| ENHANCERIA | Work package | WP3 Sustainable development through transdisciplinary research |
| --- | --- | --- |
| | Deliverable | D3.5 Practice-based menu of pathways for university strategists, educators and researchers in approaches to transdisciplinarity for sustainability |
| | Date | 30/11/2024, revision 25/03/2025 |
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| | Lead | Lead: TU Berlin, Dr. Kathrin Wieck, Final report: NTNU, Lucy Chamberlin |

# PRACTICE-BASED MENU OF PATHWAYS FOR UNIVERSITY STRATEGISTS, EDUCATORS AND RESEARCHERS IN APPROACHES TO TRANSDISCIPLINARITY FOR SUSTAINABILITY

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*Figure 1: the campus at TU Berlin*

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# 4. A SNAPSHOT OF GOOD PRACTICE: TRANSDISCIPLINARY INITIATIVES AT THE 7 UNIVERSITIES THAT FOCUS ON SUSTAINABLE DEVELOPMENT

The tables below provide two or three examples per university of initiatives that include obvious elements of transdisciplinarity and sustainable development. They cover the gamut of strategy, research and education and represent focal points or areas of practice for the challenges, facilitators and recommendations that come afterwards.

## 4.1 NTNU

| Initiative | Type of initiative (research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|
| NTRANS | An FME centre researching zero emission energy systems | Public (Norwegian Research Council) and partners from industry | user partners, user cases, workshops, research sprints, co-creation | STS, psychology, industrial economics, industrial ecology, electrical engineering, political science, business, innovation, technology | research partners, public actors and private industry | Collaboration and co-creation | Partners gain new insights and value for own projects |
| Experts in Teamwork (EiT) | Education (compulsory masters course) | Internal NTNU | Interdisciplinary teams -'villages', working on real-world, project based challenges. Practical setting, experience-based | across whole university (>3000 students every year) | Various industry and public sector, voluntary organisations | Consulting | 7.5 ECTS for students. For partners, the value of project work and of master students as possible future workforce. |

| | | | learning and group reflection | | | | |
|---|---|---|---|---|---|---|---|
| Smart Sustainable Cities | cross-disciplinary knowledge cluster (research, education and innovation) | various (internal, national and European) | Merger of transformative, technological, artistic and practice-based research: urban living labs, public-private partnerships and integrated design thinking | architecture, planning, design, art, engineering, ICT, social and economic sciences | many public, industry and municipalities across Europe, inc New European Bauhaus | Consulting, collaborating | |

## 4.2 TU BERLIN

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, collaborating, co-creating) | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|
| **Office for Science and Society** | Strategic central facility for TD research and knowledge exchange | Internal and external | Creating new partnerships with actors in society, supporting new methods and TD activities, science communication and technology transfer | All (university level) | Public authorities, civil society, research partners, science management partners | Informing, collaborating and co-creating. consulting | Established mode and strategies of transdisciplinarity at TUB, building an innovation ecosystem for circular knowledge transfer |

| **Stadtmanufaktur** | Strategic platform and network of (research focused) living labs | TU Berlin Centre for Technology and Society, Einstein Centre for Digital Futures and (initially) Berlin Senate Chancellery | Brings together existing living labs (which test and evaluate social transformations and transformative research) , provides circular exchange between science and society | All (university level) | Public authorities, entrepreneurs, civil society, research partners | consulting | Gathering transformation knowledge and science and society actors in Berlin-Brandenburg, promoting discourses, methods for urban transformation and sustainable development |
|---|---|---|---|---|---|---|---|
| Study courses in Urban Planning, Architecture, Landscape Architecture, Urban Design | Education | Internal | Specific courses and design studios in space-related disciplines for city administrators and societal / international stakeholders | Faculty VI Architecture, Planning and Environment | TUB researchers and students, public administration, civil society, small companies | Informing and collaborating | ECTS |

## 4.3 WUT

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|

| Initiative | Type | Funding | Methodologies and operation | Disciplines/departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, collaborating, co-creating) | Incentive/recognition/reward |
|---|---|---|---|---|---|---|---|
| **Human Smart Cities** | Strategy/Research | external: Structural Fund Operational Programme | Various forms of communication and awareness-raising: picnics, seminars, workshops, outdoor meetings. | WUT Faculty of Building Installations, Hydraulics and Environmental Engineering | Rawicz Municipality Government and Citizens | informing, collaborating, co-creating, disseminating | The results developed form the basis of an innovative, multi-dimensional urban management model based on operational data from different sensory layers to enable short- and long-term decision making. |
| **WUT Innovation Incubator** | Strategy/Educational | Internal plus external business sponsorship | building a self-organised network with students, academics and business stakeholders | WUT Innovation Center | mainly businesses | knowledge exchange, consulting, collaborating | A broad programme of operational and development support, including fundraising |

## 4.4 UPV

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, collaborating, co-creating) | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|
| City University Binomial | Strategic cooperation and research | Internal /municipality | a framework agreement, which includes existing | various | City of Valencia; other | Collaborating, co-creating | N/A |

| | agreement between UPV and the municipality of Valencia to achieve climate neutrality by 2030 | | collaborations – e.g. 12 chairs and different research structures – and will be developed through joint initiatives in the Living Lab that are replicable in the city. | | public university | | |
|---|---|---|---|---|---|---|---|
| UPV Living Lab | On-campus research and education lab aiming to accelerate carbon neutrality | Internal: Projects have their indirect costs covered by the Vice-rectorate for Sustainable Development of Campus. | sandbox' environment for testing, prototyping, scaling, teaching and learning. teaching content, internships, degrees and master projects, mobility programs, spaces for debate and reflection | cross-university | business, public administration, citizens | consulting + collaborating + co-creating | partners and applicants gain access to university expertise and facilities |
| 12 Chairs | Strategic research and business alliance with objectives grouped around sustainability | Activities are financed with the collaboration of the institution and companies that sponsor them | The activities span the organization of Congress, or exhibitions, to research applied to specific problems of these sponsoring entities | various | Business, local institutions, public sector | collaborating | research funding, dissemination of results, public recongnition |

## 4.5 RWTH

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, collaborating, co-creating) | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|
| BioTexFuture | Innovation space on biobased textile research | Public | research-industry collaboration (project is co-led by adidas and RWTH Aachen University); the project can organise calls and select further collaborative projects for funding, thus continuously expanding the network and focus | Textile engineering | Business and industry | Co-creating | N/A |
| Profile Areas | Strategic and organisational measure | Project-based funding | establishment of large transversal organisational units around particular themes (e.g. Internet of Production; Built & LIved Environment) to strengthen ID and TD collaboration around the twin transition | All | Various (quadruple helix) | | N/A |
| Leonardo | Educational project | | | Human Technology centre – all faculties | Mainly NGOs | | |

## 4.6 CHALMERS

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines/ departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, collaborating, co-creating) | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|
| Areas of Advance | Strategic thematic platforms, research-based partnerships with companies (structure-level) | Internal funding by Chalmers foundation as well as external funding for different projects (e.g., EU projects) | joint (transdisciplinary) projects, integrating research, research-education, and innovation | Various | partnerships with industries/ companies, City of Gothenburg, research institutes | informing (hosting competence centres), collaborating (strategic partners involved in developing new courses), signed partnership agreements | structure facilitates the possibility of sharing infrastructure, labs, industrial PhD students and Adjunct researchers |
| TRACKS | Educational | Internal (funded by Chalmers' foundation with a 10 year grant 2019-2029). Government funding for running courses besides international students' | Tracks courses are elective, and do not belong to a specific program or department. They give students the opportunity to develop their interdisciplinary competence. The initiative reduces the time required to offer | Various | Companies / industry Entrepreneurs International universities / research institutions | Tracks courses are held in close collaboration with representatives from industry, society and cutting edge of research. | Participants collaborate across program boundaries to learn by exploring societal and scientific challenges together. The initiative helps the university |

| | | tuition fees. Some funding from companies for executive courses | new educational content, in collaboration with academia, industry and society. | | | | to be agile and adaptable to continue to be relevant. |
|---|---|---|---|---|---|---|---|
| HSB Living lab | Research | Funded by three main partners (Chalmers, HSB, Johannesburg Science Park), in addition to 9 companies. | A collaboration project between Chalmers, HSB (cooperative association for housing in Sweden), and other partners, developing new ways to build and shape the housing of the future. The tenants of the house live in a constantly changing and evaluated environment while the research is ongoing. | Mainly Architecture and Civil Engineering Department | Companies in the housing, construction, electronics, energy and utilities sectors. | Collaborative research projects | Test bed for researchers. Providing accommodation for around 40 people, and tenants signed up to be part of the research. Collaborating with start-ups and research projects. Sharing knowledge. |

## 4.7 POLIMI

| Initiative | Type of initiative (e.g. research, strategy or education) | Funding | Methodologies and operation | Disciplines /departments involved | External partners | 'level' of partner engagement (e.g. informing, consulting, | Incentive /recognition /reward |
|---|---|---|---|---|---|---|---|

| | | | | | | collaborating, co-creating) | |
|---|---|---|---|---|---|---|---|
| Off Campus | Strategy (part of the strategy for community engagement and proximity innovation of the university) | Internal Polimi | University hubs are established in the city of Milan to facilitate the joint development of innovative research, teaching and social responsibility activities, in collaboration with local communities | Departments: Architecture and Urban Studies; Design; Architecture, Built Environment and Construction Engineering; Management, Economics and Industrial Engineering; Chemistry, Materials and Chemical Engineering<br><br>Schools: Design; Architecture, Urban Planning and Construction Engineering<br><br>Students' associations | Municipality of Milan, local community organizations, citizen associations, other universities located in Milan | Collaboration and co-creation | Partners implement and strengthen own activities in collaboration with Polimi.<br><br>Polimi researchers from the involved Departments develop innovative research projects (community-based, living labs) |
| Polimi Ambassador | Education (high level training courses) | Internal Polimi | Interdisciplinary "minors" for Master level students aiming at creating new professionals who -have skills in specific areas (green/smart/inclusivity/creative) -master enabling digital technologies | School of Architecture, Urban Planning and Construction Engineering; School of Design; School of Civil, Environmental and Land Management Engineering; School of | N/A | N/A | 10 ECTS for students. The Ambassador certification will be reported in the Student's |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | -master interdisciplinary tools, methods, and aptitude for a systemic vision<br>-can operate in interdisciplinary and multisectoral contexts | Industrial and Information Engineering | | | Diploma Supplement and a digital badge will be issued by Politecnico di Milano |
| Interdisciplinary PhD Scholarships | Research, education | various (internal, national and European) | Interdisciplinary doctoral scholarship program to promote collaboration among Polimi Departments and the integration of complementary skills on social impact issues | All Departments; PhD School | Research partners | Consulting, collaborating | Departments and prospective PhD students can benefit from least 20 PhD scholarships funded each year under this program, in addition to ordinary PhD scholarships funding |

# 5. CHALLENGES AND BARRIERS TO THE INSTITUTIONALISATION OF TRANSDISCIPLINARITY

The following sections represent a summary analysis of the most common challenges to transdisciplinarity, as reported by interviewees at the 7 universities.

## 5.1 LACK OF DIRECTED FUNDING AND RESOURCES

By dint of its participatory, multi-sector nature, transdisciplinary work can take significant time and resource, but this is not always recognised by university management and therefore critical levels of funding can be lacking – sometimes leading to the failure or closure of a project. Moreover, internal funding for research projects as well as education programmes is often directed through departments or disciplines rather than being allocated to multi or transdisciplinary initiatives.

## 5.2 RIGID, SILOED STRUCTURES

The disciplinary (and somewhat inflexible) structure of universities can lead to 'lock in', invisible walls or silos between research and education programmes and student associations that runs counter to the multi-faceted and complex challenges of future sustainable development. This mismatch can be the case both in financing and in legislative and regulatory systems as well as measurement and evaluation practices.

## 5.3 LACK OF REWARDS AND RECOGNITION

Often there are no financial, career-based or curricular incentives to encourage staff or students to get involved in transdisciplinary projects, and the evaluation of research and teaching is conducted according to discipline. Transdisciplinary work is not seen to carry the same status as traditional science and can even represent a barrier to career progression as the most prestigious journals have tended to prefer mono-disciplinary publications. Similarly, students can feel that single discipline studies are more advantageous in terms of employment and recognition.

## 5.4 PREJUDICE AND DIFFERENCE: LANGUAGE AND CULTURE

Disciplinary experts can be suspicious of or even prejudiced against other scientific disciplines with different cultures, epistemologies and methodologies. They may have widely diverging worldviews to their non-academic partners and even view working with these stakeholders as losing precious research time rather than bringing added value. In addition, the partners in a transdisciplinary project often misunderstand one another: community partners may not understand the language of scientific researchers, whilst experts from one field often have a different disciplinary 'language' to those from another. Moreover, the understanding of and language around sustainability differs vastly between sectors and communities.

*Figure 4: Chalmers university campus*

# 6. HOW CAN UNIVERSITIES ENCOURAGE AND FACILITATE TRANSDISCIPLINARITY FOR SUSTAINABLE DEVELOPMENT?

## 6.1 WHAT CAN STRATEGISTS DO?

### 6.1.1 Provide leadership through explicit support and institutional commitment

TD for SD requires leadership at the top strategic level of an academic organization. University management should put in place a governance model with the incentives, values and resources (especially finance) that explicitly support TD and provide an integrated approach across the institution. Interviews showed that having supportive management and institutional commitment can be vital for catalysing TD cooperation, and in particular where research silos represent barriers to action. Dedicated leadership teams or strategic roles with responsibility for implementing TD and SD can also enhance the visibility and status of TD within the institution – for example Polimi's Vice Rector for Sustainable Development, or TU Berlin's Office of Science and Society and Vice President for Sustainability. The formal organisation of Chalmers's Areas of Advance programme, with a management group and individuals responsible for every sub section, has been key to its success, and UPV is looking to implement a similarly defined approach in its SIRVE strategy.

### 6.1.2 Consult and connect

The enormous complexity of SD responses to crises requires multiple communities to work together, understand and support each other. As well as encouraging TD co-creation and collaboration with external networks, it is crucial that strategists consult widely within the university community itself (academic staff from multiple departments as well as technical and administrative staff and students) to increase motivation and engagement with TD and SD plans. At certain institutions this has been seen to make the difference between the success and failure of TD strategy. Conversely, transdisciplinary communities can provide the 'bottom up' impetus for strategy change, and it was notable at Polimi that the collective responsibility for a response to the climate crisis felt by the community of teaching and administrative staff was the prompt for new SD policy. Certain interviewees recommended that the strategy for TD itself should be co-created with all of the partners involved, in order to build in resilience and equity as well as capacity. Finally, cultivating connections at European level and growing a supportive wider network of strategists and practitioners is also key to facilitating TD for SD in a university setting, as the interviews showed that these European-scale movements and networks can have a significant influence on the mindset of university management and staff.

### 6.1.3 Engage in and encourage directed funding

Access to funding of course is key to the success of TD and SD projects, and in particular funding that allows for or is directed at the kind of collaborative, dynamic, impact-focused work that TD facilitates. Strategists need to both promote access to seed funding for developing TD ideas and research proposals as well as national schemes with a specific mission or scope that encompasses TD projects, for example the German Excellence Initiative or the Italian Resilience and Recovery Plan. Schemes with long term funding (such as Norway's FME Centres, funded for 8 years) represent particular potential for building a TD community through mutual understanding and integrated research. In addition of course, strategists must engage in EU and international funding instruments through networks such as Enhance that focus on research, innovation and societal impact and can play a role in influencing national governments too.

## 6.2 WHAT CAN RESEARCHERS AND EDUCATORS DO?

### 6.2.1 Include criteria in teaching, recruitment and training

TD for SD must be included in the taught curriculum if it is to become institutionalised and its value recognised across the universities. This can be done, for example, through the award of ECTS or degree credits, greater focus on project-based teaching, and the design of master and PhD courses to include aspects of TD and SD. It is important to begin with the right people in place, both for research and teaching: people who are open to and understood TD and have the motivation and expertise to build a cohesive team or to open their classes to other disciplines. This means including TD and SD criteria in the recruitment process and in contracts for new academic positions, requiring experience in stakeholder cooperation for example rather than just citations and publications. To facilitate and support the work of both early stage and established researchers and educators, 'Train the trainer' programmes can provide TD principles and techniques and demonstrate value in practice (e.g. see the new ENHANCE+ Train the Trainer initiative led by Chalmers).

## 6.2.2 Create a culture of openness, trust and respect

An environment of trust, respect and curiosity is essential for nurturing TD collaboration, encouraging stakeholders in the project or network to learn from each other and work productively together. Working across boundaries and acknowledging their own blind spots can be difficult for some experts, but over time trust and engagement with the value of others' work can be built up, along with a valuable interdisciplinary network. One of the most important yet simple tools remarked on by interviewees was to get research partners from different backgrounds to meet, listen to and get to know each other, and finding a conducive space for this meeting can be seen as a very practical first step. Particularly when it comes to the implementation of technology, it is also vital to understand the everyday context and practices of the 'non-expert' people interacting with it, and not just the success of its scientific aspects. Finally, in terms of teaching, encouraging students to be aware of their own disciplinary identities and have respect for the value of others is an essential skill that carries beyond education and into the world of employment.



*Figure 5: WUT campus*

## 6.2.3 Practical assets: 10 supporting methods and tools

In addition to the above, interviewees described some very practical tools and methods they had used to facilitate TD for SD. You'll find some of them in the transformation toolbox for the institutionalisation of transdisciplinarity (D3.4.1 document). The main ones from the interviews are summarised here:

1. **Design Thinking** (e.g. at WUT, UPV) represents a methodology or tool that can release creativity and new ideas by asking better questions and focusing on human centred solutions. The culture of disciplines that routinely use design thinking, such as design and architecture, can also be more open to TD.

2. **Handbooks for TD teaching**. NTNU's Experts in Teamwork for example has produced a handbook outlining the programme's methodology, reflective practice and transdisciplinary principles for all of its staff, and it is hoped this will soon be published more widely.

3. **Creative meeting and learning places** can provide space and infrastructure to combine disciplines and open communications channels with wider society. These are exemplified by living labs such as those at TUB and UPV, or maker spaces such as at Chalmers Fuse (the physical location for TRACKS), a place where research, industry, education, public sector and the wider community can meet and test ideas. (The living labs are a crucial category of methods in the transformation toolbox due to combining strategic and project-led components).

4. **Contracts with external partners**, in teaching or research, can help to agree on the responsibility of each party at the start of a project, set rules and goals and manage expectations (e.g. TUB).

5. **Co-operation with social sciences** departments can be instrumental in helping other partners to understand and co-operate with people (e.g. NTNU and WUT)

6. **University outreach** or community and sustainability policies that enhance local neighbourhoods or the city can be used as a platform for education in TD for SD (e.g. TUB, Polimi).

7. **Support for student programmes** which are self-organised and often focused on TD and SD help to raise the profile and activity level (e.g. TUB)

8. **PhD projects with a TD for SD focus** can develop new researchers whilst combining different disciplines and resources, encouraging co-creation and building trust whilst raising the profile of TD for SD. NTNU's SusRes programme is an example of 50 such PhDs.

9. **Systems thinking and reflection** are less tangible competencies that nevertheless cultivate empathy, mutual learning and enhanced understanding amongst project partners especially when it comes to addressing multi-layered sustainability dynamics and connecting practical and theoretical aspects (e.g. UPV, NTNU).

10. **Funding for educational initiatives** in TD for SD was less in evidence, but Chalmers's TRACKS was perhaps singularly successful in compensating departments for time spent in the programme by paying salaries for any staff whilst they were taking part.

*Figure 6: Polimi university campus*

# 7. FINALLY...

In closing it should be noted that this document is one of many that make up the outputs of Enhance work package 3 on sustainable development through transdisciplinary research. Whilst considering the most relevant challenges as reported by experienced internal voices, this Menu represents a specific perspective on practical pathways for implementing transdisciplinary projects fostering sustainable development in the areas of strategy, research and education. As such it complements the Transformation Toolbox (D3.4.1), which is the outcome of an investigative process of extracting tools from good practices in strategic, research and educational initiatives at the ENHANCE universities. Beyond the good practice tools the Transformation Toolbox also contains further recommendations as to how technical institutions can pursue implementation and stimulate transdisciplinary initiatives in a systematic way. This includes a compilation of jointly developed tools for creating a mutual learning environment as a step towards institutionalisation in the ENHANCE Alliance, and for future projects such as ENHANCE+. The ENHANCE+ project, funded by Erasmus+ in the period of 2023 to 2027, will integrate the research and innovation dimension of transdisciplinarity in work package 6 on 'Transdisciplinary Labs for Societal Transformation'. Here, the Transformation Toolbox and Menu of Pathways will be used to build long-term support for transdisciplinary initiatives in the Alliance: by further developing a portfolio of co-creative methods, by conducting joint transdisciplinary labs on specific topics and by offering trainings. Further information is available here: https://enhanceuniversity.eu/.

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