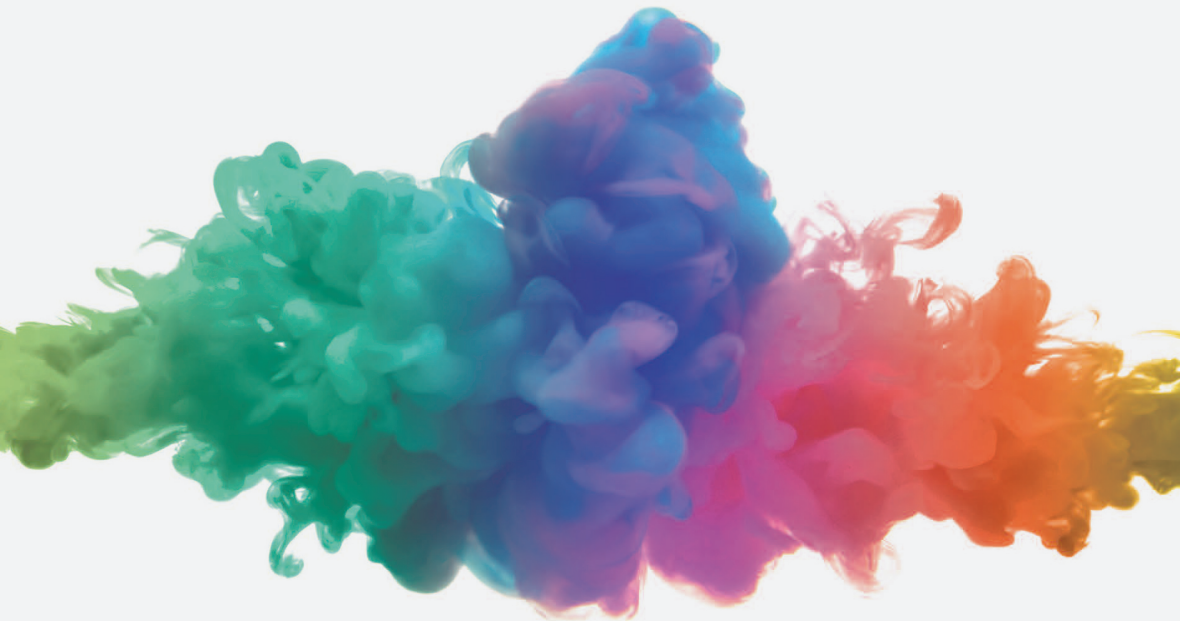
Foundations of Interdisciplinary and Transdisciplinary Research



A Reader

Edited by Bianca Vienni-Baptista,
Isabel Fletcher and Catherine Lyall

FOUNDATIONS OF INTERDISCIPLINARY AND TRANSDISCIPLINARY RESEARCH

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SHAPE-ID
Shaping interdisciplinary practices in Europe

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List of Extracts

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List of Acronyms

AAAS	American Association for the Advancement of Science
AHSS	Arts, humanities and social sciences
ECR	Early career researcher
ESRC	Economic and Social Research Council
HEI	Higher education institution
HEurope	Horizon Europe, European Union research and innovation funding programme
H2020	Horizon 2020, European Union research and innovation funding programme
ID	Interdisciplinarity
IDR	Interdisciplinary research
ITD	Inter- and transdisciplinary research
K⋆	Knowledge transfer, exchange, mobilisation
LERU	League of European Research Universities
MSCA	Marie Skłodowska-Curie Action
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
OED	Oxford English Dictionary
PNAS	Proceedings of the National Academy of Sciences of the United States of America
RELU (or Relu)	Rural Economy and Land Use Programme
RMAs	Research managers and administrators
SHAPE-ID	Shaping Interdisciplinary Practices in Europe
SNSF	Swiss National Science Foundation
SSH	Social sciences and humanities
STEM	Science, technology, engineering and mathematics
STEMM	Science, technology, engineering, mathematics and medicine
STS	Science and technology studies
TD	Transdisciplinarity
td-net	Network for transdisciplinary research (Swiss Academies of Arts and Sciences)
TDR	Transdisciplinary research

Glossary

Agonistic Used to describe conflicting attitudes. In this book it describes how researchers might establish a collaboration.

Artefact (artifact) Objects created or built by researchers or artists. Artefacts are useful to learn about a group or a certain situation.

Bricolage The construction or creation of a work from a diverse range of things (objects or ideas). In the humanities, the term is also used when groups borrow objects from others and create new aspects of their identities.

Consilience Principle stating that several sources of evidence in agreement make evidence more robust. Reaching the same result applying different methods should lead to the same answer.

Constitutive This term indicates an essential part of something, that is, a constituent.

Epistemology/epistemic Epistemology refers to the theory of knowledge. It is concerned with questions such as: How do we know things? And if we do, how and when do we know things? Epistemic indicates the relation to knowledge.

Ethnocentrism Mostly used in anthropology, an ethnocentric perspective is the evaluation of other cultures according to preconceptions originating in the standards and customs of one's own culture.

Ethnographic Method used in anthropology to study other cultures by focusing on the scientific description of peoples and cultures with their customs, habits and mutual differences.

Formative (evaluation) Assessment conducted during the development or improvement of a project or activity (in contrast to summative evaluation, which is conducted at the end of an activity).

Fungible Something that can be substituted for something else.

Generative Capable of producing or 'generating' something.

Heuristics Guidelines that can be applied to aid decision making when information is limited.

Ideal-typical Hypothetical mental construct representing a simplified version of reality, enabling comparison with real-life phenomena. An ideal-typical situation is neither 'perfect' nor an average, but an approximation to reality.

Meta-skills Short for 'metacognitive skills', higher-order skills that are applicable across domains and disciplines. An example could be communication skills.

Methodology (vs method) A method is a tool to answer research questions such as the technique used to collect data. A methodology is the rationale for the overall research approach, so it describes the overarching research strategy.

Normative When something (for example, a research finding) is compared with a (social) standard or 'norm'.

Ontology/ontological Branch of philosophy that analyses the nature of being and existence. In the social sciences, questions of ontology link to both epistemology and method since researchers' understandings of social reality affect the theoretical claims they can make.

Performative The concept that language (and by extension, other forms of behaviour) can function as a form of social action and thereby have effects on the world.

Positionality The social and political context that creates an individual's identity in terms of, for example, race, class, gender, sexuality and ability status. Also describes how that identity – derived from a social position – influences their understanding of and outlook on the world.

Positivist Positivism is an empiricist theory of knowledge, which holds that all genuine knowledge is true by definition, or derived by reason and logic from sensory experience ('positive').

Post-normal (science) Describes a problem-solving strategy appropriate in situations of urgency, uncertainty and disputed values, where standard processes of knowledge evaluation (such as risk assessment or cost-benefit analysis) fail. Climate change policy is an example of post-normal science.

Post-structuralism An intellectual movement that emerged in philosophy and the humanities in the 1960s and 1970s. It challenged previous ideas of structuralism, which believe that phenomena of human life are only understandable through their interrelations (such relationships constituting a 'structure').

Reflexive/reflexivity The capacity of an individual (often a researcher) to reflect on how their place in society has influenced their beliefs and behaviour, particularly when trying to make sense of their research data (see also 'Positionality').

Tacit Tacit knowledge is knowledge that has not been written down, codified or otherwise made explicit, making it difficult to communicate to others.

Wicked problem A problem that cannot readily be solved. There may be no single solution due to incomplete, contradictory and changing requirements, and the effort to solve one aspect of a wicked problem may reveal or create others.

Introductory Essay: Shaping Interdisciplinary and Transdisciplinary Research

Bianca Vienni-Baptista, Isabel Fletcher and Catherine Lyall

Who are we?

At the start of 2019, in a time and place that feels quite different and far away now, the three of us came together to work as part of the SHAPE-ID (Shaping Interdisciplinary Practices in Europe) project. SHAPE-ID was a Coordination and Support Action funded by the European Commission under the Horizon 2020 Framework Programme Grant Agreement No 822705. The aim of the project was to review understandings and best practice of doing and supporting interdisciplinary and transdisciplinary research (IDR and TDR)[1] involving arts, humanities and social sciences (AHSS) disciplines alongside societal partners and researchers from the sciences, technology, engineering, mathematics and medicine (STEMM). The SHAPE-ID research consortium brought together interdisciplinary and transdisciplinary scholars and practitioners from six countries, several of whom have contributed to this book (see the commentaries in Chapters 3, 5 and 8).

The SHAPE-ID project's primary stakeholder groups were funders and policymakers, research performing organisations, researchers and research partners from enterprise or society. A core objective of the project was to deliver a toolkit and recommendations that would guide these decision makers and researchers, at different levels of the research and innovation system, towards successful pathways to integrating AHSS disciplines in IDR and TDR with STEMM disciplines, and societal partners, and thereby help key stakeholders to make better decisions and promote change in policymaking, funding and educational institutions.

The three of us worked closely on the production of the toolkit. Between us we represent different degrees of familiarity with the academic literature and with the research policy contexts across a range of countries and continents. We have researched, taught and led workshops on the topic of interdisciplinarity (ID) and transdisciplinarity (TD), and share a view that, if we are going to undertake IDR and TDR, then we want to build on good practice. We want to do this in a way that helps researchers surmount some of the typical entry barriers so that the field can progress more quickly and on more solid foundations. Our work with SHAPE-ID has shown that, within the rhetoric of research funding bodies and the strategic plans of research institutions worldwide, the same issues and challenges keep recurring. In large part this is because current academic literature on inter- and transdisciplinary research is dispersed across many different knowledge domains. The result is that scholarship is less cumulative and embedded than might be expected. This book aspires to rectify this situation by guiding readers through the basics.

Who is the book for and how could it be used?

Interdisciplinarity and transdisciplinarity are now common terms in research policy, and have a long history in a variety of research fields. These modes of knowledge production promise to solve complex and multidimensional problems and inform science policy at all levels of the European research system. Both are relevant to the European Framework Programmes that foster 'mission-oriented' collaborative research between academic and societal stakeholders in order to tackle global challenges. Nevertheless, interdisciplinary and transdisciplinary research are not new,[2] and are not solely embraced by researchers responding to external funding drivers: research has long had a tradition of 'borrowing' from other disciplines, and indeed, this is how disciplines develop and evolve (Klein, 1996). Yet, despite being currently in high demand, the practice of IDR and TDR is still not well understood, or at least it is understood in very uneven ways across different research communities.

We have designed this book as an introductory text for those new to the area of inter- and transdisciplinary research, and for those who have already dipped their toes into the interdisciplinary pool but are keen to learn more and perfect their craft. Our primary purpose in selecting and explaining the key texts that follow is to provide readers with an overview of the varied ways in which these approaches to research have already been developed and practised. We seek to provide new entrants with solid foundations on which to build their own IDR and TDR by sharing existing knowledge of how to successfully conduct collaborative forms of research and reduce the endless relearning or 'reinventing of wheels' – previously a feature of much that has been written on the topic.

What this book therefore seeks to do is to develop a better shared understanding of what IDR and TDR are (or could be), and to provide a 'grounding' in key works which might, in turn, help to speed up the development and dissemination of inter- and transdisciplinary knowledge. What the book offers is a carefully curated selection of key readings on inter- and transdisciplinary theory and practice, sharing current good practice and benchmarking the progression of thinking about IDR and TDR.

Research that spans different disciplines and sectors takes place in many different contexts, where similar activities may be given different labels. Key terms we are aware of include: collaborative research, interdisciplinary research, team science and transdisciplinary research. Add to this the general view that different disciplines are still at different stages in their understanding of the benefits and challenges of IDR and TDR (as we explain in more detail) and we have a very inconsistent and complex landscape for newcomers to navigate. This heterogeneity makes it especially hard to identify cross-cutting ideas and underpinning themes when conducting boundary-spanning research and making use of the results of such research. This book therefore introduces the reader to a large, unwieldy and diverse body of rich literatures (that overlap and indeed, sometimes, contradict) in what we hope are easily digestible, bite-size pieces. The reader is invited to follow the pathways offered by the chapters that follow and to search for more details in their own journey through the literature. Each chapter includes a 'References and further reading' section, giving readers who are curious the opportunity to explore similar resources and readings.

We envisage this book might be used in three different, but complementary, ways. The first would be as a teaching text in research methods courses for (post-)graduate students who are increasingly keen to undertake inter- or transdisciplinary research projects and need to be introduced to the specific skills required to undertake such research successfully. The second would be as body of practical knowledge to draw on at key points in the research process – for example when writing a research proposal – or as a resource to structure workshops on particular topics – perhaps the specific challenges of funding or evaluating collaborative research. Finally, we hope that individuals and groups will make use of it more informally at the beginning of a collaboration, either individually or in reading groups. However they use it – and there are certainly other ways that we have not thought of – we hope that all readers will employ the extracts, commentaries and further reading as a way of identifying the pieces of writing that are most relevant to their particular situation, enabling them to benefit, as we have, from the collective wisdom of those who have done this before.

In presenting this book as a 'reader' for those seeking to find out relatively quickly about the topic before embarking on their own deeper explorations, we are not proffering a polemic or position statement on what

interdisciplinarity or transdisciplinarity could or should be. Nor are we attempting to create a new field. No academic arguments will be constructed (or demolished), and we are emphatically not trying to draw all the existing inter- and transdisciplinary scholarship into one mega 'synthesis'. Indeed, we have written elsewhere on the benefits of embracing this heterogeneity (see Vienni-Baptista et al, 2022). This is straightforwardly a guided introduction to a complicated and multifaceted area of research, recognising that there is no 'right' way to do it but offering lessons to newcomers based on what we have found helpful in our own development as interdisciplinary researchers. Above all, this is our personal selection of readings, spanning literature that has influenced and informed our own thinking as interdisciplinary and transdisciplinary practitioners at different stages in our careers as well as drawing on the further knowledge that we have gained as a result of working together with partners in the SHAPE-ID project.

How did we select the readings?

Inter- and transdisciplinary research pose several general challenges that are rooted in the nature of these phenomena. IDR and TDR are not established as well structured fields in the academic and policy literatures, and insights on them are scattered across unrelated bodies of literature. There are distinct pockets of expertise, for example in sustainability science or in the lab-based biomedical sciences, but knowledge derived from these fields may not be directly applicable to other quite different combinations of disciplines. Collaborations among and across different fields of knowledge imply dynamic intertwinements of concepts, data, methods, theories and experiments. Researchers and practitioners may contribute to co-producing knowledge in different ways, depending on their worldviews and interests in the problem.

Historically, STEMM disciplines have been dominant in IDR and TDR, and the SHAPE-ID project focused on better integrating the arts, humanities and social sciences within inter- and transdisciplinary research practice. Integrating knowledge from a wider range of different disciplinary contexts, which includes AHSS in a meaningful way, is an intricate task that requires careful selection, interpretation and translation for readers from different backgrounds and with different forms of research experience.

To address this intricate task, this book aims at connecting inter- and transdisciplinary research practice and theory to offer a supportive space for readers to learn. We have carefully selected readings that take into consideration the historical and geographical contexts of implementing and supporting collaborative research projects. The commentaries that accompany each chapter offer insight into how theory and practice play out through case study examples and personal experiences. Invited authors

who contribute with each commentary also have different disciplinary backgrounds and expertise in working in inter- and transdisciplinary settings.

We based our selection of readings on an extensive literature review done by the SHAPE-ID team (for details of the review methods see Vienni-Baptista et al, 2019, 2020a). After building a robust sample of literature, the team aligned qualitative and quantitative methods to map understandings of IDR and TDR found in the literature. Datasets were created by querying scientific citation databases, supplemented by bibliographies prepared during a preliminary scoping analysis of inter- and transdisciplinary literature.

We compiled academic and policy literatures on inter- and transdisciplinarity, and critically examined these sources in order to: (1) map different approaches to the same topic across these two corpuses, and (2) bring together different theoretical perspectives (Burgers et al, 2019). Academic literature consists of peer-reviewed journal articles, book chapters and books on ID and TD, while policy literature included non-peer-reviewed documents contributing to debates in research policy.[3] In both these literatures concepts of ID and TD overlap significantly with normative accounts of how to conduct inter- and transdisciplinary research.

We scanned both bodies of literature to identify the different understandings of IDR and TDR and the factors contributing to their success or failure. We qualitatively analysed 121 scientific papers and 103 policy reports, including readings selected from a survey of members of the SHAPE-ID team together with a Delphi study performed annually by the Network for Transdisciplinary Research (td-net, Tour d'Horizon of Literature, Switzerland).[4] These datasets (containing over 5,000 items) were summarised and are accessible online in a Bibliography that is available from the SHAPE-ID Toolkit.[5]

During our study, we identified a set of challenges that characterise IDR and TDR that are shared in different geographical contexts. Such challenges include, among others, the lack of perceived legitimacy of inter- and transdisciplinary research as scientifically sound modes of knowledge production, the fragmentation of inter- and transdisciplinary communities of practice, differences in national and international policy and practice in their treatment and funding of IDR and TDR, a lack of status of AHSS disciplines in relation to STEMM contributions, and the need to defend AHSS' constitutive territory. We then explicitly worked towards addressing these challenges in the selected readings and also by encouraging invited authors to reflect on the constraints that they, themselves, might have overcome in order to pursue an inter- or transdisciplinary career or to support these types of collaborative research, as we explain in the following section.

What did we learn from SHAPE-ID and how is this reflected in the book?

Throughout our work in the SHAPE-ID project, we have argued that inter- and transdisciplinary research urgently need to be better supported in research, funding and policy institutions (Vienni-Baptista et al, 2020b; Fletcher et al, 2021). The paradox of interdisciplinarity (as Peter Weingart [2000] termed it 20 years ago) – whereby interdisciplinarity is often encouraged at the policy level but poorly rewarded – still challenges the establishment of cross-sectoral boundaries and connections. The role of AHSS disciplines in IDR and TDR raises particular questions about barriers to their integration.

From the different analyses the SHAPE-ID team conducted, three major insights (relevant for researchers, funders and policymakers alike) emerged:

1. An urgent need to acknowledge plural understandings of ID and TD and permit them to coexist in research (and funding) environments.
2. Recognition that the conditions that influence IDR and TDR are context-dependent: factors that hinder IDR and TDR can be transformed into enabling measures, even during the development of a research project.
3. A demand (and responsibility) to reassess AHSS roles and functions in IDR and TDR so that these disciplines can contribute fully in inter- and transdisciplinary settings.

In what follows, we explore these three insights and draw connections between the different analyses carried out during this phase of the SHAPE-ID project.

Acknowledgement and commitment to plural understandings of inter- and transdisciplinarity

The academic literature shows no agreement over the definitions of interdisciplinarity and transdisciplinarity. Rather, it shows plurality and overlapping conceptualisations, even contested and contrasting discourses when we take into consideration AHSS perspectives on ID and TD. Solving societal problems is seen as the main purpose of IDR and TDR, but other parallel discussions are taking place that provide alternative and substantial models of collaborative knowledge production processes. For instance, some AHSS communities are aligned to critical and philosophical discourses on ID and TD (see, for example, Extract 2.4 by James Leach and Extract 3.4 by Chris Rust).

We argue that, rather than develop new definitions, it is necessary to find connections between the diverse definitions of ID and TD that currently

co-exist within the academic literature. The lack of connections between different communities results in a tendency to adopt a narrow approach whereby researchers ignore alternative collaborative pathways; this acts as an obstacle to further integration of AHSS disciplines in inter- and transdisciplinary research. Differences between academic fields with regard to methodologies and output modalities are obvious, but differences also exist between universities (some invest much more time, people and money in supporting IDR and TDR than others), and between countries (some have developed IDR and TDR policies at the national level, and some are less advanced in this area) (Spaapen et al, 2020).

Researchers and funders alike need to recognise that ID and TD are conducted for different purposes and are conceived in different ways, for example, as: (1) objects of study; (2) methods; and/or (3) phenomena that vary according to historical and geographical contexts (see Extract 1.2 by Andrew Barry et al).

We argue for a plural understanding of interdisciplinarity and transdisciplinarity because this could substantially improve inter- and transdisciplinary research policymaking and funding by giving institutions a greater appreciation of the conditions that are needed to support IDR and TDR in different contexts (Vienni-Baptista et al, 2022; see also Chapter 4 focusing on funding of IDR and TDR). In Chapter 1, we show these differences by means of a selection of extracts, a commentary by Isabel Fletcher and a list of 'References and further reading'. Allowing for the co-existence of plural understandings of ID and TD could also support early career researchers wanting to focus on IDR and TDR by making the pathways towards such a career more transparent (Lyall, 2019; see also Chapter 9 for a deep dive into this topic).

Acknowledging this urgency also implies commitments, responsibilities and specific actions from different societal actors and institutions. Actions to be implemented to promote a cultural change towards inter- and transdisciplinary research can include (based on Vienni-Baptista, 2023):

1. *Co-production of concepts:* to support the coexistence of different definitions that are context-dependent, researchers, funders and policymakers alike can develop co-production processes. Co-producing means simultaneous processes through which understandings of the world are built and related to representations, identities, discourses and institutions (Jasanoff, 2013). These can be developed during the research process or while elaborating funding schemes.
2. *Systematisation and traceability of a range of processes and practices:* to acknowledge that ID and TD imply different phenomena for different societal actors demands that all actors involved in IDR and TDR should develop processes to systematise these varied practices. This would

involve creating a 'memory' of IDR and TDR, including common understandings and agreements on what IDR and TDR are, the factors that hinder or help ID and TD development, how to better integrate AHSS and what methods and tools to use.

3. *Mapping of understandings:* to take into consideration that different modes of ID and TD exist, and these operate according to various logics. Mapping plural understandings, using different tools, leads to new spaces (epistemological, team-based, institutional, cross-sectoral) where IDR and TDR can be performed. In these spaces, AHSS disciplines can engage in new collaborative roles and functions.

Factors that affect inter- and transdisciplinary research are mutable

Factors that help successful inter- and transdisciplinary research as well as those that hinder such efforts are concrete realities. If we consider interdisciplinarity and transdisciplinarity as dynamic phenomena with multiple understandings and a heterogeneity of practices, trying to divide a list of factors into positive and negative conditions for research can be tricky.

In the academic literature, we identify 25 factors[6] influencing the outcomes of IDR and TDR. In the policy literature, four main factors are mentioned: (1) appropriate funding (see Chapter 4); (2) existing academic career structures (see Chapter 9); (3) the extended timescale required to conduct good quality IDR and TDR (see Chapter 2); and (4) recognition of key inter- and transdisciplinary skills (Lyall, 2019; see Chapter 7).

A promising finding on the factors that can help or hinder IDR and TDR collaboration is the indication from the literature that the same factor may act as either a barrier or an opportunity, depending on the circumstances within a project. This means that factors can be changed, transforming them from problematic to enabling during the research process. In part, this depends on what we value within research cultures and how far we are willing to go to change them: 'As a community we create our value systems. We can also alter them' (Lattuca, 2001: 264).

A demand (and responsibility) to reassess the roles and functions or the arts, humanities and social sciences in inter- and transdisciplinary research

'AHSS' is a problematic label, obscuring the differences between a set of disciplines with very different cultures and histories, and variations in methods, epistemologies and ontologies. Moreover, the model of inter- and transdisciplinary research as providing solutions for complex social problems – sometimes labelled 'mission-oriented research' – can be especially inhospitable to AHSS researchers due to its instrumental and technocratic approach to research (see Extract 4.3 by Julia Stamm).

The uneven representation of AHSS disciplines within inter- and transdisciplinary research projects needs to be recognised: while the SHAPE-ID findings confirm considerable levels of integration between disciplines from social sciences and environmental science, medicine and computer science, they also highlight the comparatively lower integration of arts and humanities disciplines with non-AHSS disciplines.[7]

Perhaps the biggest challenge for AHSS disciplines is to fight prejudice and misconceptions, among both researchers and policymakers (Spaapen et al, 2020). Findings from the SHAPE-ID project showed that the subordinate roles and functions assigned to AHSS disciplines discourage their greater involvement with STEMM disciplines in IDR and TDR. The problem has two aspects. On the one side, AHSS researchers have a responsibility to show more willingness to collaborate with other disciplines. On the other side, pro-active funders and policymakers also have a responsibility to change things for the better to support AHSS integration in IDR and TDR.

The academic literature and the case studies we have developed[8] also reveal a plethora of relationships between AHSS and other disciplines in inter- and transdisciplinary research. Transformative connections (which imply a change in disciplinary domains) and productive convergence (in which researchers integrate different types of knowledges), for instance, go beyond the instrumental function usually attributed to AHSS disciplines where, so often, they act in a subordinate role to the STEMM disciplines; for example, 'doing the public engagement' (Balmer et al, 2015; Fletcher and Lyall, 2021) once the 'real' research has been completed.

Significantly, even within the existing inter- and transdisciplinary literature, there are knowledge 'silos'. However, interdisciplinary research is still much more prevalent among different STEMM disciplines than between STEMM and the AHSS disciplines. Moreover, there is ample evidence that, when AHSS and STEMM disciplines do come together, the research agenda is (1) predominantly led by STEMM and (2) AHSS disciplines are chiefly represented by the social sciences (rather than the arts and humanities) and frequently by only a very limited sub-set of social science disciplines (such as economics) (Vienni-Baptista et al, 2020b).

AHSS disciplines have a relevant role to play and can contribute to consolidating a cultural change towards IDR and TDR development. What we seek to do here, with this book, is to redress this imbalance and provide a more comprehensive and diverse account of how IDR and TDR can flourish across all the disciplines. In the selected readings that follow, we have deliberately sought out extracts from journals and books that might be less accessible to, for example, natural scientists, and to introduce them in ways that render them more easily understandable. By providing additional lists of further reading for each chapter, we have tried to cover the same topic from a range of perspectives while acknowledging the inevitable imbalance

resulting from the, as yet, uneven dissemination of inter-and transdisciplinary knowledge across different disciplinary traditions.

Contribution to state of the art

In the UK, where two of us are based, the research we do is increasingly influenced by 'the excellence turn' (Gläser and Laudel, 2016), whereby only exceptional research is deemed worthy of research funding. And this, in turn, is influenced by the UK's national quality assessment mechanism, the Research Excellence Framework or 'REF', which shapes the publications and other outputs and impacts we generate, based on that 'original' and 'excellent' research (Lyall, 2022). So, by its very nature, this book is unlikely to be considered 'REF-able' in UK academic parlance. While this 'Introductory Essay' draws substantially on findings from the SHAPE-ID project, the anthologised structure of the chapters that follow would not qualify as 'new' research. It is these strictures that render the REF highly problematic for certain disciplines and for interdisciplinary research in particular. Irrespective of these somewhat parochial concerns, we believe that this book exemplifies the general need to ascribe greater importance to the integration and application of existing knowledge (Frodeman, 2014) and not simply to cherish the traditional scholarship of new discoveries within a single discipline (Lattuca, 2001). In doing so, we believe this book fills an important need and provides a novel contribution to the state of the art in several respects.

First, it brings together, and therefore renders more accessible, a range of key texts from a variety of disparate literatures. One of the characteristics of the arts and humanities is that scholars are more likely to publish in book format, which, unlike publications from the natural and increasingly the social sciences, may be less readily available electronically. While one of the impacts of the COVID-19 pandemic has been that many wealthy university libraries have extended their electronic subscriptions, the same cannot be said worldwide. An old-fashioned 'reader' still has a role to play.

Not least, this carefully curated anthology format offers much more than a collection of readings that could be simply downloaded from journal repositories. It allows us to consider the differences between, for example, interdisciplinarity, transdisciplinarity and team science, and how they might relate to the different contexts in which they were developed. At face value, a novice may consider that these are all simply forms of collaborative research. Yet a more nuanced reading of the literature shows us that transdisciplinarity, for example, is much more than 'interdisciplinarity plus engagement with stakeholders' but is characterised by an ethos of openness to new encounters, co-production of knowledge and reflexivity (Pohl and Hirsch Hadorn, 2007). Unlike some forms of ID and team science, TD routinely makes

use of a range of new research methods to address power dynamics within collaborative projects. The very notion of transdisciplinary research may be new to some readers, albeit that they may already have some familiarity with interdisciplinary research (see, for example, Lyall et al, 2015). The format of this book therefore enables us to highlight cross-cutting issues without minimising important differences between these approaches or trying to impose standardisation.

Developing the book out of our work on the SHAPE-ID Toolkit and the research that underpinned its development has also enabled us to identify gaps in current knowledge; for example, we were unable to find much existing information on budgeting for ID and TD. We have also reflected on how different country contexts matter (see also Vienni-Baptista and Klein, 2022), and how different disciplines approach similar challenges but feel the need to brand them with their own imprimatur. Again, this may be a feature of modern research cultures that, at the same time as we are recognising the benefits of cross-disciplinary collaboration, academia still feels the need to carve out its own specialisms. Current work on 'responsible research and innovation' (Felt, 2018) may be one such example, and surely has much to learn from existing scholarship on transdisciplinary research.

How is the book structured?

This book shares elements of its structure with the SHAPE-ID Toolkit, which was developed with a similar aim of providing a guide to existing resources on how to undertake inter- and transdisciplinary research.[9] The Toolkit was structured around a set of nine goals that followed the research process from the beginning to its end – from finding out about interdisciplinarity and transdisciplinarity to developing a career in the field – and we have used these goals as chapter headings for this book.

The design of the SHAPE-ID Toolkit was based on a synthesis of the findings of the literature reviews, survey, interviews, stakeholder workshops and Expert Panel consultation that constituted the main elements ('work packages', in EU funding terminology) of the research project. The Toolkit is structured in such a way as to act as a gateway to direct users to relevant information tailored to their specific interests and goals. It takes the form of 'guided pathways' that provide different points of access to enable customised user journeys based on the needs of individual Toolkit users. The web-based Toolkit was therefore designed with these features in mind, allowing different entry points and pathways depending on the profile of the user (for example, researcher, funder); their existing level of knowledge about inter- and transdisciplinary research; and the tasks they wish to accomplish (such as co-create a project, evaluate an IDR and TDR proposal).

Following this 'Introductory Essay', nine chapters introduce readers to selected core texts that underpin the current state of knowledge in the field. These mirror the guided task-based pathways that we created for the SHAPE-ID Toolkit. As such, they represent the core topics in ID and TD that cover the main challenges for newcomers but also for more experienced researchers and practitioners. Each chapter begins with a short introduction to the topic written by one of the editors, followed by three or four selected extracts (reproduced by permission of the original publishers, see 'Copyright Permissions' at the end of the book) that illustrate key learnings on the topic from the perspective of different writers. These readings are accompanied by short commentaries provided by invited contributing authors (and, in some cases, the editors) where the commentators reflect on why these readings are important to the practice of ID and TD. In doing so, they draw on examples of how they, themselves, have made use of specific approaches (conceptual or practical) described in the extracts, and offer insights into how useful or successful they were. Through these personal reflections, our contributing authors explain how their own experiences relate (or not) to the accounts given in our chosen extracts, offering the reader different standpoints and key takeaway points from each chapter. Every chapter also includes a short list of suggested further readings to offer additional perspectives.

In adopting this format, our goal is to offer an overview of the many and varied forms of ID and TD so that readers can build on these foundations in their own work. Rather than attempt to offer an overarching final conclusion, the book closes with a short 'Epilogue' authored by the three editors, with contributions from our commentary writers, where we reflect on our own experiences of inter- and transdisciplinary research and the process of producing this collection. Given the nature of this book, it is not our goal as editors to imply that this collection constitutes the only way to do these forms of research.

The commentaries as a conversation on inter- and transdisciplinarity

Inter- and transdisciplinary research are collective endeavours. Sharing the accumulated wisdom of those with practical experience of these kinds of research was of particular importance to us as an editorial team. We liked the idea of some form of dialogue that would test out our understandings of the significance of the readings we had chosen as emblematic of some of the issues that practitioners might encounter. This also enabled us to bring in a range of perspectives and, crucially, lived experiences. In this section, we offer a conversation that intertwines key insights from the chapters of this book. In such a conversation, we elaborate on cross-cutting topics

throughout the chapters, showing that the book is rich in offering food for thought and open spaces for further explorations by the readers. Chapters can also be read separately – they all contain a narrative that guides the reader into the topic.

We, the editors, invited colleagues at different stages of their career and with different roles within academia to share their insights in the form of commentaries that accompany each of the chapters in this book. This group of contributing authors reflects diversity in their engagement and experience with inter- and/or transdisciplinary research. Authors hold a variety of leadership or mentorship roles, and strive for IDR and TDR as junior or senior researchers, project or programme managers in different countries. Their commentaries offer personal reflections, weaving a dialogue with the scientific literature embedded within the carefully selected excerpts contained in each chapter. These commentaries do not impose fixed formulas for successful collaboration; rather, they offer honest accounts of the challenges we face when we try to *define, co-create, design, evaluate, fund, communicate, improve, support and develop a career* in inter- and transdisciplinarity.

Chapter 1 focuses on disentangling some of the understandings of inter- and transdisciplinarity. Literature revolving around definitions of these terms has extensively discussed the differences in conceptualisations and explores how these definitions influence practices and research processes. The selection of extracts in this chapter provides the reader with a detailed and nuanced framework for understanding different models of collaborative research.

Closing Chapter 1, Isabel Fletcher offers an insightful text by exploring the extracts in the light of her own career. She positions herself as a researcher interested in 'interdisciplinary topics', and from that perspective, details a personal account of the academic literature on interdisciplinary research. From Fletcher's commentary, we learn what is common to a generation of researchers working in interdisciplinary settings: 'we arrive to the field because of our specific interests and motivation but not really knowing the corpus of knowledge available to guide our interdisciplinary practices'. We, interdisciplinarians and transdisciplinarians, then, are and were grateful for Julie Klein's books to light our path.

Another important observation Fletcher draws is her experience in the interdisciplinary field of science and technology studies (STS). She rightly points out that some fields or disciplines encourage methodological (and epistemological) pluralism. Should this be the rule for all disciplines faced with current societal challenges? The internal structure of disciplines influences the ways in which researchers working within them practise interdisciplinarity (and transdisciplinarity). At the end, Fletcher is right in signalling that the extracts in this chapter give us a vocabulary to better explain what we do when we do inter- or transdisciplinary research.

Chapter 2 turns our attention to how to develop collaborative conditions when working in inter- or transdisciplinary settings. The selected extracts build a strong connection with Chapter 1, when Isabel Fletcher enquires about the concept of integration in interdisciplinarity and transdisciplinarity, and how researchers need to take opportunities to collaborate and engage in more restricted ways, without undermining the potentials of inter- and transdisciplinary research. However, there is a rich literature that provides guidelines on how to improve our collaborative skills, competencies and mindsets. Once more, a plethora of terms is presented – integrating, co-producing, co-creating, interfacing; with nuances, they point to the primary role of listening, understanding and enjoying working with others.

Bianca Vienni-Baptista builds on experiences from EU researchers in the commentary that accompanies this chapter. From her study of the experiences of these researchers when building and being invited to participate in large consortiums, she and her colleagues identified a group of factors that either facilitated or hindered the potential of such collaborations. Constraints ranged from individual inability to share a common goal to institutional obstacles that do not account for the time frames required for inter- and transdisciplinary research. In order to overcome these difficulties, Vienni-Baptista argues that 'care' is an indispensable component of successful collaborations. Care, affection and emotion in interdisciplinary research constitute recent topics of inquiry, together with the relational aspects of identities in collaborative settings (see, for example, Smolka et al, 2020; Schikowitz, 2021). Care in collaboration extends the individual attitude of tenderness to a collective practice, in which outputs are desired but the process of collaborating already constitutes a result.

As our focus is also on arts and humanities integration in inter- and transdisciplinary research, Vienni-Baptista highlights some of the differences that need to be considered when researchers from these fields are participating in or leading collaborative processes. As mentioned before in this 'Introductory Essay', new forms of framing problems and integrating perspectives can be put into practice when the arts and humanities have a voice (a loud and clear one, but not a soft or instrumental one, as Fletcher indicates in Chapter 1).

Continuing the conversation, **Chapter 3** centres on how to co-create a research project. It brings to the fore an often-neglected aspect of inter- and transdisciplinary research: the power dynamics that are at play in collaborative settings. An increasing number of authors have consistently posed the question of power in research ('who is entitled to start a transdisciplinary process and why?'; see, for example, Schmidt and Neuburger, 2017). However, this still seems to be a domain of other disciplines (such as anthropology or science and technology studies). The arts also call attention to the issue of power and asymmetries. Meaning-making and meaning

change in interventions and artistic work offers a good example of processes of collaboration – between the artist, the researcher and the communities – which questions who has the authority to understand a work of art.

Acknowledging and accepting the power differentials that exist in collaborative settings (see Extract 3.1 from Felicity Callard and Des Fitzgerald) might be a means to fight the 'utopia of co-creation', as Sibylle Studer indicates in her commentary in Chapter 3. She offers an informed perspective of how methods and tools used in inter- and transdisciplinary research projects have potentials but also may impose limits to what we can learn in such processes. Following the authors in the extracts, Studer strives for a combination of methods that allows researchers to think about when and in which phase they want to craft moments of co-creation, with whom they envisage interacting and with what intensity.

Studer's substantive experience in facilitating capacity-building workshops endows her with a rich perspective on how the question on methods can be deconstructed when the arts come into the conversation. Studer reflects on how methods and tools rely on their co-creators for continuous meaning-making. The need for attribution may put some co-creators more at risk than others, particularly if the former are deemed less powerful. Interestingly, Studer asks whether such uneven situations may lead to the decision not to co-create. Co-creation, as Studer expresses, is a multifaceted process, starting with agreeing on definitions, as shown in Chapter 1, and strengthening skills, as mentioned in Chapter 2 and discussed further in Chapter 7.

Chapter 4 moves a step further and explores funding collaborative research projects. Catherine Lyall reflects on how politics and power dynamics are still in place when funding agencies decide in what way and how to support inter- and transdisciplinary research. She observes that debates on interdisciplinarity and transdisciplinarity have not moved on, with extracts from later periods still discussing the same challenges we, researchers, face when gaining funding for our proposals. Lyall rightly observes that institutions around the world still do not develop systemic programmes of funding schemes for inter- and transdisciplinary research. Some examples give us hope, and efforts, such as the current Horizon Europe programme, serve as inspiration for future approaches.

But funding alone is not enough. Effective inter- and transdisciplinary programmes need integral support in the medium and long term. Lyall's commentary reminds us of the need for greater flexibility in inter- and transdisciplinary funding. Inter- and transdisciplinary research need spaces, symbolic and physical, to develop and change as they respond to the needs and perspectives of different disciplines and societal actors.

From this commentary, we are reminded that inter- and transdisciplinary processes need careful planning. Who initiates interdisciplinarity (in all its forms) is significant – whether it is initiated and driven mainly by science

managers and policymakers or by researchers (see Extract 4.3 by Julia Stamm). This can influence research and its achievements. We can argue that this unsystematic implementation of funding schemes has been the norm for many years, and has led to the untidy and inconsistent ecosystem that we see around inter- and transdisciplinary research. What are funding agencies aiming for when funding inter- and transdisciplinary programmes without a consistent policy? We described a similar situation in the SHAPE-ID policy briefs in which we argued that the exclusion of contributions from the arts and humanities when addressing societal challenges means that inter- and transdisciplinary research do not achieve their full potential (Fletcher et al, 2021). One way out of this problem is to foreground the role of the integration expert in inter- and transdisciplinary research, as colleagues have recently argued for (Hoffmann et al, 2022).

The evaluation of inter- and transdisciplinary research projects is the topic of **Chapter 5**. Assessing collaborative settings, their outputs and impact, constitutes a challenging task. It implies responsibility from reviewers but also from institutions. In his commentary, Christian Pohl agrees with Katri Huutoniemi and Ismael Rafols (see Extract 5.2) that breadth, integration and transformation are three key aspects of inter- and transdisciplinary research and their quality.

We call the attention of the reader to the second element – integration – which is also a key element of evaluation processes. Pohl suggests that good inter- or transdisciplinary proposals should explicitly state what the applicants mean by integration (for example, reaching consensus, relating differing viewpoints), why this is the appropriate type of integration given the project's purpose, and how the applicants plan to achieve integration. Such processes can lead to the co-creation of new types of leadership (and of power relations?). In the future, assessment of leadership skills that support successful collaborative process should be part of the evaluation process in inter- and transdisciplinary research (see Extract 2.1 by Catherine Lyall et al). In her commentary for Chapter 4, Lyall asserted that other forms of collaboration and knowledge co-production are being ignored in evaluation processes. However, processes to assess these aspects of collaboration are currently in use. Examples include the Quality and Relevance in the Humanities (QRiH)[10] criteria or the Declaration on Research Assessment (DORA)[11] followed by the Swiss National Science Foundation when evaluating career paths.

Chapter 5 focuses mainly on the evaluation of research proposals, but we could also extend Pohl's concerns to peer review processes for scientific papers and other publications. Although some could argue that this is 'a whole different kettle of fish', both processes entail the operation of levels of authority and power that are not usually openly acknowledged within the academic system. In this book, **Chapter 6** focuses on communicating

inter- and transdisciplinary findings, which indirectly relates to how these outputs are assessed.

Chapter 6 considers what constitute successful inter- or transdisciplinary publishing or knowledge transfer processes. While selecting the extracts that compose this chapter, we recognised that a more profound understanding of this process is still needed. There is little literature analysing the challenges of communicating co-created findings in inter- and transdisciplinary research. Although a seminal work by O'Rourke and co-authors was written in 2013, other relevant topics have been added to this discussion through the years. One example is the paper by Christian Pohl (Extract 6.2), which argues that transdisciplinary research can contribute to policymaking using a collective process involving multiple policy cultures.

Chapter 6 shows different levels and purposes of communication processes. Extracts address topics such as publishing inter- and transdisciplinary outputs, the potential transdisciplinarity has as a means of bridging communication with the policy sector, and the impacts of inter- and transdisciplinary research. In the accompanying commentary, Sabine Hoffmann acknowledges this eclectic set of topics in relation to the overarching aim of communicating science. Hoffmann adds new references that emphasise the need for more sustained and intense interactions – both formal and informal – between researchers and target groups to ensure greater use of inter- and transdisciplinary research findings.

Hoffmann rightly points out that interdisciplinarians and transdisciplinarians face the pervasive culture of 'publish or perish', reinforced by obstacles posed when seeking to publish in high-impact journals. Following Erin Leahey et al (Extract 6.3), Hoffmann shows that inter- and transdisciplinary research is a 'high-risk, high-reward endeavour' involving fewer published papers but higher visibility in the long run.

Chapter 7 highlights the skills that inter- and transdisciplinary researchers and practitioners develop in the course of their work. These encompass attributes such as leadership, communication, negotiation and integration, already mentioned in the previous chapters. In this case, the extracts allow the reader to better understand the cultural and emotional aspects of inter- and transdisciplinary research. As social activities, collaborative research practices are embedded in relational but also personal approaches to work. In authoring the commentary for this chapter, Nathalie Dupin draws on her experiences as an early career researcher. This standpoint confers real depth and value to Dupin's observations. From her perspective, new researchers may underestimate the skills involved in building multiple relationships in interdisciplinarity and transdisciplinarity. To explain this further, she structures her reflections around three concepts that most benefit newer researchers or those new to inter- and transdisciplinary research – learning, ethics and reflexivity.

In the last few years, an increasing number of inter- and transdisciplinary researchers in different scientific communities have come to address failures in their work (see Fam and O'Rourke, 2021). Dupin has the courage to also address delicate matters such as the necessity for 'ethical research within reflexive relationships', a topic that is still an 'elephant in the room' in inter- and transdisciplinary settings. She rightly indicates that remaining ethical in our relationships is a critical factor in building trust within a team.

Dupin concludes her piece by addressing the relevance of reflexivity in inter- and transdisciplinary research. We researchers usually take for granted the personal and collective processes of reflection we are embedded into during collaborative practices. In her commentary, Dupin discusses two interrelated levels: how individual group members need to learn from each other to carry out effective collaborative work, and the importance of an ethical stance in relationships to maintain safe spaces in which members can freely contribute their best efforts. These relationships are continually evolving practices that require us to be aware of, and monitor, our own actions in relation to others.

Chapter 8 continues this dialogue on interdisciplinarity and transdisciplinarity by centring the attention on how to support collaborative researchers. Researchers, practitioners, students and administrators are often faced with institutional encumbrances when trying to align structural norms to the daily practice of conducting inter- and transdisciplinary research.

Maureen Burgess and Doireann Wallace, colleagues from the SHAPE-ID consortium, played a substantive role in that project as financial manager and project manager respectively. They contribute the commentary to this chapter as important actors in inter- and transdisciplinary projects whose voices are usually unheard but are, in fact, indispensable to achieving a successful collaborative process. Burgess and Wallace build their reflections around two aspects: the need to understand, map and connect inter- and transdisciplinary expertise within and beyond higher education institutions, and the importance of long-term vision and leadership to build a culture supportive of inter- and transdisciplinary research.

Undoubtedly, institutions hold responsibility and power to enable more and better inter- and transdisciplinary research, as Christian Pohl indicates in his commentary in Chapter 5 or Catherine Lyall in hers in Chapter 4. But how to make institutions and their authorities listen to demands about recognising, nurturing and facilitating integration expertise? One way suggested by Burgess and Wallace is to acknowledge the difficult realities of undertaking and supporting inter- and transdisciplinary research, and to find ways to map and connect the tacit expertise that exists across the institution, among both researchers and professional staff. Burgess and Wallace offer recommendations at different levels of commitment but equally relevant to supporting interdisciplinarity and transdisciplinarity in institutional contexts,

all of which can be summarised in the urgent need to consolidate a cultural change towards impactful collaborative research.

Completing the book, **Chapter 9** places the emphasis on future generations of researchers developing a career in inter- and transdisciplinary research. From mixed messages to lack of adequate supervision or mentorship, early career researchers shape the field of interdisciplinarity and transdisciplinarity while navigating dangerous waters. How do we better support them and encourage them to take risks in an academic ecosystem where more experienced researchers still find it hard to work collaboratively? The chapter collects four extracts from different authors working in varied contexts dealing with complementary obstacles to consolidating an inter- or transdisciplinary career.

The commentary in this chapter is authored by Kirsi Cheas, an early career researcher herself, who has taken on an active role in fostering empowering stories for junior researchers that go beyond obstacles and difficulties. She offers an honest account of the constraints she faced, balancing realism and reassurance in supporting the careers of other inter- and transdisciplinary scholars. Cheas acknowledges her own struggles, but confesses that those have helped her to develop the qualities of perseverance, resistance and tolerance for ambiguity and failure that she finds are fundamental for a career in inter- and transdisciplinary research. Should we argue that early career researchers need to experiment with inter- and transdisciplinary research but not pay the price of burnout, frustration and insecurity based on fixed-term contracts and uncertain career prospects? We read elsewhere that appreciative leadership (Whitney et al, 2010) is a means to strive for positive power – meaning that we can bring out the best in people and situations when we have the courage to inspire others. And this can be the key for early career researchers: offering them appreciative supervision that allows for their independence, while providing care and guidance.

Cheas is a clear example of such appreciation within inter- and transdisciplinary research. Her piece describes ways to build communities of practice but also demonstrates the need for commitment and bridges between existing networks. The positive examples she gives provide clear evidence that 'faith' also plays a role in science, and by believing in the capacities early career researchers bring to inter- and transdisciplinary research, we are supporting cultural change.

From the commentaries we learn that researchers and practitioners embrace heterogeneity in conducting, accompanying, supporting or promoting inter- and transdisciplinary research. In the chapters that follow, the reader will learn about inter- and transdisciplinary research in a different way: there are no fixed formulas, pre-digested definitions or ready-prepared recipes. The book offers highlights, contrasts, surprises and food for thought. We encourage readers to be inspired and, perhaps, to use this book to inspire others to embark on inter- and transdisciplinary research.

Technical note

We have described how we curated the collection of readings that follow. In each case we have acquired the rights to reproduce selected extracts from these published materials from the copyright holders (see 'Copyright Permissions' at the end of the book). We have endeavoured to reproduce these extracts faithfully from the originals. This means that we have not edited or corrected any errors in the selected text. This results in, for example, a mix of UK/US English spellings, some idiomatic use of language and occasional typographical errors that were in the originals. To avoid excessive copyright charges, we have generally decided against including any original figures in these extracts except where that was unavoidable to make sense of the reading. In some of the longer pieces such as book chapters, where we have selected non-contiguous text, this has been indicated using ellipses (see Extract 4.3, for example). Following some user testing, we took the decision as an editorial group not to include in this book any references, footnotes, endnotes or any cross-referencing from the extracts themselves. After some debate, we took the view that, including all of this material might risk overwhelming the reader and be counterproductive to the overarching goal of the anthology, which is to provide a manageable introduction to a potentially unwieldy topic. This does mean that, occasionally, readers will see a table or a figure cited that has not been included with the extract. However, full reference citations are given for all of the extracts that we have included, and we hope that readers will be motivated to seek out and read sources that have inspired them in full. For each chapter, we include a 'References and further reading' section that includes any additional references cited by the commentary writer together with a small selection of readings that the editors felt provided complementary perspectives from the longer SHAPE-ID bibliography. Finally, in addition to a 'List of Acronyms', we have included a short 'Glossary' of (predominantly) social science terms that appear in some of the extracts. This is by no means an exhaustive glossary, and nor are we claiming that these are the only interpretations available, but the definitions we offer may make this anthology more accessible to readers from other backgrounds.

Notes

1 To aid readability we have tried to minimise the use of acronyms. Despite this, IDR and TDR and ID and TD are sometimes given as acronyms.

2 The term 'interdisciplinary' was apparently first used in the 1920s (Klein, 1990).

3 We did not include policy literature in this reader, but we provide relevant references in the 'References and further reading' section at the end of each chapter.

4 https://transdisciplinarity.ch/en/publikationen/tour-dhorizon

5 See www.shapeidtoolkit.eu/wp-content/uploads/2021/03/Guide-Annotated-Bibliography-Academic.pdf

[6] For a detailed list of factors see Vienni-Baptista et al (2020b).
[7] For a detailed explanation on the quantitative methods that we applied and the findings, please refer to Vienni-Baptista et al (2020b).
[8] To illustrate the roles that AHSS research and creative practice can play in IDR and TDR, the SHAPE-ID Toolkit offers short accounts of innovative research projects and infrastructures. These case studies can be downloaded as PDF documents from: www.shapeidtoolkit.eu/case-studies
[9] See www.shapeidtoolkit.eu
[10] www.qrih.nl/en/about-qrih
[11] https://sfdora.org

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