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# Complexity in Action: Inter- and Transdisciplinarity in EURECA-PRO

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**Abstract:** Integrated approaches to research set a common goal, which, in the case of the EURECA-PRO programme, is to work towards realising Sustainable Development Goal (SDG) 12, Responsible Consumption and Production (RCP). However, the diversity of perspectives, expectations, and work methods within all types of cross-disciplinary work can be challenging. Based on the work of the RE-EURECA-PRO project, which develops the research and innovation agenda of EURECA-PRO, this contribution provides an insight into the complexity, challenges, and opportunities of interdisciplinary research collaboration and transdisciplinary actions.

**Keywords:** Sustainable Development Goal 12, Responsible Consumption and Production, Interdisciplinarity, Transdisciplinarity, Complexity, EURECA-PRO

**Komplexität in Aktion: Inter- und Transdisziplinarität in EURECA-PRO**

**Zusammenfassung:** Integrierte Forschungsansätze verfolgen ein gemeinsames Ziel, welches für EURECA-PRO darin besteht, auf die Verwirklichung des SDG12 („Nachhaltige Konsum- und Produktionsmuster sicherstellen“) hinzuwirken. Allerdings stellen die vielfältigen Perspektiven, Erwartungen und Arbeitsmethoden innerhalb interdisziplinärer Arbeiten eine Herausforderung dar. Basierend auf der Arbeit des RE-EURECA-PRO-Projekts, das die Forschungs- und Innovationsagenda von EURECA-PRO entwickelt, bietet dieser Beitrag einen Einblick in die Komplexität, Herausforderungen und Chancen interdisziplinärer Forschungszusammenarbeit und transdisziplinären Handelns.

**Schlüsselwörter:** Nachhaltiges Entwicklungsziel 12,

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Verantwortungsvoller Konsum und Produktion,  
 Interdisziplinarität, Transdisziplinarität, Komplexität,  
 EURECA-PRO

## 1. Introduction

The need to develop and strengthen international cooperation and cross-disciplinary research in the field of Responsible Consumption and Production (RCP) is undisputed given the complex societal, economic, technological, and ecological challenges facing our present and future generations. Within the EURECA-PRO programme, the work of the RE-EURECA-PRO project is dedicated to strengthening the research and innovation aspects of the European University alliance, and this means above all developing inter-university collaborations which draw on interdisciplinary and transdisciplinary research methods. The aim of EURECA-PRO is to develop integrated knowledge about RCP with and for societal stakeholders through the pursuit of research that crosses disciplinary boundaries and demonstrates societal impact. Yet, the existing cognitive frameworks and practical modes of inter- and transdisciplinarity are complex and challenging. They do, however, offer many opportunities and rewards for the participating researchers, students, administrative staff and societal stakeholder, as will be discussed in what follows.

## 2. Theoretical Framework: Working across Disciplinary Boundaries

The prevailing dominance of single, independent science disciplines has become untenable because challenges such as climate change, responsible consumption and production, and the digital transformation require interdisciplinary treatment and collaborative solution approaches. As Gräfrath et al. have argued, “all sciences must rather see themselves as an integral part of a culture of reason, whereby the provision of orientation cannot be the exclusive task of a single discipline or a group of disci-

plines" [1]. Hence, science should provide orientation and assistance, and this can best be achieved through interdisciplinary collaborations. The result is a picture of diversity and complexity: although each scientific discipline has its clearly defined research methods and practical models, the complexity of modern life and reality requires inter- and transdisciplinary approaches.

Interdisciplinary research (IDR) is particularly valuable for the EURECA-PRO partner universities because it allows them to "integrate information, data, techniques, tools, perspectives, concepts or theories from two or more disciplines or bodies of specialized knowledge" [2]. The aim of the alliance is to integrate expert research on RCP from various disciplines (including mining, engineering, biotechnology, chemistry, physics, sociology, business studies and more) into coherent research projects which address the challenges of SDG12. As Brandstädter argues, the emphasis of interdisciplinary work is thus on *integrating* expert knowledge that stems from different disciplines with the aim of finding "a holistic, more complex perspective on a problem or issue" [3]. This emphasis on the integration of specialized knowledge and research practices distinguishes interdisciplinary approaches from multidisciplinary which "draws on knowledge from different disciplines but stays within their boundaries. Interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole" [4].

RE-EURECA-PRO is committed to pursuing strategies that build a strong and cohesive European Research Area and lead to transformative environmental and social framework development in the field of RCP. For this reason, interdisciplinary collaboration in research and innovation plays a central role in the activities of the consortium. There is no doubt that high-level work within disciplinary boundaries is important and indeed necessary for the establishment and dissemination of knowledge expertise but it must also be interrogated for its effectiveness in today's interconnected world.

According to Hollaender, there are several factors that influence interdisciplinary cooperations. They consist of the following: group constellation, group size and identity; individual behavior; the willingness to cooperate (motivation); organizational structures; spatial distance between participants; and leadership (competent management) [5]. One might add to this list social factors, cultural differences, knowledge diversity, and communication competencies. As far as the conditions for interdisciplinary collaboration are concerned, De Bruin and Fischhoff have identified the following requirements (Fig. 1): shared project goals, shared methodology, shared effort and communication, and shared benefits (project outcomes relevant for all) [6].

Opening up and going beyond interdisciplinarity at the level of scientific research, the EURECA-PRO consortium addresses complex societal problems and thus aims at working in a transdisciplinary manner as well. This entails reaching out to wider society (involving stakeholders in business, industry, governance, and education) to communicate or even co-produce scientific results. As Jerneck and colleagues state, particularly in research on sustainability

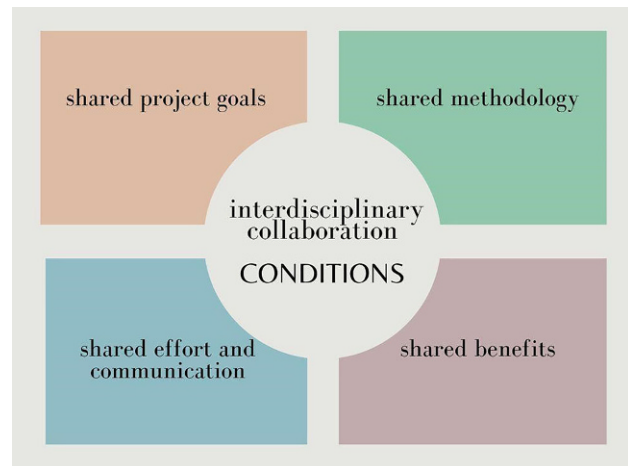


Fig. 1: Conditions for interdisciplinary collaboration. (based on Wändi Bruin de Bruin & Baruch Fischhoff [6])

"it is expected that interdisciplinary groups of researchers engage in such transdisciplinary processes in order to demonstrate how sustainability transitions for society can come about" [7].

Sustainability issues, such as those addressed by EURECA-PRO, are highly complex. They require perspectives from and beyond multiple disciplines and, thus, also the management of the complexities inherent in combining disciplines in a project. Apart from the complexities inherent in RCP, the process of dealing with complexity is in itself challenging.

Following Maylor and Turner, complexity has three aspects: structural, socio-political, and emergent complexity [8]. Structural complexity expresses complexities inherent in the setup of the project, such as the number of people involved or the number of specialist disciplines working together. Socio-political complexity expresses complexities surrounding the project, such as the political support for a project or the potentially conflicting interests of stakeholders. Emergent complexity addresses the development of complexities over time, such as changes in the political context or the development of the project vision. In what follows, some of the complexities, challenges, and opportunities of inter- and transdisciplinary collaboration in EURECA-PRO are presented.

### 3. Research Approach: Survey and Complexity Assessment

Interdisciplinary work is about satisfaction, community, knowledge, cohesion, flexibility, and exchange. RE-EURECA-PRO aims to question and critique some of the value frameworks prevalent in European teams and build a foundation of trust to enable interdisciplinary collaboration and create the best possible joint outputs from diverse creative minds. RE-EURECA-PRO aims to provide researchers with the necessary interdisciplinary and transnational work tools to carry out successful collaborations in the context of increasingly interconnected

environments. For this reason, a survey was conducted in the (RE-)EURECA-PRO consortium to determine current interdisciplinary approaches and draw attention to the difficulties, concerns, expectations and wishes of the people involved in the project.

In order to assess the complexities inherent in the inter- and transdisciplinary work in EURECA-PRO, the Complexity Assessment Tool as developed by Maylor, Turner and Murray-Webster was applied [9]. This tool addresses complexity as a subjective notion and, thus, includes 32 questions for project managers. The five leading EURECA-PRO project managers responded to the questionnaire which was structured around the three aspects of complexity: structural, socio-political, and emergent complexity. To questions such as “The visions of the work can be clearly articulated”, the project managers answered on a range from 0 “do not agree” to 10 “fully agree”. In addition, reasoning behind the answers to the questionnaire was discussed.

#### 4. Analysis: Complexity in Action

The implementation of interdisciplinarity in the EURECA-PRO alliance is aided by the Organisational Scientific Framework Charter (SFC) for interuniversity research collaboration and supported by the work of a Research Task Force (RTF). Both bodies provide the structural frameworks and impulses for joint research about responsible consumption and production and are constantly under review as the work of the EURECA-PRO programme develops.

During Phase One of the programme, the RTF identified five topical Lighthouse Research Missions which focus on (1) responsible material flows, (2) environment and water, (3) sustainable materials and products, (4) clean energy, and (5) process automation and industry 4.0. The thematic foci of the lighthouse missions reflect the distinct research expertise and scientific traditions of the partner universities which strive for alignment and integration of research collaboration.

Due to the expansion of the alliance and its evolving research landscape, the thematic areas of EURECA-PRO have been updated and redefined in a process of re-mapping, which constitutes a core activity of research leaders involved in Phase Two of the programme. Additional interdisciplinary actions have been taken, for example the establishment of a research focus on circular economy and health and the collaboration with multi-media artists in the context of an SDG12 awareness exhibition, which will conclude the RE-EURECA-PRO project.

The SFC articulates the collaborative mechanisms and support structures for research within and across the lighthouse missions by defining the communication flows, roles, and responsibilities of each partner. The designated Research Task Force creates, implements, and organises joint transdisciplinary research inside EURECA-PRO through the use of digital tools and dialogue platforms (e.g. the digital Societal Dialogue Platform, which serves as an information, communication and activity interface between EURECA-PRO and civic society) and by hosting regular Open Science events. The aim of the

multi-level, transdisciplinary research activities and organizational tasks of the RTF is to integrate the disciplinary expertise and skill-sets of the partner universities (which cover a diverse range of technological, ecological, policy, economic and societal aspects). This integration of expert knowledge and best practices is needed in order to tackle the challenges presented by the ecological, economic, technological and cultural transformations of our global society. Transdisciplinary actions carried out so far include Science Slams, Project Weeks and Children’s Universities at all partner universities, as well as Open Science activities (public talks, round tables, discussions with experts on RCP, etc.).

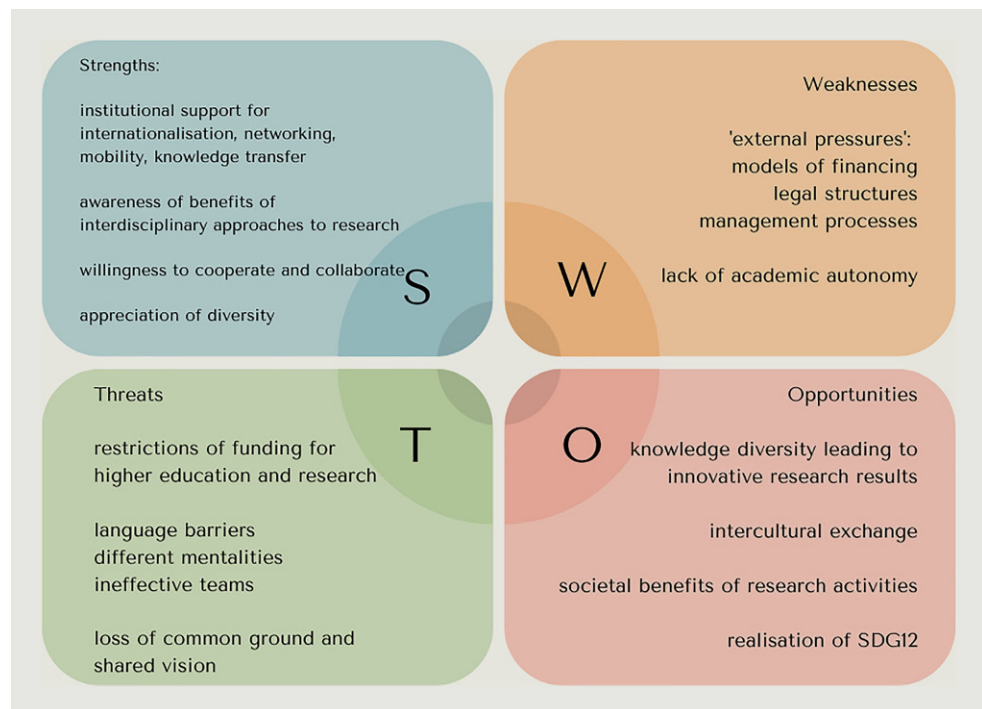
As Clause and Wiese note, “interdisciplinarity is an approach of collaboration, which sets high standards for the integration of disciplinary perspectives” [10]. For an optimisation of knowledge integration and exchange, a positive collaboration mindset is required as well as an understanding and appreciation of the diversity of experiences, expectations, and outlooks. In response to a survey [11] among EURECA-PRO, colleagues expressed their high appreciation for the core values of interdisciplinary collaboration and internationalisation, namely equality, tolerance, openness, integrity, responsibility, determination, freedom, and autonomy. There is also a strong awareness in the team that conflicts of opinion, different mentalities, and heterogeneous workstyles are not a problem as long as there is agreement on the shared vision of the project and a willingness to find common ground. The survey also showed that diversity and difference can enhance creativity and be beneficial for the development of a project if values such as openness, diplomacy, knowledge integration, high motivation, and reasoning remain predominant.

The results and responses to the survey demonstrate that there is a high level of awareness regarding the challenges, benefits, and potentials of interdisciplinary collaboration in EURECA-PRO. Based on the responses to the survey and information retained from the alliance partners’ strategic development plans, a SWOT analysis of the current mindset of internationalisation and approaches to interdisciplinary collaboration was made (Fig. 2).

In the context of inter- and transdisciplinary work within EURECA-PRO, a range of complexities arise. A central structural complexity is represented by the novelty of the European Universities initiative forming alliances such as EURECA-PRO. In order to work towards sustainability, EURECA-PRO connects different disciplines and reaches out to society beyond academia. This is not done for one university, but for a consortium of nine universities. This, of course, also entails working across different cultures, addressing heterogeneous legal systems, and engaging a range of academic disciplines.

In the day-to-day work of the project, individual responsibilities are sometimes difficult to discern. If, for instance, a lecture series should be installed across the consortium—who needs to be involved in the process? While for some issues, top-level management should be involved, many other issues also require getting people interested in the project in a “bottom-up” process.

Fig. 2: Internationalisation and interdisciplinarity: SWOT analysis



A further structural complexity is presented by the alliance's work across the "knowledge square" [12], which entails integrating education, research, innovation, and societal outreach. Thus, in a transdisciplinary manner, the needs and perspectives of civil society are taken into consideration.

One socio-political complexity is that EURECA-PRO needs to succeed in changing the way universities collaborate across the entire consortium. The common aim of working towards sustainability needs to be integrated across all corners of the knowledge square throughout the consortium. Oftentimes, the work across different paradigms and perspectives can lead to resistance. Within the consortium, different approaches to teaching, education, research, and leadership meet. Despite this range of approaches, EURECA-PRO needs to externally present itself as one coherent unit. Furthermore, the consortium needs to align itself, despite internal differences, with the perspective and vision for European Universities put forward by the European Commission [13].

Regarding emergent complexity, the project managers hope for change and expect change to happen. This also means that emergent complexity does not necessarily have to be something negative. As the project develops, it will be structured in a more productive manner. The project objectives will become clearer and the vision of the European Union for the University Alliances will also become more concrete. Overall, the skills of the project management team at handling this novel constellation are likely to improve.

## 5. Reflection and Future Outlook

Inter- and transdisciplinary approaches set a common goal, which, in the case of the EURECA-PRO initiative, is to work towards realising the SDG12 on Responsible Consumption and Production (RCP). However, the diversity of perspectives, expectations, and work methods within all types of cross-disciplinary work can be challenging. As German psychologist Simone Brandstädter accurately explains, such diversity can be a double-edged sword [3]. On the one hand, cognitive diversity leads to better decisions being made, more creative solutions being developed, and more innovative products being developed; on the other hand, such heterogeneity in a research team can also create obstacles, conflicts, and challenges which have to be overcome so that effective inter-disciplinary work can be carried out.

The results of the research carried out for this contribution show that alliance members are aware of the complexities and challenges of collaborative work and interdisciplinary research. Overall staff members have a positive collaborative mindset and an appreciation for the benefits of working together across national and disciplinary boundaries. The current and future work of EURECA-PRO will continue to embrace cross-disciplinary work as a way of addressing the challenges of RCP. Phase two of the programme entails a re-mapping of the thematic research areas within the alliance, which will identify new collaboration opportunities across universities and disciplines. As a way of rendering research socially relevant, additional transdisciplinary work will be implemented, such as an RCP Innovation Hub, citizen engagement activities, and collaboration with the arts.

Managing complexity within EURECA-PRO will require a three-step approach involving raising awareness, reducing, and actively addressing complexities [8]. One important aspect is furthering staff development initiatives that foster competencies of intercultural and interdisciplinary collaboration as well as project management skills. Additionally, relationship development through improved internal and external communication will be emphasized and strengthened in the future work of the alliance. In conclusion, it will be necessary to actively embrace the necessity of complex thinking in order to address the challenges of RCP and realise the many opportunities offered by the formation of a European University alliance.

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