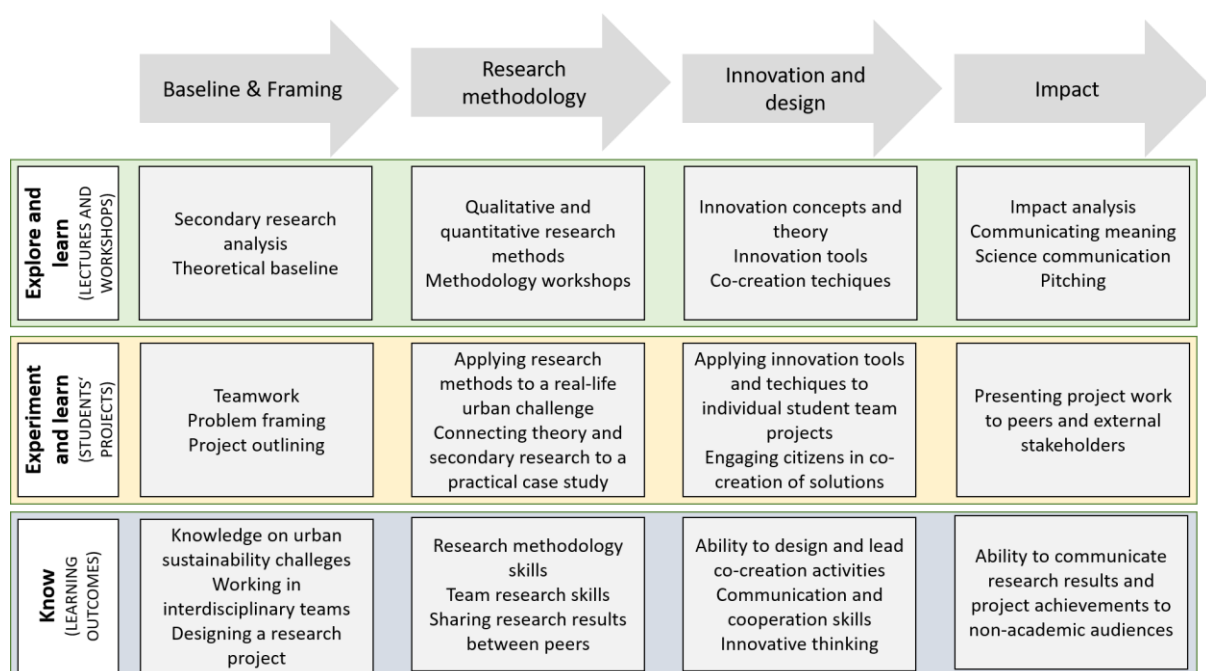


Image 2: Overview of UCityLab teaching and learning process

## How to use the UCityLab Toolkit

The UCityLab Toolkit is initially intended to support the planning and implementation of four pilot Challenge Programmes at project partner universities. However, the final version of the Toolkit, supplemented with practical experience, will be made freely available and widely distributed to assist any higher education institution in developing a problem-based learning module focused on urban sustainability challenges and in partnership with external stakeholders (city authorities, institutes, planning departments, industry partners, local businesses, NGOs, etc.).

The Toolkit provides the following components of the City Challenge Programme:

- overview of the programme syllabus (chapter 2);
- overview and description of four modules with key baseline readings list, a collection and description of suggested student activities to be undertaken within each module, and a list of intended learning outcomes (chapter 3);
- suggested student assessment methods (chapter 4);
- description of suggested teaching methods (chapter 5);
- suggested involvement and role of external organisations in the programme (chapter 6);
- and guidelines for programme administration and management, including the integration of the City Challenge Programme into existing programmes or curricula (chapter 7).

In the UCityLab project, the four partner universities are integrating the programme to different study programmes, the modules will be delivered by university teachers from different disciplines, and they are recruiting or involving students with different study backgrounds.



Therefore, the Toolkit provides a wide selection of topics, teaching and learning approaches, and allows for a range of possibilities to design individualised and adapted programme syllabi and curricula. **The Toolkit should be read as a guidance document and a choice of recommended approaches and topics, i.e. tools for designing and implementing the UCityLab's City Challenge Programme, and not a prescriptive methodology.**

## 2. CITY CHALLENGE PROGRAMME SYLLABUS OUTLINE AND TEMPLATE

The City Challenge Programme syllabus outline chapter provides **a template (a sample) for creating the programme syllabus**. The syllabus template is not prescriptive and the content can be adapted by each participating HEI according to their UCityLab pilot programme specifics. **Not all elements of the syllabus may apply to an individual pilot and would be omitted in such case.**

The syllabus outline includes chapters on the organisation of the learning process, specific requirements, an outline of the programme content, programme aims and intended learning outcomes, as well as a suggestion of the student assessment, if this will be a part of the individual pilot. The key programme aims and the general intended learning outcomes should guide and be integrated into all four UCityLab programmes; however, individual specifics of each implementing partner's context will inevitably shape the delivery of the programme (e.g. the programme may be integrated within an existing programme; the student selection criteria/entry requirements might vary or might not be needed; the programme may be offered to students within a specific field or degree programme; the ECTS or programme hours might differ between the four UCityLab cases etc.). Additionally, as the project's HEI partners are based in different disciplinary backgrounds, the field of study in which the programme could be implemented will also impact and shape the content and orientation of the programme, i.e. the UCityLab programme will take the flavour of the topic of the degree – be it business studies, anthropology, or engineering.

### 1. Position of the programme within HEI structure and study curriculum [explain the embeddedness/integration of the Challenge Programme at your HEI]

The interdisciplinary programme is offered as part of an existing study programme at given HEI (integrated into an existing programme at a specific Department/Faculty), or as a free-standing (extracurricular) programme across Faculties/Departments of the HEI. The programme is open to interested students of all disciplines/all students enrolled at a particular department.

### 2. Type of instruction/teaching and forms of work [describe how the Challenge Programme will be implemented]

The programme is taught in lectures/seminars/workshops/through individual and group assignments (team project work). The programme will be delivered in the frame of XY hours. It takes a problem- and project-based teaching and learning approach where groups of students work on real-life urban challenges in partnership with external organisations (city stakeholders). Individual/group assignments are organised as a research, design and/or development project, undertaken by student teams mentored jointly by pedagogical mentors and external organisation representatives (field mentors).

Language of instruction: local language(s), English

LECTURES	SEMINAR	TEAM PROJECT ASSIGNMENTS	TOTAL HOURS	ECTS
XY hours	XY hours	XY hours	XY	XY

### 3. Entry requirements/Prerequisites [list entry requirements, if any]

In case there are any entry requirements at an individual HEI or its individual programme, these should be included in the syllabus.

### 4. Programme content [describe content of the Challenge Programme]

The programme enhances cooperation and knowledge exchange between higher education and city stakeholders (external organisations, such as city authorities/municipality, local councils, planning departments, local districts, policy-making authorities, local businesses/industry, relevant NGOs or non-profit institutes, R&D organisations etc.) as an important strategic direction in tackling urban sustainability challenges. The programme takes the form of problem-based learning, which enhances practice-oriented learning outcomes: it combines theory and methodology with practical work assignments in the form of student team research projects on real-life city challenges, identified in partnership with external city stakeholders. The programme structure and content support acquiring the knowledge, skills, and competences that increase the students' employment opportunities and career prospects.

The programme content is divided into four thematic clusters (modules):

- a) Urban context and associated opportunities and challenges (relevant theoretical insights into socio-economic and environmental city challenges, including but not limited to: resource availability and management, energy efficiency and energy poverty, water, urban environment and urban green, food safety, housing, mobility, or pollution).
- b) Qualitative and quantitative techniques of systematically gathering and analysing data (research methods ranging from e.g. secondary sources analysis, surveys, interviews, to participant observation, or other research techniques relevant to the discipline/field of study, in which the UCityLab programme is integrated).
- c) Conceptual and practical tools of innovation (e.g. user-centred design and development, co-creation techniques and tools, the quadruple helix model of innovation, citizen innovation, social entrepreneurship and business model innovation as a special chapter).
- d) The art of selling a promising idea and creating impact (e.g. impact assessment, science communication, pitching).

All theoretical and methodological learnings are transferred into and experimented with in practice, as the student teams conduct practical project assignments within the selected city challenge. The students work in teams to prepare a project proposal, research plan, implement research, analyse results, support them with theory and secondary research analysis, give substantiated feedback to their peers, and prepare a presentation. The detailed content of the programme is adjusted by the participating HEI/pedagogical mentor, taking into account the selected city challenges and topics, field of study/programme within which the programme is embedded or is part of, as well as the selected external city stakeholders.

### 5. Readings [list any recommended or obligatory literature]

The readings and the core obligatory literature for the implementation of the programme will be defined by each programme coordinator, since it is expected that the programme contents are adapted to the selected city challenges and themes. Additional readings suggestions are included in the description of modules in chapter 3.

- Darchen, S. and Searle, G. (2018). *Global Planning Innovations for Urban Sustainability*. Routledge studies in sustainability. Routledge.
- Gehl, J. (2013). *Cities for People*. Island Press.
- James, P. (2014). *Urban Sustainability in Theory and Practice: Circles of sustainability*, Advances in Urban Sustainability, Routledge.
- Nijkamp, P. and Kourtit, K. (2013). The "New Urban Europe": Global Challenges and Local Responses in the Urban Century'. *European Planning Studies*, 21(3), 291-315.

## **6. Learning outcomes [specify the key intended learning outcomes]**

This is an overview of key learning outcomes, targeted by the UCityLab Challenge Programme. However, each participating HEI can specify specific intended learning outcomes, as they apply to their individual context.

### *KNOWLEDGE AND UNDERSTANDING*

Upon successful completion of the City Challenge programme, the student will be able to:

- demonstrate knowledge and understanding of urban sustainability challenges,
- demonstrate comprehensive knowledge of specific sustainability topic(s), related to their selected project topic,
- demonstrate an awareness of the complexity of the urban actors' network and a deeper knowledge of the specific external organisation(s);
- show an advanced knowledge of qualitative and quantitative research methods and data analysis in project work;
- display an understanding of innovation processes, including user-centred development and co-creation techniques;
- argue for the value of interdisciplinary research processes;
- explain and display the basic premises of science communication;

### *SKILLS AND COMPETENCES*

The student successfully completing the City Challenge programme will gain the following key skills and competences:

- teamwork and ability to work in interdisciplinary research teams (communicating across disciplines, active listening);
- outlining and implementation of the research process (research plan, choice of methods, research implementation, sharing research results);
- applying theory into practice and vice-versa (connecting theory to real-life challenges);
- project management (development, organisation of work, coordination, communication, reporting, giving feedback)
- impact assessment and communication of project results;
- communication and cooperation with non-academic partners;

## **7. Assessment [specify assessment specifics, if any]**

In case assessment is an integral part of the UCityLab Programme, the assessment process may be specified in the syllabus, defining obligatory components of the programme, and specifying the graded assignments.

### 3. CURRICULUM WITH DESCRIPTION OF MODULES

Chapter 3 provides a more detailed description of the four proposed modules in the City Challenge programme. Each module component includes a description of the learning objectives, the themes covered with a list of reading suggestions, as well as suggested learning activities and practical assignments. **This serves as a resource only. The description of modules is not prescriptive and will be adapted by each participating HEI according to their individual institutional context (HEI, programme, embeddedness of UCityLab Challenge Programme), programme focus, selected city challenge(s), and choice of external partner organisations.**

UCityLab's programme design incorporates four modules, aimed at equipping the participating student with the relevant skills and competences for social entrepreneurship activities and engaged citizenship through applied research, project development and implementation, project teamwork and applying theory and research methodology to real-life urban sustainability challenges.

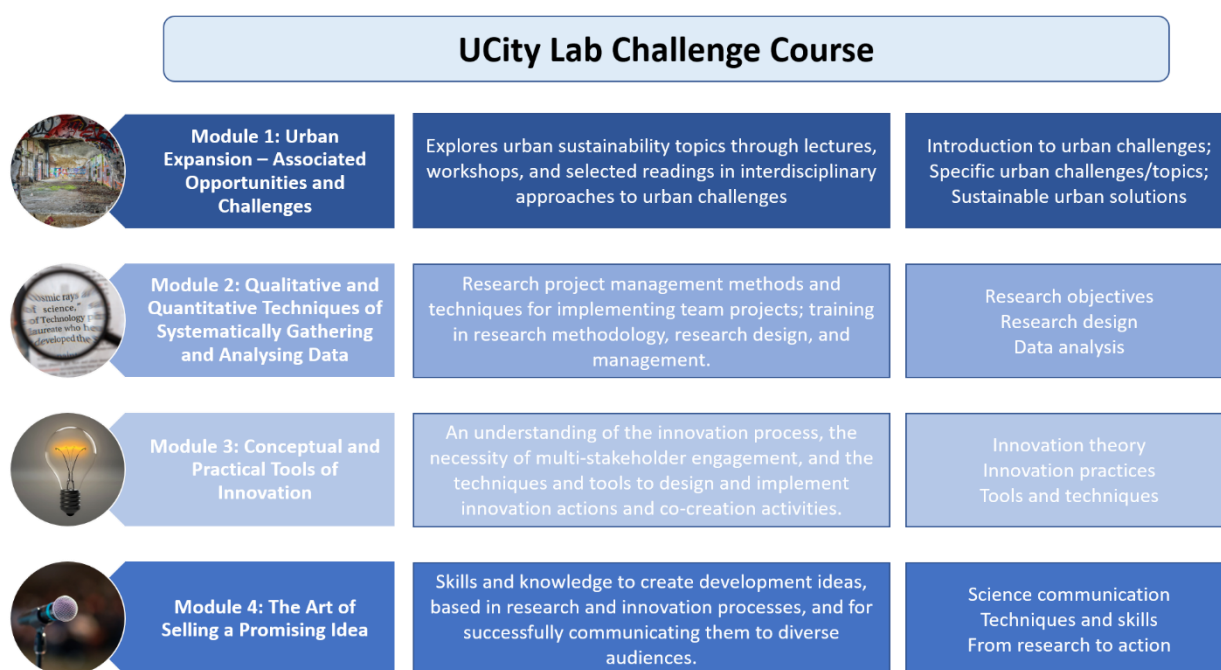


Image 3: Overview of UCityLab Challenge programme

The description of each of the four modules begins with an outline of *intended learning outcomes* (learning objectives), which is divided into topics, theory, or methodology covered by the module and skills and competences to be obtained within the individual module. Each *module content* is then briefly discussed and divided into phases, which are supplemented with a baseline *exemplary reading list* and an example of suggested *teaching and learning activities*, connected with the topics covered by the module and the set learning objectives. The modules are constructed widely to allow adaptation of the programme content and activities to individual HEI context.

## Organising the learning process

There are (at least) three variants of organising the learning process, which includes both theoretical and methodological topics covered, as well as practical, project-based work carried out by the students in teams. The implementation of the learning process is agile and individual HEIs can either adopt one of the models, or design a combination thereof.

- a) In the first variant, the theoretical and methodological components of the programme's modules are intertwined (supplemented) with practical assignments – blending lectures, workshops with student group project work. In the description of the modules in this chapter, the suggested activities therefore include corresponding practical, project activities, which are connected to the topics covered in each module section. The key benefits of such an approach are that the new knowledge is immediately put into practice through practical assignments. The lectures and workshops are delivered in a “just in time” manner. The student teams begin working on their projects already within the first module, testing and experimenting with different methods, approaches, and teamwork, and are progressing through their projects in a paced manner. However, this variant requires a well-planned curriculum outline, pacing the lectures and workshops strategically with the required time for research and other project activities.
- b) In the second variant, theoretical and methodological components of the modules are clustered and form the first part of the learning process, while the project work with practical assignments (research planning, research implementation, research analysis and presentation) form the second part of the learning process, where academic and external organisation(s) mentors play the role of advisors and guide the research process and project activities of the student teams. The two components of the programme (theoretical and practical) can be organised in different timelines, not necessarily divided equally within programme duration. The key benefits of such an approach are that the programme planning process is easier, as all theoretical and methodological content is delivered in one sequence. Additionally, the students get a full overview of the theory and methodology before they set out to plan and implement their team projects. However, this can also present an obstacle, as the learning content is very diverse and presented in condensed continuum, which may affect the students' capability of delivering the activities.
- c) In the third variant, the UCityLab Programme is carried out as a practical component of existing course(s) at an individual HEI. In this case, the theoretical and methodological inputs are in the domain of those courses, while Challenge programme provides its practical components – project- and problem-based work on urban challenges and in cooperation with external stakeholders, where participating students apply theory and test or experiment with the methodology acquired within their respective curricula.

## Adapting programme content to individual HEI

1. When the programme curriculum is planned at your institution, we suggest that you start with narrowing down the intended learning objectives of each module. These will depend

on a number of factors, such as institutional orientation (within which HEI/programme/discipline the UCityLab programme is embedded); institutional capabilities (availability, knowledge and experience of teaching staff); availability of potential invited external experts, or the type and nature of selected external organisations. (What we wish to offer vs. what we have the capacity to offer.)

2. Then consider the learners' profile: who are the students attending the programme, what are their academic backgrounds, their existing skills, and learning needs?
3. When the intended learning outcomes are clear and the students' profiles identified, start selecting the programme learning activities that will optimally fill the gap between learning objectives and students' needs and existing knowledge or skills.



Image 4: Playbook for innovation learning: 35 diagrams to support talking and thinking about learning for innovation, Bas Leurs and Isobel Roberts (nesta, 2018)

### Selection of urban challenges for team projects

The specific challenges that the student teams will be working on in the practical part of the programme (team projects) can be identified and selected in at least three different ways. The challenges partially depend on the nature (type) of external city organisation(s) that have been identified as collaborators in the learning process, as the selected challenges should also be relevant to or connected with the aims or type of work these organisations are doing.

- a) **Loose challenge definition.** The HEI and the external organisation(s) collaboratively define broader relevant urban sustainability topics (e.g. urban mobility or urban space). In case the external organisation has a wide array of work areas (e.g. local municipality), the topics may be structured even more loosely. The student teams then identify their specific challenge and research questions through literature review (Module 1) and exploratory research (Module 2). This approach allows for a consensus between the



interests of all three stakeholder groups (HEI, external organisations, students) and furthermore supports the idea that the challenges should be real-life, based in everyday experiences of the city inhabitants or specific groups of city inhabitants. It also takes into account that the external organisations would preferably be selected prior to the beginning of the programme and that this can affect the selection of potential project topics. However, this model also poses a risk that not all team may be equally successful in identifying their specific challenges on time, which may cause delays in their progress through the programme.

- b) **Partially structured challenge definition.** The HEI and the external organisation define a number of specific urban challenges (e.g. how to increase the uptake of e-mobility in the city; or how to revitalise a certain degraded urban area). These options are then presented to the students and teams of students are formed around each specific challenge. This approach responds to the needs of the HEIs and external organisations, but leaves less room for exploration to the students. It also to an extent excludes the actual users and the process of identifying their existing practices and needs as the baseline of setting up research objectives. Prior partial identification and structuring of the challenges allows for a more detailed planning of the programme content, as the specific project topics are known in advance. It also ensures that all teams have a partially defined and relevant challenge and equal starting point, and that they can progress through the project at a similar pace.
- c) **Unstructured challenges.** The HEI identifies a number of potential external partner organisations that are willing to take part in the teaching and learning process. As the students explore urban sustainability topics in Module 1, they are allowed to define their topics of interest in a team consensus. The specific challenges are identified by the student teams through review of secondary research materials, available sources, or exploratory research. The external organisation is selected accordingly, based on the principle of best fit (considering each specific challenge). This approach offers a high degree of autonomy to the students and requires an advanced degree of independent and team work, as well as experienced guidance by their HE mentors. It also allows for identification of those challenges that are most relevant to the target groups, responding to their needs. However, it is organisationally and logistically challenging, as the exact external partner organisations are not known in advance, which can affect the programme content planning and pose certain risks, such as unexpected unavailability of fitting external organisations.

**Module 1: Urban Context – Associated Opportunities and Challenges**

LEARNING OBJECTIVES	KEY SKILLS & COMPETENCES
Urban challenges & urban sustainability	Recognition of the interdisciplinary nature of urban challenges
Urban – rural dynamics	Ability to find, critically read & assess secondary research material and sources
Urban expansion and migration	Ability to discuss urban sustainability challenges with peers
Circular economy	Ability to link theoretical insights with own everyday experience
Social innovation	Ability to apply previous theoretical and methodological knowledge to urban sustainability challenges
Smart cities and communities	
Inter- and trans-disciplinarity	

Urban sustainability is a systemic interplay between environmental, economic and socio-technical factors that require an interdisciplinary approach to research and development. As more than two thirds of the European population lives in cities, these are faced with a number of challenges that require immediate attention in order to ensure that the cities of the future are sustainable, resilient, and inclusive. “Making cities sustainable means creating career and business opportunities, safe and affordable housing, and building resilient societies and economies. It involves investment in public transport, creating green public spaces, and improving urban planning and management in participatory and inclusive ways” ([Sustainable Development Goal 11: Sustainable Cities and Communities](#)). The first module explores urban sustainability topics through lectures, workshop, and selected readings in interdisciplinary approaches to urban challenges through the lens of the individual UCityLab programme specifics (i.e. disciplinary background, programme orientation etc.).

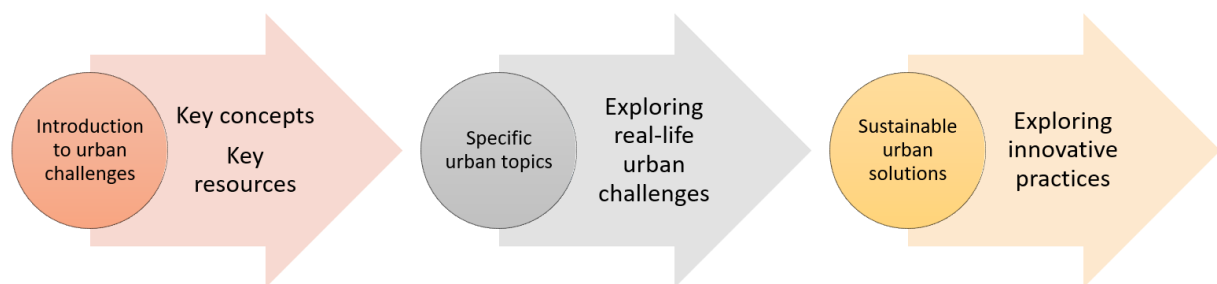


Image 5: Module 1 concept

**Introduction to Urban Challenges**

Why are cities exciting and challenging at the same time? The module introduces urban research and an overview of urban sustainability issues. The students are familiarised with key

concepts (incl. sustainability, urban planning, urban expansion, smart cities) and introduced to contemporary issues in urban policy-making. The resources covered support recognition of the inherent interdisciplinarity of urban challenges. The topics can be taught in the form of lecture(s) and/or individual/group assignments.



### Suggested readings

- Dushenko, W. T., Dale, A., & Robinson, P. (2012). *Urban sustainability: Reconnecting space and place*. Toronto: University of Toronto Press.
- James, P. (2014). *Urban Sustainability in Theory and Practice: Circles of sustainability*. Advances in Urban Sustainability, Routledge.
- Lang, D.J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., Swilling, M., Thomas, C.J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science*, 7, 25–43.
- Nijkamp, P. and Kourtit, K. (2013). The “New Urban Europe”: Global Challenges and Local Responses in the Urban Century. *European Planning Studies*, 21(3), 291-315.
- Video: [The OECD Principles on Urban Policy](#)
- [Cities of tomorrow: Challenges, visions, ways forward](#). European Union Regional Policy, October 2011.
- [Inclusive Smart Cities: A European Manifesto on Citizen Engagement](#)



### Suggested activities

- **In-class activity:** in pairs or teams, students explore the online EU urban policy resources and map out key organisations and agencies that deal with cities and urban challenges and/or key topics that are recurrently dealt with. They present and discuss their findings with peers (P2P feedback).
- **Individual reading assignment:** students read an overview chapter/paper on urban sustainability prior to class and participate in a critical discussion of the paper with peers and mentor(s).

## Specific Urban Sustainability Topics

**Which specific urban challenges are we faced with in our everyday lives?** Starting from everyday lived experience of the class, the module focuses on particular thematic clusters of urban sustainability challenges, e.g. resource availability (water, energy, food), urban space (public space, urban green), housing and infrastructure, or urban mobility. The topics are explored through secondary research material (selected articles) and taught in the form of lectures/workshops and reading assignments. This section offers an opportunity to invite external experts/representatives of external stakeholder organisations to present their experiences and practical examples in a lecture or a workshop. The students are familiarised with a wide selection of urban sustainability topics and get a deeper understanding of individual urban challenges. They can discuss and begin identifying the local challenges that they will address in their team projects.



### Suggested readings

- Morgan, K. (2009). Feeding the City: The Challenge of Urban Food Planning. *International Planning Studies*, 14(4), 341-348.
- Rutherford, J. and Coutard, O. (2014). Urban Energy Transitions: Places, Processes and Politics of Socio-technical Change. *Urban Studies*, 51(7), 1353-1377.
- Devine-Wright, P., Batel, S., Aas, O., Sovacool, B., Labelle, M. and Ruud, A. (2017). A conceptual framework for understanding the social acceptance of energy infrastructure: Insights from energy storage. *Energy Policy*, 107, 27-31.



### Suggested activities

- **Formation of student teams**, allocation of individual urban sustainability topics between teams.
- **Group reading assignment**: teams read a case study/research paper on individual urban sustainability topic and present a critical assessment of the case to their peers, leaning onto theoretical inputs from previous lectures and assignments.
- **First meeting with external stakeholder organisation(s)** representative(s) – presentation of local city challenges and roundtable discussion with students.

## Sustainable Urban Solutions

**How do cities address urban challenges creatively and innovatively?** The module concludes with a deeper dive into individual urban sustainability topics with identification of innovative/successful practices in cities in Europe and beyond. The students are familiarised with the concepts of social innovation, social entrepreneurship, circular economy etc. through lectures/workshops. In teams, the students identify and explore best practice examples in their chosen/allocated topic (e.g. energy efficiency or urban green space) through review of literature and online sources.



### Suggested readings

- Dobernig, K., Veen, E., & Oosterveer, P. (2016). Growing Urban Food as an Emerging Social Practice. In: *Practice Theory and Research: Exploring the dynamics of social life*. G. Spaargaren, D. Weenink, & M. Lamers (Eds.). New York and London: Routledge. Pp. 153-178.
- Parra, D., Swierczynski, M., Stroe, D., Norman, S., Abdon, A., Worlitschek, J., O'Doherty, T., Rodrigues, L., Gillott, M., Zhang, X., Bauer, C. and Patel, M. (2017). An interdisciplinary review of energy storage for communities: Challenges and perspectives. *Renewable and Sustainable Energy Reviews*, 79, 730-749.
- Balkmar, D. and Summerton, J. (2017). Contested mobilities: politics, strategies and visions in Swedish bicycle activism. *Applied Mobilities*, 2(2), 151-165.



### Suggested activities

- **Teamwork**: student teams search for secondary research and other sources, relevant to their team topic. They create an online tool for sharing resources and information between their team members (e.g. Slack).

- **Team presentations:** the teams present an analysis of best practice examples and innovative/creative solutions to urban challenges within their team topic. They support their analysis with relevant theoretical inputs.
- **Workshop:** student teams, external stakeholder organisation representatives and academic mentors can narrow down, discuss, and select a specific challenge each individual team will address in their project.

## Module 2: Qualitative and Quantitative Techniques of Systematically Gathering and Analysing Data

LEARNING OBJECTIVES	SKILLS & COMPETENCES
Research methodology	Ability to choose the right research methods for the specific research questions
Interdisciplinary research process	Ability to design an interdisciplinary research plan
Designing a research plan	Ability to communicate research results in (an interdisciplinary) team
Conducting research	Practical experience in using different research methods
Systematically analysing research results	Giving feedback to peers Research project management Ability to analyse, synthesise, and critically evaluate information

The second module equips the students with the research project management methods and techniques for implementing their team projects. The academic mentor(s) provide lectures and training in research methodology, research design, and management. Since we intend to develop sustainable solutions to urban challenges and to ensure that the cities of the future are resilient and inclusive, research that focuses on the “users” (citizens) is the first step and one of the key tools for engaging the different layers of city stakeholders (city inhabitants, local communities, relevant organisations) into the development process. Well-planned and conducted research can provide us with an insight into the real-life practices and needs of the individuals and communities that our projects concern or are addressing. The overarching “umbrella” of this module is interdisciplinary team research, however, as the programme may be embedded within a specific programme or field of study, the research methodology will reflect this baseline, building upon the students’ previously acquired research methodology and techniques.

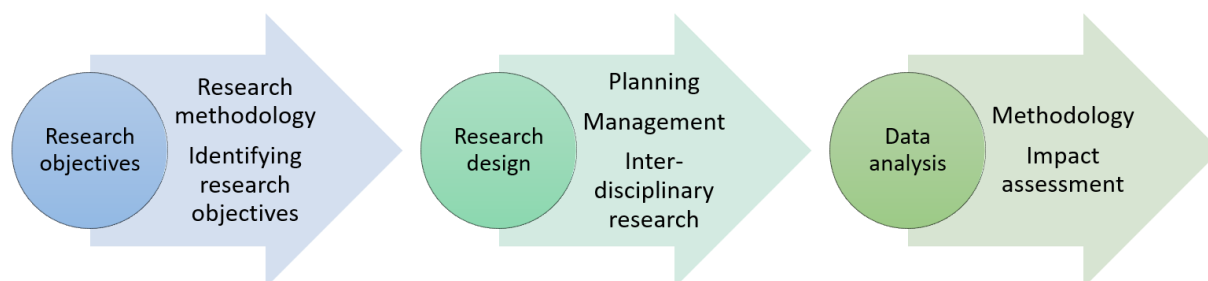


Image 6: Module 2 concept

## Framing Interdisciplinary Research Objectives

**Who is affected by the specific urban challenge and what do we want to achieve?** The first part of the module provides an exploration of the different research methods and techniques that can be used by student teams in their projects. As it is expected that the enrolled students had already completed first level methodology training in their respective fields, the module then focuses on reviewing key research methods and techniques. The goal of the lectures and trainings provided in this section is to attune the students to the importance of framing research objectives that are based in real-life urban experiences and reflect and address the actual needs of the different city stakeholder groups/target groups. The teaching therefore includes a more thorough exploration of selected qualitative and quantitative research techniques (e.g. interviews, questionnaires, focus groups, participant observation/ethnography, measurements, or any other research technique relevant within the host programme/disciplines), as well including guidelines in research ethics (e.g. informed consent).



### Suggested readings

- Szostak, R. (2007). How and why to teach interdisciplinary research practice. *Journal of Research Practice*, 3(2), Article M17.
- Stokols, D. (2013). Training the next generation of transdisciplinary. In: *Enhancing Communication and Collaboration in Interdisciplinary Research*. O'Rourke, M., Crowley, S., Eigenbrode, S.D., and Wulfhorst, J.D., Eds. Thousand Oaks, CA: SAGE Publication. Pp. 56–81.
- Carra, G., Loucksb, D. P. , Blöschla, G. (2018). Gaining insight into interdisciplinary research and education programmes: A framework for evaluation. *Research Policy*, 47(1), 35–48.
- Knowlton, J. L., Halvorsen, K. E., Handler, R. M., and O'Rourke, M. (2014). Teaching Interdisciplinary Sustainability Science Teamwork Skills to Graduate Students Using In-Person and Web-Based Interactions. *Sustainability*, 6: 9428-9440.
- Scheel, E.D. (2002). Using Active Learning Projects to Teach Research Skills Throughout the Sociology Curriculum. *Sociological Practice*, 4(2), 145–170.
- Ladner, S. (2014). *Practical ethnography: A guide to doing ethnography in the private sector*. Walnut Creek: Left Coast Press.



### Suggested activities

- **Field visit:** guided by the mentors or external expert, the students go for a field visit, where they experiment with a given research technique (e.g. participant observation or sensory ethnography). Moderated discussion of the experience.
- **Practical assignment:** student teams use either of the methods independently to explore the relevant research questions (e.g. conduct exploratory interviews with external organisation representatives, organise a focus group discussion with stakeholders, relevant to their selected urban challenge topic).
- **Written assignment:** student teams write a short (e.g. 1-2 page) research objective concept with research questions, using relevant sources and exploratory research data.

## Research Project Design and Management

**How do we plan our research project and how do we make sure our plan is sound?** The second section provides the students with an overview of interdisciplinary research project design and

management. These are skills that are commonly not taught to university students, although they are increasingly important in a number of work settings – inside and outside academia. The students explore the relevance and potential of interdisciplinary research and are equipped with guidelines for conducting research in a team (explaining the rationale of specific research methods, communicating research results, establishing a common language, addressing disciplinary jargon and paradigms, incorporating feedback from fellow team members, setting up a data analysis framework etc.). The students review the characteristics of good research (controlled, rigorous, systematic, valid and verifiable, empirical and critical) and are familiarised with key components of research project planning and management (incl. timeline, research team, research plan, data analysis strategy, evaluation strategy).



### Suggested readings

- Tobi, H. and Kampen, J.K. (2018). Research design: the methodology for interdisciplinary research framework. *Quality & Quantity*, 52(3): 1209-1225.
- Brewer, G.D. (1999). The challenges of interdisciplinarity. *Policy Science*, 32, 327–337.
- Morse, W. C., M. Nielsen-Pincus, J. Force, and J. Wulfhorst. (2007). Bridges and barriers to developing and conducting interdisciplinary graduate-student team research. *Ecology and Society*, 12(2): 8.



### Suggested activities

- **Workshop:** project management workshop by an external expert (e.g. on evaluation, on research design skills etc.)
- **Designing a research plan:** student teams prepare project proposals (plans) with all key components included (timeline, research objectives, research plan, project management structure, evaluation strategy ...)
- **Team presentations:** student teams present their project plans to external organisations (peer-to-peer feedback, discussion with external experts).
- **Research:** teams begin conducting their research as per their team plans.
- **Team research communication:** the student teams use online tools for communicating research progress, intermediary results, and giving feedback to their fellow researchers.

## Data Analysis and Impact Assessment

**How do we analyse data and what does the data tell us?** In the final part of the module, the students deepen their knowledge in qualitative and quantitative data analysis techniques and methodological procedures in data analysis: how to interpret and analyse interviews, field notes, questionnaires (qualitative content analysis, grounded theory etc.). One key aspect is a continuous engagement of domain experts (these may be external organisation representatives or other experts) in the process of analysis and interpretation of data. The students are familiarised with the term of impact assessment and learn the techniques of strategizing, measuring, and arguing for the relevance and impact of research findings or project activities. They consider the impact and role of the researcher on the research process (subjectivity vs. objectivity).





### Suggested readings

- Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. London and New York: Routledge.
- Other core readings (organisation/department/programme-specific)



### Suggested activities

- **Individual/team assignments:** the students find examples of project calls, project proposals, or project reports (e.g. EU projects, local funding schemes etc.) and analyse the impact requirements or impact assessments.
- **Team assignment:** if the students are already conducting their team research, each team prepares an intermediary research report (written report).
- **Presentation and feedback:** The student teams present the intermediary research findings to their peers, in turn providing feedback to other teams.

**Module 3: Conceptual and Practical Tools of Innovation**

LEARNING OBJECTIVES	SKILLS & COMPETENCES
Innovation theory and models	Bridging between stakeholders: academia, urban authorities, organisations, citizens
Applied social sciences	Ability to design and deliver co-creation activities
Research and innovation practices	Developing sustainable, people-centred ideas
User-centred design and innovation	Ability to intertwine research, theory, and methodology into practice-oriented, applied projects
Co-creation techniques and tools	

The goal of the module is to equip the students with an understanding of the innovation process, the necessity of multi-stakeholder engagement, and the techniques and tools to design and implement innovation actions and co-creation activities. The Quadruple Helix (Carayannis and Campbell 2009) innovation model is particularly relevant to the UCityLab project and the Challenge Programme, as it reflects the teaching and learning innovation partnership. The model is built on co-creation principles, in which four key groups of stakeholders are actively involved and granted a level of valuable expertise: local government, university, industry, and citizens. It is based on the Triple Helix model and adds the 'public' and civil society as the fourth helix. The Triple Helix acknowledges explicitly the importance of higher education for innovation, it places the emphasis on knowledge production and innovation in the economy, while the Quadruple Helix also encourages the perspective of the knowledge society and of knowledge democracy for knowledge production and innovation. In the final subchapter, we focus in more detail on business model innovation, which may be an integral part of the UCityLab Challenge Programme.

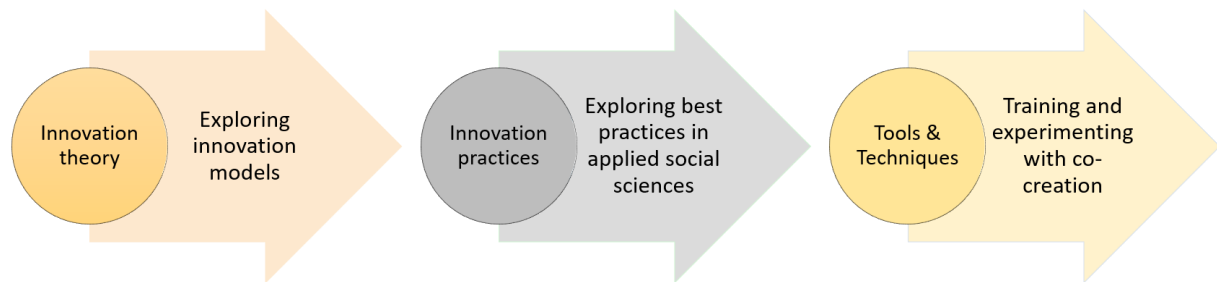


Image 7: Module 3 concept

**Innovation Theory**

The module starts with an introduction to innovation theory, concepts and models, focusing on classifying the different types of innovation and explaining their commonalities and differences (e.g. disruptive vs. sustaining innovation, and architectural vs. modular innovation). The context or source of innovation is considered, exploring the differences between business, science, technology, marketing, or end-user innovation. The students are familiarised with the Quadruple Helix model, open innovation model, citizen innovation, or other models, exploring the potential of university-business cooperation for innovation as well as specific settings or

environments that support innovation, such as Living Labs, a collaborative platform for research, development, and experimentation in real-life contexts, based on specific methodologies and tools, and implemented through specific innovation projects and community-building activities (Schaffers & Turkama, 2012). Other concepts may be explored, such as innovation life-cycle, innovator's dilemma, and diffusion of innovations. The introductory part focuses on creating awareness of the need for bridging between the diverse actors (stakeholders) in order to facilitate the supporting infrastructure and potential for sustainable (user-centred/people-centred) innovation processes.



### Suggested readings

- Christensen, C. M. (2015). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business Review Press.
- Carayannis, E.G. and Campbell, D.F.J. (2009). 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management*, 46 (3/4), 201–234.
- Von Hippel, E. (1988). *The Sources of Innovation*. Oxford University Press.
- Gassmann, O. and Enkel, E. (2004). Towards a Theory of Open Innovation: Three Core Process Archetypes. University of St.Gallen. 6.



### Suggested activities

- **Reading assignments:** selected theoretical readings and critical discussion.
- **Practical assignment:** students explore, map, and categorise the existing innovation infrastructure in their cities (how is innovation encouraged, supported, or organised: organisations, policies, funding, spaces etc.).

## Research and Innovation Practices

The second part of the module dives deeper into innovation practices, particularly focusing on how innovation processes are enhanced by approaches stemming from applied research in social sciences, humanities, and arts, supporting the innovation in products, services, but also policy-making or governance. Several relevant disciplinary, interdisciplinary, or transdisciplinary fields and approaches are presented, e.g. human-centred design, design thinking, design anthropology, human-centred design, participatory design, or organisational anthropology etc. The goal of this section is to provide an insight into innovation practices that are based in research and methodology of different disciplines or are an interdisciplinary endeavour and create an understanding of how research can be embedded in and is in fact a crucial part of the innovation process.



### Suggested readings

- Cefkin, M., ed. (2009). *Ethnography and the Corporate Encounter: Reflections on Research in and of Corporations*. New York and Oxford: Berghahn Books.
- Sanders, E. B. N. (2002). From user-centered to participatory design approaches. In: *Design and the Social Sciences*. Frascara, J. ed. London and New York: Taylor & Francis Books Limited. Pp.:1-8.
- Sanders, E. B. N. and Stappers, P. J. (2008). Co-creation and the new landscapes of design, *CoDesign*, 4(1), 5-18.
- Gunn, W., Otto, T. and Smith, R. C., ed. (2013). *Design Anthropology: Theory and Practice*. London, New York, New Delhi, Sydney: Bloomsbury.
- Hanington, B. M. (2010). Relevant and Rigorous: Human-Centered Research and Design Education. *Design Issues*, 26 (3): 18-26.
- Kumar, V. (2013). *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization*. Hoboken (NJ): John Wiley & Sons.

- o Eijck, G. V., Kums, M., Lofvers, W., Naafs, S., Spaandonk, T. van, Steketee, A. and Ziegler, F. (2017). *Urban Challenges, Resilient Solutions: Design Thinking for the Future of Urban Regions*.



### Suggested activities

- o **Reading assignments:** selected readings and critical discussion.
- o **Guest expert lectures:** researchers or practitioners present their work in innovation projects, applied research ...
- o **Practical assignment:** the student teams draft an outline of the innovation potential/strategy/plan of their team projects, using the theory and methodology covered in this module and ground it in their (ongoing or completed) research. The draft plans should include a selection of the needed infrastructure, appropriate approaches, and key stakeholder groups to be involved (including the external organisation).

## Innovation Tools and Techniques

The last section of the module equips the students with the techniques and tools for designing and implementing co-creation activities that will establish and support the innovation process within their team projects. The methodological part covers the selected methods, techniques, or tools that are used within different approaches, through hands-on workshops and readings on: e.g. design thinking, lead user, prototyping, experience prototyping, focus groups, shadowing, rapid ethnography, personas, user journeys, card sorting etc. In the practical part of the module, the students incorporate co-creation and innovation into their team projects.



### Suggested readings

- o Ackerman, S., Gleason, N. and Gonzales, R. (2015). Using Rapid Ethnography to Support the Design and Implementation of Health Information Technologies. In: *Techno-Anthropology in Health Informatics: Methodologies for Improving Human-Technology Relations*. Botin, L., Bertelsen, P. and Nøhr, C. eds. Amsterdam, Berlin: IOS Press. Pp: 14–27.
- o Buchenau, M. and Suri, J. F. (2000). *Experience Prototyping*. Proceedings of DIS. New York: ACM, 424–433.
- o Czarniawska, B. (2007). *Shadowing: And Other Techniques for Doing Fieldwork in Modern Societies*. Copenhagen: Liber. Copenhagen Business School Press.
- o Kimbell, L. (2015). *The Service Innovation Handbook: Action-oriented Creative Thinking Toolkit for Service Organizations*. BIS Publishers.
- o IDEO.org (2015) 'The Field Guide to Human-Centered Design.' <http://www.designkit.org/resources/1>



### Suggested activities

- o **Workshops:** on selected co-creation and innovation techniques. Discussion and critical assessment of the techniques.
- o **Team assignment:** creating an innovation plan – the student teams prepare a plan for organising and delivering innovation and co-creation activities within their team projects. Selection of relevant techniques, target groups, content.
- o **Practical assignment:** the student teams implement co-creation activities within their team projects and prepare written reports/presentations of the process and outcomes.

## Business Model Innovation

There are many companies with excellent technological products. Especially in Europe, many firms continuously introduce innovations to their products and processes. Yet, many companies will not survive in the long term despite their product innovation capabilities. Why

do prominent firms, which have been known for their innovative products for years, suddenly lose their competitive advantage? The answer is simple and painful: these companies have failed to adapt their business models to the changing environment. In future, competition will take place between business models, and not just between products and technologies. New business models are often based on early weak signals: trendsetters signal new customer requirements; regulations are discussed broadly before they are eventually approved. New entrants to the industry discuss new alliances at great length; disruptive technology developments are results of many years of research.

It is often said that existing business models 'don't work anymore'. Still, the typical answers provided by R&D engineers are new products based on new technologies and more functionality. By contrast, the underlying business logic is rarely addressed despite the fact that business model innovators have been found to be more profitable by an average of 6 % compared to pure product or process innovators (BCG 2008). As a consequence, managers consider business model innovation to be more important for achieving competitive advantage than product or service innovation, and over 90 % of the CEOs surveyed in a study by IBM (2012) plan to innovate their company's business model over the next three years. But a plan is not enough.

Business model literature has not yet reached a common opinion as to which components exactly make up a business model. For the purpose of the UCityLab Challenge Teaching Toolkit, we will use the "St.Gallen Business Model Navigator" (2014) methodology. It employs a conceptualization that consists of four central dimensions: the Who, the What, the How, and the Value. Due to the reduction to four dimensions the concept is easy to use, but, at the same time, exhaustive enough to provide a clear picture of the business model architecture:

- **Who:** Every business model serves a certain customer group (Chesbrough and Rosenbloom 2002; Hamel 2000). Thus, it should answer the question "Who is the customer?" (Magretta 2002). Drawing on the argument from Morris et al. (2005, p. 730) that the "failure to adequately define the market is a key factor associated with venture failure", we identify the definition of the target customer as one central dimension in designing a new business model.
- **What:** The second dimension describes what is offered to the target customer, or, put differently, what the customer values. This notion is commonly referred to as the customer value proposition (John-son et al. 2008), or, more simply, the value proposition (Teece 2010). It can be defined as a holistic view of a company's bundle of products and services that are of value to the customer (Osterwalder 2004).
- **How:** To build and distribute the value proposition, a firm has to master several processes and activities. These processes and activities, along with the involved resources (Hedman and Kalling 2003) and capabilities (Morris et al. 2005), plus their orchestration in the focal firm's internal value chain form the third dimension within the design of a new business model.
- **Value:** The fourth dimension explains why the business model is financially viable, thus it relates to the revenue model. In essence, it unifies aspects such as, for example, the cost structure and the applied revenue mechanisms, and points to the elementary question of any firm, namely, how to make money in the business (see Fig. below).



Image 8: Business Model Definition – the magic triangle

By answering the four associated questions and explicating (1) the target customer, (2) the value proposition towards the customer, (3) the value chain behind the creation of this value, and (4) the revenue model that captures the value, the business model of a company becomes tangible and a common ground for its re-thinking is achieved.

A central virtue of the business model is that it allows for a holistic picture of the business by combining factors located inside and outside the firm (Teece 2010; Zott et al. 2011). For this reason, it is often referred to as a boundary-spanning concept that explains how the focal firm is embedded in, and interacts with, its surrounding eco-system (Shafer et al. 2005; Zott and Amit 2008). The task most commonly attributed to the business model is that of explaining how the focal firm creates and captures value for itself and its various stakeholders within this ecosystem.

Based on this process model, the UCityLab Challenge Teaching Toolkit will use the 4I-framework (Frankenberger, Weiblen, Csik and Gassmann, 2013) that shall lead each step of the students work.

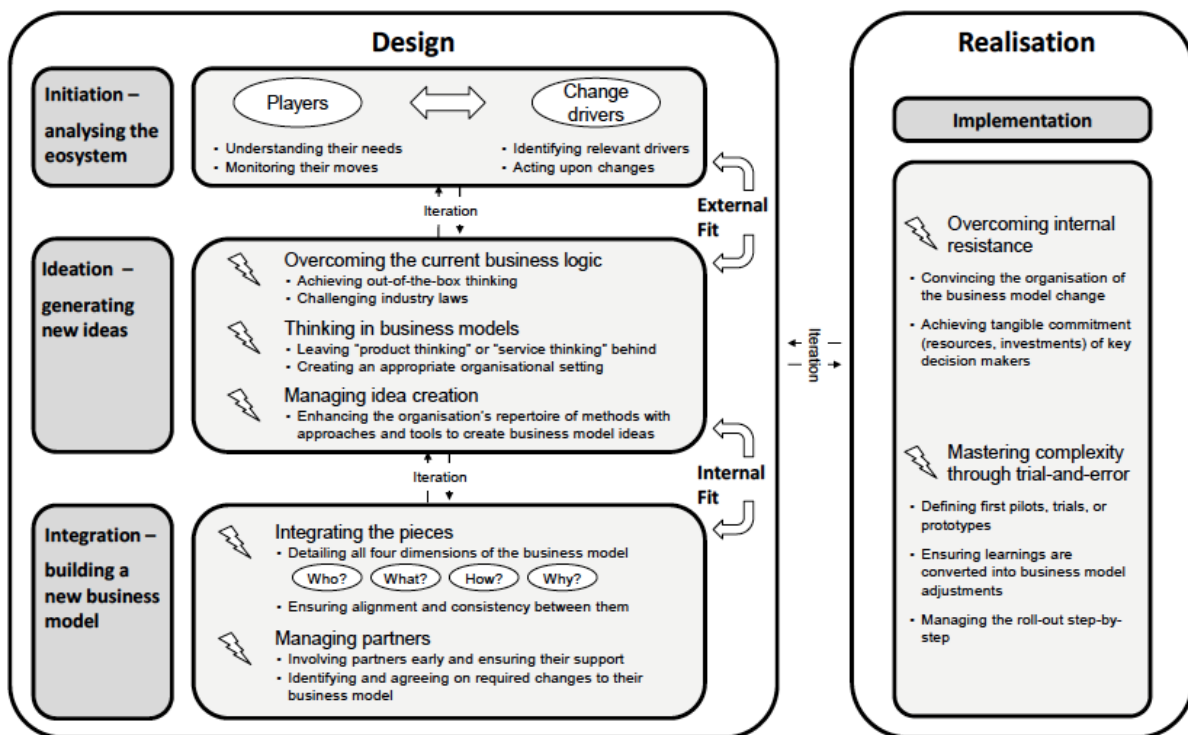


Image 9: Framework

The framework consists of four phases which were derived from innovation management literature and adapted to business model innovation processes through the exploratory study of the 14 cases. Within each phase various challenges can be identified:

In the initiation phase, which focuses on the analysis of the ecosystem, the challenges are to understand the needs of the players within the ecosystem and to identify relevant change drivers. In the ideation phase, which refers to the generation of innovative ideas, managers need to overcome the current business logic, focus on business model thinking, and apply tools for the creation of business model ideas. In the integration phase, which is concerned with the building of a new business model, the challenges are to ensure that all pieces of the new business model are integrated and that the relevant partners are involved. The last phase, the implementation or realisation phase, includes two major challenges. The innovating firms need to overcome the internal resistance and implement the new business model in a step-by-step process including pilots, trial-and-error and experimentation.

The first three phases - initiation, ideation and integration – can be summarised into the meta-phase "design", as they focus on the business model development with respect to content. The last phase, implementation, in contrast, focuses on the commercialisation of the content and thus the "realisation" of the new business model.

The framework displays an iterative process with multiple steps forth and back. In fact, experiences made during realisation can require adjustments of the business model, as it is recognised that the planned design does not work in real life. This iterative loop is crucial in order to finally develop a business model that can be successfully implemented. As all factors can change over time, it is important to review the framework and especially the existence of the fits or misfits between the single phases of our framework regularly.



#### 4I phases:

- Initiation

The initiation phase in business model innovation processes can be described by activities which focus on the understanding and monitoring of the surrounding ecosystem of the innovating firm. The ecosystem comprises players such as customers, suppliers, competitors, universities, or governments and immediately influences the operations of the focal firm. Their needs and moves influence the focal company and often set the starting point for a change of business model. Therefore, it is important to monitor them closely. Other important point within the initiation phase is the identification of change drivers, which can also initiate business model changes. Technology changes, such as digitisation, and regulatory changes are mentioned as such events that triggered the re-thinking of the business model.

- Ideation

Ideation, the second phase in the generic innovation process, focuses on the generation of ideas for potential new business models. More specifically, it is concerned with the transformation of opportunities, which are identified in the initiation phase, into concrete ideas for new business models.

- Integration

The third phase typically used in innovation processes, the integration phase, also plays its role for business model innovations. The activities within this phase focus on the development of a new business model based on promising ideas identified in the ideation phase. They need to be transformed into a complete and viable business model. Using the four dimensions (who, what, how, why) of a business model allows for an interesting insight: typically, the idea initially determines the 'What' and/or 'Who' component of the future business model, whereas the revenue model ('Why') and value chain architecture ('How') are added during integration phase. Put differently, the marketing-driven product/market combination perspective prevails in ideation.

- Implementation

The last generic innovation process phase, implementation, is clearly a crucial point in time for business model innovations, too. Once fully designed and integrated, the new business model can be implemented - which typically involves huge investments to be made and risks to be taken by the focal firm. In contrast to product innovation, where early prototypes can be shared and evaluated with customers during their development, a new business model often needs to be fully implemented before it can be tested in reality. People are reluctant to change due to the fact that they are afraid of the new situation or due to the fact that they do not see a reason to change, as the old business model is still working well. Managing organizational change is not an easy task per se, and the overarching scope of the business model that requires changes to many different areas within the firm makes it even harder. In this phase, it is important to communicate openly and explain how the new business model can help the company.



## Module 4: The Art of Selling a Promising Idea

LEARNING OBJECTIVES	SKILLS & COMPETENCES
Science communication Pitching	Transforming research into action “Translating” research results for non-academic audiences
Social entrepreneurship	Designing and delivering persuasive presentations Ability to assess and argue the impact of applied projects

In the fourth module, the students learn how to efficiently communicate research results to academic and non-academic audiences in particular, and to transform their research into action: either to create entrepreneurial ideas or development projects, influence policy or public opinion. The key goals of the module are to equip the students with the necessary skills and knowledge to create development ideas, based in research and innovation processes, and for communicating these to non-academic audiences. Science communication skills are rarely addressed in higher education curricula, although they are increasingly an integral part of any job description, inside and beyond academia. This last module progresses from designing, developing and implementing an applied project, based in research, to creating, assessing, and communicating its impact.

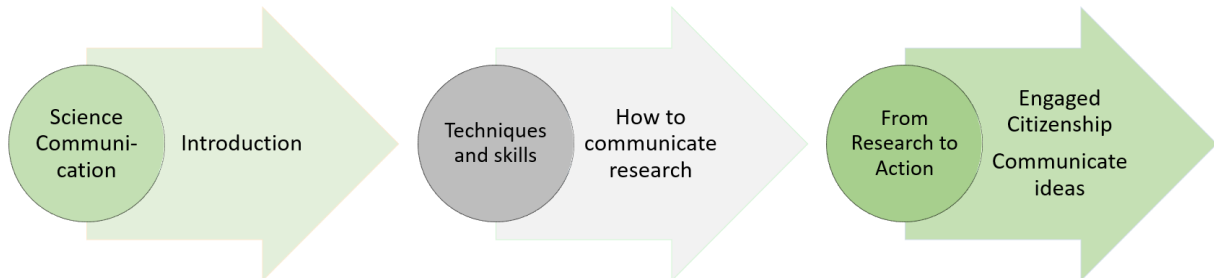


Image 10: Module 4 concept

### Introduction to Science Communication

The first section of this module provides a theoretical overview of science communication. The lectures and selected readings explain why science communication is relevant and how it can generate support for scientific research or study, or inform decision making. It addresses the issues of communication research and project work to either general public or specific relevant stakeholders, usually outside academia (decision- and policy-makers, industry, society organisations). It explores the different forms and contexts in which science can be communicated and promoted, from more traditional venues, such as media, various events, or conferences, to more creative projects, such as e.g. citizen science.



#### Suggested readings

- Olson, R. (2018). *Don't Be Such a Scientist, Second Edition: Talking Substance in an Age of Style*. Island Press.

- Jennings, Richard C., Bennett, David J. (2011) *Successful Science Communication: Telling It Like It Is*. Cambridge: Cambridge University Press.
- Schiele, B., Claessens, M., Shi, S. (2012). *Science communication in the world: Practices, theories and trends*. Dordrecht, New York: Springer.
- Groulx, M., Brisbois, M. C., Lemieux, C. J., Winegardner, A., & Fishback, L. (2017). A Role for Nature-Based Citizen Science in Promoting Individual and Collective Climate Change Action? A Systematic Review of Learning Outcomes. *Science Communication*, 39(1), 45–76.



### Suggested activities

- **Team assignment:** student teams find examples of science communication (in media, text, visual, or interactive) and discuss them in class, assessing how well the research or project was communicated, what could be improved etc.
- **Attending an event:** the students attend a local event, where research is presented to various audiences (general public, media, non-academics). The event is then discussed in class, identifying the strategy, approaches, techniques in which the content and messages were delivered, assessing their impact on the audience.

## Science Communication Techniques and Skills

In continuation, the programme explores the individual selected communication techniques in more detail. These can include techniques in textual communication, speech, or visual communication, e.g. storytelling, or hero journeys. The module is practice-oriented, so active experimentation with different techniques would be encouraged.



### Suggested readings

- Bowater, L., & Yeoman, K. (2013). *Science communication: A practical guide for scientists*. Chichester, West Sussex; Hoboken, NJ: Wiley-Blackwell.
- Sundin et al. (2018). Rethinking communication: integrating storytelling for increased stakeholder engagement in environmental evidence synthesis. *Environ Evid*, 7:6



### Suggested activities

- **Expert workshop:** students participate in a workshop on a selected communication technique (e.g. storytelling), delivered by an external communication expert.
- **Team assignment:** student teams prepare short presentations, using science communication theory and the selected tools and techniques to explain their team projects/research relevance/research outcomes to their peers.

## From Research to Action

The final part of the module focuses on integrating research results into practice-oriented, applied projects or actions, and communicating them to the relevant stakeholders (external organisations and other relevant city actors). The topics covered may therefore include social entrepreneurship, preparing a business plan, pitching, delivering public presentations etc. Each student team will build on their team research, innovation, and co-creation activities to design a development/applied project idea. Depending on their research topic and outcomes, this could either be an entrepreneurial idea, a policy-impacting initiative, a creative workshop or something else. Building on communication theory and practice in this module, the students design a presentation of their project idea which incorporates the team research and its outcomes. The teams present these first to their peers, receiving and giving constructive feedback and incorporating it to finalise their presentations, before they present them to a selected external audience (including their external partner organisations' representatives).



### Suggested activities

- **Expert workshop:** a practical workshop on developing a sound entrepreneurial idea/business plan.
- **Expert workshop:** a practical workshop on public speaking techniques to get the students more comfortable with public communication (e.g. drama coaching).
- **Team assignment:** development of an entrepreneurial/development idea, project, or action, based on the team research outcomes.
- **Public presentation:** presentation of the research and development ideas to external audiences.

### 3 ASSESSMENT

This chapter provides guidelines for planning, designing and implementing the student assessment in the City Challenge programme. The role that the assessment process should have is twofold: **evaluating as well as enhancing the students' learning process**. The guiding principle is "to design assessment before designing the content of the module as part of an integrated assessment system which serves the purposes of both assessing for learning and the assessing of learning" (Norton 2009: 136). Depending on the individual UCityLab pilot, the assessment strategy might differ or might not be a part of the Challenge Programme. Therefore, this chapter is intended to serve as **a resource and guideline and is not prescriptive**.

#### Assessment approach

The suggested assessment in the City Challenge Programme has a step-by-step design. Individually and in teams, the students complete a number of tasks in each of the four modules as they progress through the module content, where one of the assignments within each module is selected to contribute to the final overall grade of the individual student. Smaller assignments play the role of **formative assessment**. This means that the assessment strategy involves the evaluation of student learning progressively over the duration of the entire programme and includes providing students with comprehensive feedback, instead of taking up a strictly **summative** approach, which would only assess the learning outcomes of the students at the end of the programme or a chapter (module).

The assessment structure allows the programme instructors to evaluate the learning process through the four thematically, theoretically, and methodologically diverse modules and to use assessment as a contribution to the learning process itself. This type of assessment, where the programme instructors interpret the students' performance intermittently, can help students to "understand their strengths and weaknesses and to reflect on how they need to improve over the programme of their remaining studies." (Maki 2002: 11) As the programme is designed in a close collaboration with external partner organisations, their representatives should to a certain degree also be engaged in the assessment process by providing feedback on the student teams assignments.

#### Assessment structure

In each of the four modules, one of the (team) assignments (or a cluster of assignments) can be selected for graded assessment. As teamwork and team research are an essential part of the learning process and intended learning outcomes, part of the overall assessment is provided to student teams, while the final written report or similar output might be an individual assignment and each student would be assessed individually.

#### Assessment methods

There are four key assessment methods (cf. Stiggins 1997), either contributing to the final grade or not, that can be used in the City Challenge Programme, depending on which assignments are selected in each of the four modules.

- **Essay assessment:** the students or student teams are provided with an assignment or a set of assignments and exercises that expect an extended written answer to a complex question or an elaboration of a certain topic, using the theory, methodology, or content provided in the module.

- **Task assessment:** the student or student teams have to prepare a certain part of their project, e.g. a research plan, poster, visual presentation etc., incorporating knowledge gained in the module and practicing the necessary skills (e.g. team communication).
- **Performance assessment:** the student or the student teams prepare and carry out a certain activity (e.g. presentation of research results), in which they have to use the knowledge and skills learned in the module (e.g. science communication, public speaking).
- **Personal communication assessment:** assessment of student's individual participation in classroom discussions and feedback sessions (peer-to-peer feedback) etc., can contribute significantly to the overall assessment of the student's performance and the evaluation of the successful learning process (i.e. how well we are achieving our intended learning objectives).

## 4 LEARNING AND TEACHING METHODS

The City Challenge Programme blends two closely related principles and approaches to learning and teaching, which are the overall guiding principle or concept of the programme: **problem-based learning** and **project-based learning**. This chapter provides an overview of the UCityLab teaching and learning approach, identifying the learning and teaching methods which can potentially be used in the programme.

### Problem-based learning

is one of the established and widely used and researched **learner-centred approaches** that “empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem” (Savery 2006: 12). Originally gaining momentum in 1980s with the aim of boosting the medical students’ problem-solving skills, PBL has spread out to other disciplines in its original and a number of hybridised forms (cf. Fukuzawa et al. 2017). The approach is characterised by the following key ideas: 1. the learners should have the responsibility for their own learning; 2. the problem simulations should be ill-structured to allow free inquiry; 3. the learning integrates a number of disciplines; 4. collaboration is essential as it reflects the common reality of work, research, or development teams, while the tutor is primarily a facilitator of the learning process, instead of a traditional transmitter of knowledge (Savery 2006). An example of full integration of problem-based learning into the university curriculum can be found for instance at Aalborg University (see e.g. [PBL Problem Based Learning](#)).

### Project-based learning

is a similar model that organizes learning around projects and project work. Projects are here understood as “complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations” (Thomas 2000). Although often used in conflation with problem-based learning, we understand that the model of project-based learning can have a wider meaning and may or may not involve working on solving a specific “problem” or challenge.

The **UCityLab approach blends the two approaches**: the students will be working on specific urban challenges and their teamwork will be carried out in the specific form of a project, incorporating all key components of project work, from the identification and definition of the individual challenge, to research plan development, teamwork, to project management and reporting. Furthermore, the above-mentioned “ill-structured problems” that the student teams will be working on (team projects) in the City Challenge Programme are not only simulations; instead, by building and actively managing the university-city partnerships with external stakeholder organisations, the teams will address real-life city challenges, identified between the HEI, external organisation(s) and/or students, and based in everyday experiences of the city inhabitants. Similarly to the Aalborg model, one of the key overall objectives of this approach, complementing specific theoretical, methodological, and content objectives, is to “address student competencies in problem formulation, self-reflection, meta-cognition, and collaboration” ([Principles of Problem and Project Based Learning: The Aalborg PBL Model](#)).

The learning and teaching methods in the City Challenge Programme therefore reflect the overall learning approach and model. Below is an uncomplete list of specific approaches that

may be used during the programme. As one of the specifics of the programme is close collaboration with external city stakeholder organisations (city authorities, planning department, research and development organisations, NGOs, etc.), it is important to strategically involve representatives of these organisations in the learning process and to incorporate their contribution intentionally and by design.



To ensure a smooth flow of project-based work, we suggest that the programme instructor, the external organisation(s) representatives, and students co-create an adaptable timeline of the project work, indicating regular meetings with external stakeholders, student meetups, key deadlines etc.

Teaching and learning method	Description	How and when to use
Lectures	Traditional form of teaching, where content is provided by the programme instructor(s), mostly one-directional.	Should be kept to the necessary minimum, as an introduction to a new topic, e.g. urban sustainability overview.
Invited lectures	Traditional form of teaching, but the content is presented by invited external experts.	Brings experts into the classroom, makes the programme more diverse and interesting. To provide expert knowledge on certain topics that is not available within own faculty.
Workshops	Can involve one-directional flow of information, but engages students in active participation and hands-on activities.	To be used often, conflating new content with experimentation, creative tasks, using the knowledge or skills. Lead by programme instructor or invited external experts.
Feedback	Continuous verbal assessment of the students' work to support the learning process and as part of the learning process.	Incorporated throughout the programme curriculum. Should be positive and encouraging, directing and stimulating the student towards learning objectives.
Peer-to-peer feedback	Students assess each other's work in a verbal or written format.	Incorporated throughout the programme, guided by the programme mentor, providing guidelines for constructive feedback and meaningful discussion. In-person or through use of online tools.
Self-assessment	Encouraging students to deliver self-assessment and reflection as a form of learning.	Encourages the students' responsibility for own learning progress. Could be used in certain team or individual assignments, during preliminary interviews, or post-programme evaluation. The students should learn to critically assess their progress, potential shortcomings, and identify possible routes for improvement.
Teamwork	Students work in teams, managing their projects, completion of tasks, team communication, division of work etc.	An essential part of the programme. The programme structure and approach will allow for intensive teamwork, both in allocating specific tasks to teams, and in allowing teams to develop and work on their specific team projects. In-person and virtual team communication should be supported. Development of a comprehensive set of competences and skills.
Supervision of project work	Role of the programme instructor in guiding and	An integral component of teamwork and project-based learning approach. Continuous supervision

supporting the team and support to the student teams in managing their projects. team projects should be integrated into classroom activity throughout the programme duration.

## 5 ROLES OF KEY EXTERNAL STAKEHOLDERS

As the external city stakeholders (city authorities, policy & planning organisations, relevant research organisations, businesses/industry, relevant NGOs etc.) are an integral element of the UCityLab programme, it is important to identify and define their roles within the programme structure. This chapter provides an overview of these potential roles, as well as guidelines for managing the relationship and partnership between the HEI and the selected city stakeholders.

As the students enrolled in the programme will be working on real-life urban challenges, the external city stakeholders play an essential part in the development, implementation, and evaluation of the City Challenge programme. The roles, requirements, and responsibilities should therefore be defined and agreed upon in advance to ensure that the programme will run smoothly. In the table below, we list the potential roles these organisations could play and provide a short description of the requirements and responsibilities. Each HEI should define the concrete roles in cooperation with the individual external organisation prior to the commencement of the programme.

ROLE OF EXTERNAL STAKEHOLDER	REQUIREMENTS, RESPONSIBILITIES, TASKS
Contributing to structuring the programme	Participating in preparatory meetings Review and feedback on the programme preparatory materials (this Toolkit, programme syllabus)
Contributing to city challenges identification	Participating in preparatory meetings Participating at introductory meeting with the students Identifying a selection of challenges from own field of work
Mentoring the students	Regular, intermittent meetings with the assigned student team(s), providing feedback
Enabling access	Providing access to available materials on the selected topic Providing access to own organisation Enabling access to research sites and target groups Connecting the students with relevant experts within own or other organisations
Contributing to the learning content	Delivering a lecture, presentation, workshop in class
Contributing to student assessment	Participating in the assessment process during selected class activities by providing feedback to the students and engaging in discussions
Contributing to programme evaluation	Systematically evaluating the learning process and HEI-own organisation cooperation Participating in the final programme evaluation (evaluation meeting) by providing oral or written feedback

The keyword for managing cooperation between HEI and the external organisation(s) is **relationship**. Building a good relationship with the external organisation is a necessary element and a prerequisite for a successful implementation of the programme. In order to make it solid and productive, the relationship should be based on a mutual respect and understanding, which should be the guiding principle of designing and developing such a programme, and identifying the motivators, facilitators, and barriers for establishing and sustaining the relationship could be useful as a baseline. Generally, a barrier provides a hindrance or obstacle to do something,



facilitators enable or ease the process, while motivators trigger the starting of an activity and are often related to the expected outcome(s) (Davey et al. 2018: 77).

In the table below, we list some generic (potential) motivators, facilitators and barriers for external stakeholder organisations to take part in this form of university-city cooperation. As particular barriers or drivers could be context specific and may be either a barrier or a facilitator depending on the context, the list should be complemented by each individual HEI in cooperation with external stakeholders, discussing the possible ways in which the cooperation process can be further supported or individual barriers eased or overcome.

MOTIVATORS	FACILITATORS	BARRIERS
Access to university knowledge	Common interest with HEI (urban sustainability challenges)	Time (allocation of internal HR to the programme work, availability of staff)
Access to research materials and outcomes	Interest in accessing HEI knowledge	Differing interests between HEI and external organisation (learning vs. goal-oriented; process vs. product-oriented)
Access to innovation capacity in policy-making, project development etc.	Usually geographically closely located	Non-existent funding for external organisation involvement in the programme implementation (?)
Potential for further cooperation with HEIs (access to funding, research)	Existing funding for programme development and implementation	Differing vision of the final goal of the programme (competences vs. usable research outcomes)
Access to and identification of promising students as potential future employees	Mutual trust Prior relation with the HEI	No prior relation with the HEI

### General guidelines for establishing and nurturing cooperation with external stakeholders

1. Begin building the relationship early on, prior to the commencement of the programme.
2. Whenever possible, choose external stakeholder organisations, with which you have previously cooperated, have good experience with, or know individual representatives within the organisation.
3. Identify and define cooperation terms in advance and through mutual agreement between HEI and external organisation.
4. Sign a letter of intent or an agreement between HEI and external organisation.
5. Identify the individual external organisation representative who will function as the central contact point between HEI and external organisation.
6. Be clear about the programme goals: the key objective of the programme is the learning process and the students gaining relevant competences.
7. Managing expectations (related to above): the outcomes of the students' projects can be an added value, but are of secondary importance to the learning process and not all projects may be successful in terms of immediately "usable" studies or products and reports (i.e. the students are not paid consultants or hired researchers).
8. In cooperation, define the roles and responsibilities of external stakeholder organisation within the programme structure clearly and in detail.
9. Continuous communication is of crucial importance. The programme instructor (HEI) and the central contact point (external stakeholder organisation) should clearly define the means and

frequency of communication between them and with the students. Creating a timeline could be beneficial to support the communication.

10. Communicate clearly and often, providing updates on the programme and student team projects progress.
11. Build a personal relationship.
12. Enable access to HEI resources (research, knowledge, staff), if requested or needed.

## 6 PROGRAMME ADMINISTRATION

### Integrating the programme into HEI curricula

There are several options in which the UCityLab Challenge Programme can be integrated into the existing HEI curricula, related to the extent and mode of integration. Each integration type has its strengths and weaknesses, but is to a large extent dependent on the individual HEI partner's context.

INTEGRATION TYPE	STRENGTHS	WEAKNESSES
Extracurricular course (not integrated into an existing curriculum or study programme)	Allows enrolment of students from a number of fields of study; Allows independent structure and content of the programme; Attracts highly motivated students.	Extracurricular course structure must be available at HEI; Student recruitment process may require more promotion activities and might be difficult; More resources needed to design, develop, officially confirm/register the programme at HEI; Demanding time and schedule management (students with differing curriculum schedules).
Elective course (integrated into existing study programme/department as a separate programme)	Allows enrolment of students from a number of fields of study; Is embedded within an existing programme curriculum and schedule management is easier.	Students from other departments may not in all cases be able to enrol (differing schedules/organisational limitations).
Integrated into an existing course at a particular HEI department/programme	Easier management of schedule, existing infrastructure.	An appropriate course has to exist at a certain department and the programme instructor has to be part of the project or willing to adapt the course syllabus; Enrolment of students from other departments/fields might be difficult.
Integrated into an existing scheme of cross-department elective courses	Facilitates easier enrolment of students from different fields of study.	The scheme has to exist at the HEI.
Integrated into an existing course at an existing interdisciplinary study programme	Interdisciplinarity is an inherent part of the existing programme. Easier integration of the programme structure and content within the course.	The study course has to be available at the participating HEI and willing to be part of the project.

## Key steps for organising the programme

An implementation plan provides an overview of the key steps to be taken during the programme design and development phase (prior to programme commencement).

Action	Description
Integration of the programme	Identification of the course/programme where Challenge Programme will be integrated; decision on the mode of integration within HEI curricula/study programme (in- or extra-curricular)
Identification of the lecturer/facilitator	
Definition of the parameters	ECTS points, workload, timeframe etc.
Identification of external stakeholders	Identify the possible or appropriate external stakeholders (government, NGOs, businesses, research institutes etc.)
Designing the programme framework	
Identify needs for the Challenge Programme	e.g. rooms, equipment, facilities
Create promotional material for the Challenge Programme	Focused on external partners and internal stakeholders
Selection of external partners	Set up meetings, explain programme, potential results, but manage expectations
Definition of the Challenge	Understand the needs of external stakeholders and define these into a problem statement
Specifying the urban challenge programme	Specify fundamentals, e.g. aim, research question, process, timeline and expected outcomes, communicate with external partners
Agreement with external partners	Draft, elaborate, and sign a letter of intent/agreement with external stakeholders, indicating their commitment, defining their roles and responsibilities
Plan the programme delivery	Plan seminars, mentoring sessions supporting the delivery of the programme, organise kick-off presentation from the partner and confirm final presentations by the students, preferably at the location of the external partner
Student baseline	Prepare a baseline of skills, competences, and motivations of students – prior to course commencement

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