From idealised transdisciplinary research to reality: reflections from research practitioners

Nina de Roo, in collaboration with Valentina C. Materia, Jillian Student, Jeanne Nel, Karen Fortuin and Joske Bunders

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Executive summary

The actual real-life challenges that research practitioners (and others) face when attempting to work transdisciplinarily are not well documented. To encourage reflection, WUR organised the Wageningen Integration for Impact event in June 2022. Based on an analysis of lessons learned during this event, and a number of subsequent reflection sessions, a group of mostly WUR researchers developed this report. The aim is to identify strategies to overcome often experienced challenges among researchers engaging in transdisciplinary research. We developed a number of recommendations:

1. Embed learning about transdisciplinary research better in the organisational culture.
2. Acknowledge and value the expertise that is required to bring together different types of knowledge.
3. Identify and apply specific selection criteria for project leaders and business developers, so that people are selected based on their expertise in managing transdisciplinary projects.
4. Acknowledge that politics are part and parcel of transdisciplinary research and develop a clear vision on how to navigate knowledge politics as WUR.
5. Lobby for more flexible and longer-term funding; apply this to internal research projects.
6. Strengthen and professionalize transdisciplinary education at BSc, MSc and PhD level, as students are the future.
7. Build on and nourish the positive energy that exists within knowledge institutes among a growing group of researchers who is eager to work transdisciplinarily.

The above mentioned suggestions could result in a (WUR) community which, on the longer-term, could contribute significantly to the co-creation of societally relevant solutions but also to bringing the conceptual discussions about transdisciplinarity to a higher level.

1 Introduction

The world faces many interrelated challenges, including climate change, persistent poverty and food insecurity, and biodiversity losses. These challenges are often framed as wicked problems (Lawrence et al. 2022; Rittel and Webber 1973), with unpredictable and non-linear dynamics. Furthermore, wicked problems are characterised by confusion about interrelated causes and effects and controversies about what the (cause of the) problem is. This makes it difficult to identify knowledge and solutions that are effective and acceptable to both researchers and (all) societal actors. Wicked problems cannot be solved by conventional (within discipline) research; new ways of knowledge generation are needed (Funtowicz and Ravetz 1993; Scholz and Steiner 2015). Although science can contribute its part to effectively addressing or even solving wicked problems, society increasingly requests science to: (I) Open up to societal actors who have legitimate experiences and knowledge(s) in relation to the issue at hand; (II) Open up to the lived experiences and concerns of those who are affected; and (III) Open up to the value of multiple disciplinary perspectives, integrating these perspectives to create new, context specific, and societally relevant, knowledge[1].

In response, in the past decades, researchers (alongside governments and civil society actors) have been turning to a collection of approaches such as citizen's science, co-creation, participatory research, action research, and/or transdisciplinary research (Scholz and Steiner 2015). Despite the variety of names diversity in how they are being applied, these approaches have in common that research questions and problem definitions are identified together by researchers and societal actors. In this article, we use the term transdisciplinary research to refer to processes where researchers from different disciplines work together with societal actors to address wicked problems (Klein et al. 2001; Lawrence et al. 2022). The premise of transdisciplinary research is that if done well, collaborating researchers and stakeholders find common agreement on the nature of the problem and jointly experiment with possible pathways for acceptable future(s). It is argued that this results in a shared problem definition, more robust innovations, and higher levels of ownership of the new knowledge generated in this process, which increases the likelihood of successful implementation of the newly generated knowledge. These benefits outweigh the sometimes articulated criticism about the resource and time-intensive nature of transdisciplinary research (Kalinauskaite et al. 2021).

Characteristics of transdisciplinary research

There is an increasing body of academic knowledge available about transdisciplinary research; some even argue that transdisciplinary research is becoming a discipline of its own (Hirsch Hadorn et al. 2008; Lawrence et al. 2022). Generally, three key characteristics can be derived from the literature which delineate transdisciplinary research from other forms of action-oriented and interdisciplinary research. Firstly, **transdisciplinary research is mostly aimed at addressing specific problems that arise from specific contexts in society** rather than derived from scientific knowledge gaps or driven by pure curiosity (Hirsch Hadorn et al. 2008; Klein et al. 2001). In line with this, transdisciplinary research is (ideally) composed of research teams of researchers and societal actors, teams that emerge based on the problem context. Due to the context specificity, the research methodologies often emerge during the process and cannot be pre-described. Secondly, in order to incorporate knowledge from other than academic sources, **the knowledge co-creation process in transdisciplinary research is characterised by transcending disciplinary and institutional boundaries** (Carew and Wickson 2010). This distinguishes transdisciplinary research from interdisciplinary research, which integrates knowledge from scientific disciplines (only), and from action research, which does not necessarily involve different disciplines (Scholz and Steiner 2015). In other words, transdisciplinary research results in societally robust knowledge (Gibbons et al. 1994). Thirdly, **transdisciplinary research ideally offers relevant new knowledge both for practice (society) and theory (science)**(Lang et al. 2012; Scholz and Steiner 2015). The combination of societal and scientific relevance distinguishes transdisciplinary research from fundamental, or mode 1 knowledge (Funtowicz and Ravetz 1993) on the one hand, and action research and consultancy on the other hand (Lang et al. 2012; Scholz and Steiner 2015).

[1] This does not imply that monodisciplinary knowledge is no longer relevant. It is however insufficient to address wicked problems.

Gaps in literature and practice

Although transdisciplinary research has the potential to steer research towards addressing wicked problems by embracing societal actors since its inception, to the best of our knowledge the available literature on transdisciplinary research is ill-suited to support individual researchers who are eager to embark in a transdisciplinary research experience, in particular those with limited experience in engaging in boundary crossing research. We argue in this report that literature on transdisciplinary research is biased towards either anecdotal case studies of single projects or programmes – often success stories (see for instance (Palazzo and Shirleyana n.d.; Queste and Wassenaar 2019), or highly conceptual contributions (Carew and Wickson 2010; Lang et al. 2012; Scholz and Steiner 2015). The thorough review of Brandt et al. (2013) indicates that there is a clear mismatch between the abundance of published conceptual papers and their application in practice. It seems rather futile to use concepts such as process phases and knowledge types, if these concepts cannot be clearly communicated to, or used by, practitioners seeking to engage in concrete transdisciplinary research (Brandt et al. 2013). The same conclusion is reiterated by Christian Pohl, one of the key authors on transdisciplinary research, who states that 'the problem with abstract principles and practical tools is that researchers who are not familiar with transdisciplinary research do not know how to adapt or integrate them to their research project' (Pohl et al. 2017, p.43).

In fact, doing transdisciplinary research can be a rather messy exercise, which often fails (Kloet et al. 2013). We observe that the literature on transdisciplinary research tends to analyse exiting research projects, while the challenges that emerge before or in-between projects are not well-documented (Horcea-Milcu et al. 2022). Among the barriers that researchers face are epistemological, political and institutional barriers. An epistemic barrier is for instance is how to practically go about integrating different forms and types of knowledge (Hoffmann et al. 2022; Pohl et al. 2017). For instance questions regarding how to value and incorporate non-academic knowledge or knowledge from different knowledge systems. But also how to navigate differences in viewpoint between different disciplines about what is considered valid knowledge or what are acceptable research methods. At the political level, we found that the political dimension of running transdisciplinary research is largely missing in the literature and conceptual frameworks. There seems to be little recognition of the potential conflicts and pitfalls these approaches entail for achieving the goals of transdisciplinary research (Siebenhüner 2018): transdisciplinary processes are surrounded by non-violent conflicts among actors based on differences in values, interests, and knowledge claims. An often mentioned challenge at the institutional level is that the incentive system at universities is still centred around monodisciplinary excellence.

Aim of this report

In other words, we miss a more reflective approach towards the actual real-life challenges that research practitioners (and others) face when attempting to work transdisciplinarily[2], and what some of the strategies are that they employ in trying to overcome these challenges. Based on lessons learned during the Wageningen Integration for Impact event (June 2022) and a number of reflection sessions afterwards among the authors, this report was developed by a group of mostly[3] WUR researchers – referred to here as transdisciplinarity practitioners. These practitioners are not necessarily experts in doing transdisciplinary research nor identify themselves as transdisciplinary researchers.

The aim of this report is to (1) reflect on the challenges that research practitioners face while engaging in transdisciplinary research, and to (2) identify strategies to overcome these challenges. Ultimately, we hope to strengthen the empirical basis of what transdisciplinarity practitioners face in their daily practices. With this contribution, we provide insights for better informed organisational policies at knowledge institutes, so that researchers can engage more effectively in transdisciplinary research processes.

The structure of this report is as follows. We first describe the research context, followed by our research approach. We then outline the findings, starting with the identified challenges and continuing with strategies to overcome the many challenges of working transdisciplinarily. Lastly, we synthesize the findings and conclude with a number of recommendations for knowledge institutes in particular.

[2] There is some literature available of individual experiences of individual researchers engaged in *inte*r-disciplinary research. See for instance (Morse et al. 2007).

[3] Three co-authors are employed at other knowledge institutes, two in the Netherlands and in India.

2 Research context

With its slogan 'Science for Impact' Wageningen University & Research (WUR) profiles itself as a knowledge institute that combines academic and applied research, working on technological, scientific and social aspects of life sciences domains with the ultimate goal of contributing to healthy lives on a healthy planet. Using integrated and/or systems approaches is common at WUR. WUR is made up of a university focusing on academic research and education (WU) and applied research institutes (WR). The unique institutional links between the university and applied research institutes are argued to promote the societal relevance of WUR's research.

Increasingly, researchers at WUR employ inter- and or transdisciplinary approaches in their research. Despite the barriers, we see promising signals of an increasing group of researchers who see the need to transcend these obstacles. A key motivation is given below by one of the researchers involved in the writing of this report:

> "Societal challenges do not present themselves into nice chunks of disciplinary sub-challenges, and solutions to societal problems are often found outside the expertise of scientists. I believe we need to move beyond disciplinary boundaries to stay within planetary boundaries."
> (WU researcher, follow-up mail after WIFI event)

Two WUR programmes that explicitly promote inter- and transdisciplinary research are Wageningen University's Interdisciplinary Research and Education Fund (INREF) and the Wageningen Research Programme on Food Security and Valuing Water (FSVW). Both programmes make use of integrated research approaches geared towards societally relevant research in low and middle income countries, contributing to achieving the Sustainable Development Goals. On June 13-14th, 2022, INREF and FSVW organised the Wageningen Integration for Impact (WIFI) event, where researchers reflected together on the key challenges of engaging in transdisciplinary research and education, and what strategies work to address these challenges.

3 Research approach

Departing from the conventional unit of analysis – established and funded transdisciplinary research projects - we take the perspective of individual researchers and the knowledge institute as unit of our analysis. The discussions and presentations during the WIFI event are the core of the empirical data with which we started our analysis. The WIFI event was attended by 120 participants, mostly from WUR but also from other knowledge institutes, policy organisations, companies, consultants and NGOs. We also made use of two recent publications in preparation of the WIFI event (Asjes et al. 2021; de Roo and Tielens 2021). During the WIFI event, we randomly selected 20 participants and conducted interviews asking the participants about their motivation to work transdisciplinarily, which challenges they face, and strategies applied to overcome these challenges. The vast majority of interviewees were either students or WUR employees working for either the university or one of the research institutes. Of the remaining interviewees, two were not working for WUR; one was working at an NGO, and another one was an independent consultant.

The research process was done iteratively, consisting of several rounds of analysis. First, the interviews, session notes, and presentations were coded in word using a simple coding scheme, loosely based on the categorisation of challenges identified by (Brouwer et al. 2018): **epistemological challenges & strategies**, **institutional challenges & strategies**, **socio-political challenges & strategies**. Epistemological challenges relate to the content of the research, among others this includes differences in perception of what can be known and how to generate knowledge. Institutional challenges relate to characteristics of the research system and organisational incentives. Lastly, socio-political barriers are those barriers that relate to communication and power relationships between participants in transdisciplinary research (including researchers). This initial analysis was further refined during two focus group discussions, attended by a total of 16 participants (who had also participated in the WIFI event). In a next step, we further analysed the challenges and strategies by constructing a problem tree and opportunity analysis (Chevalier and Buckles 2013). This lens, which is often used in systems analysis of complex problems, allowed us to look at the interlinkages between the identified challenges and strategies in doing transdisciplinary research. It also helped to distinguish symptoms from causes eventually identifying root causes. The problem and opportunity tree were discussed in another focus group discussion with five participants. Other contributors gave written feedback.

The first author did most of the analysis and writing. She initiated and facilitated a co-learning process with the co-authors, resulting in the findings presented in this report. All co-authors were involved as presenter during the WIFI event. Additionally, they reviewed and reflected on (initial) findings, either by attending focus group discussions, participating in online calls or through providing written feedback. The majority of contributors consider themselves as practitioners and learners when it comes to doing transdisciplinary research. Collaborators were consistently present during focus group discussions and feedback sessions and provided extensive feedback to early drafts; contributors provided one round of feedback (either during a focus group discussion or in written form). We consulted an external expert (Professor emeritus J.G.F. Bunders, former director of the transdisciplinary Athena Institute) to think along and provide feedback during the process of data collection, analysis and writing.

4 Findings

This section is based on interviews with participants of the WIFI event, presentations at the WIFI event, and on discussions that took place during the sessions of the WIFI event. We only describe challenges that were mentioned three times or more.

4.1 Main challenges and underlying causes

Following Brouwer and colleagues (2018) we categorised the identified challenges into institutional challenges, epistemological challenges, and socio-political challenges. In Table 1 we present a summary of the most often mentioned challenges.

Table 1 *Most often mentioned institutional, epistemological and socio-political challenges.*

Challenge category	Often mentioned challenges
Institutional	Time consuming;
	Resource intensive;
	Lack of flexibility in project management;
	Transdisciplinarity is seen as add-on to existing work;
	Incentive system is based on monodisciplinary excellence
Epistemological	Confusion about how and when to integrate knowledge;
	Lack of guidance on 'how to do transdisciplinarity';
	Confusion on which methodologies are appropriate;
	Competing knowledge claims;
	Knowledge integration is not considered an expertise (no-one is responsible)
Socio-political	Power imbalances between researchers and societal actors;
	Involvement of societal actors often too late in the process;
	Who is legitimised to decide on scope and framing of transdisciplinary research projects?

4.1.1 Institutional challenges

Among the most often mentioned challenges is that transdisciplinary research is more **time consuming** than monodisciplinary research. While *interdisciplinary* research already takes extra time and effort to come to a common ground on how to understand the phenomenon of interest, *transdisciplinary* research takes additional time and effort because it also includes different viewpoints and types of knowledge from societal actors. A PhD student put it like this:

> "As a PhD student it is challenging because if you have an idea, and it is not in line with one or two others in the team, you have to discuss and convince them, or find and alternative. And that takes time. It feels like you are not making progress." (Int 4)

Related to the time-dimension is the observation that existing projects and programmes often lack the **flexibility** that is needed to deal with different types of knowledge and viewpoints. Involving different disciplines and stakeholders inevitably results in a change in or additional research questions, which need to be tackled for the research to be relevant for all those involved. Such changes are often not foreseen or budgeted for in initial project formulations.

Furthermore, it was mentioned that when it really comes down to it, most people prioritise their own (research) agenda and the funding of their department, and see transdisciplinary work as an **add on to**

their existing workload which distracts from advancing their academic career. This point relates to the perceived incentive structure within WUR and in science in general.

Looking deeper into the data, we observed that the dominant culture at WUR is that researchers are expected to excel in scientific research, which is often interpreted as being recognized in a particular disciplinary research domain. Several interview respondents mentioned that the majority of senior researchers and managers do not particularly **value** colleagues or students who are 'jack of all trades'; this is considered by many as a diluted version of pure knowledge, as the following quote describes:

> "Senior scientists think that when they allow their students to become interdisciplinary, students will no longer choose 'their' topic. With less students, there will be less money. I see a fear among the higher management levels in this organisation that letting go of specialist expertise would be bad for the individual domains" (Int 2)

The academic **incentive system and research funding system** are contributing to this culture, as these systems are still largely based on single disciplines (and metrics for impact). Consequently, generalists and integration specialists are less valued in the current professional culture. Moreover, most senior researchers and project leaders have been **trained** in a monodisciplinary manner; monodisciplinarity is what they have known so far. In this culture, doing transdisciplinary research is seen as a nice extra. This hampers researchers who do this type of work to advance their careers. This point is illustrated by the quote below of a senior researcher:

> "In my head I have this battle: I see myself spending time talking to people, sharing knowledge, doing participatory work, but in my mind I struggle because that's not what I've been taught how to become a good scientist. A good scientist would not spend all this time discussing and sharing knowledge, because that's not in their competitive advantage..." (Focus Group 2)

Furthermore, it was observed by some interviewees and participants of the WIFI event that research which incorporates other ways of knowing (e.g. indigenous knowledge) is often faced with **resistance in the dominant scientific system** as it does not meet the disciplinary quality requirements. For instance, the current - Western - approach in animal disease management is dominated by single effect treatments. These treatments are straightforward to measure and validate in experimental settings. A non-Western scholar who presented their work during the WIFI event explained his challenge:

> "How do I prove the accumulated effect of different treatments on the cows that graze in the Indian meadows? There are interrelated factors, feedback loops. But the cows are healthy! Farmers [in India] want the traditional treatments [ayurveda], but the vets are hesitant to work with it because it is not considered scientific. Because of the complexity involved, it would require additional time and resources to provide the evidence and get it peer-reviewed and published. I face many challenges in getting it accepted." (Presentation during WIFI from project "Dairyherbs").

This challenge was confirmed by another speaker at the event, who mentioned that "Western scientists are not trained in stepping out of their existing ideologies, practices, and knowledge regimes when working in other contexts. This complicates their work, as their identity and (subconscious) biases could influence research decisions" (discussion during WIFI session on knowledge integration).

4.1.2 Epistemological challenges

Epistemological confusion and disagreements exist among researchers at several levels. For instance, game researchers seem to have different perspectives on some important methodological and epistemological issues related to the development and application of game-based research. There appears to be little consensus about what is good practice when it comes to transdisciplinary research and education. An important question is: how and when to **integrate knowledge?** For some, knowledge integration should ideally start at the project formulation phase, while for others, it is better to do this towards the end of the

project. These distinct paradigms lead to debates within projects, which are considered inefficient as these discussions are continually repeated without resolutions. However, the insights from these discussions are not often passed to other projects. This results in people repeating discussions or mistakes, or "reinventing the wheel". The interviews revealed that there is a need to have some kind of **guidance or protocol of 'how to do transdisciplinarity'**, researchers want to know 'how to do it right'. This need was most commonly expressed by researchers from a natural science background and those who are relatively new to transdisciplinary research.

In other cases, **different knowledge claims clash with each other**. In transdisciplinary research projects, people from different disciplines have to come to an agreement on what is valid knowledge. This is also apparent when it comes to research methodologies to acquire data. For instance, when using serious gaming[4], people from different disciplines and non-academic stakeholders work together to make sense of a given situation or phenomenon. They all come in with their distinctive (disciplinary) expertise, jargon, and methods. Firstly, it takes effort, patience and willingness to understand each other and identify a joint language to communicate across disciplines and/or between academic and non-academic actors. In some cases it is a matter of taking the time to come to a common understanding. But some differences of opinion are more difficult to overcome, as they relate to ontological and epistemological differences in how to understand reality and whether and how knowledge can be acquired. Because of this, researchers from different disciplines who work on serious games and those who build models often experience a lack of consensus on determining the quality of serious games or models.

> "There is no consensus on how to assess the impact of serious games. This relates to how different disciplines perceive serious games. For instance, agronomists tend to focus on exploring and understanding farming decisions made in games, while for social scientists social dynamics are important. As such different aspects of gaming sessions are recorded and analysed. This greatly limits the possibilities and opportunities for comparability across studies and consequently hinders the development of a solid evidence base about what games can, or cannot, do in terms of expected outcomes" (SESAM, INREF)

Furthermore, it seems that most participants in transdisciplinary research participate from their own (combination of) disciplines, while **there is no-one responsible for the integration process**. Transdisciplinarity is not considered as an expertise of its own; everyone does it 'on the side'. A former student reflected on his interdisciplinary research thesis:

> "For my MSc thesis at Plant Science I wanted to work on intercropping, which uses a farming systems approach and requires knowledge on different crops and their interaction(s), as well as social and economic aspects of farming. In my department all students work on breeding. They are not convinced that intercropping is a way to go because they look at it from their specialised angle only. That is why I contacted students from other departments. Someone was working on diseases, another on farm management, on yield, etc. I had to do all of that as an extra task. Now, in the company where I work I face the same problem!" (Int 7)

4.1.3 Socio-political challenges

The interviewees mentioned that in their experience, academics and researchers are often convinced that they are best positioned to formulate the right research questions. Consequently, **societal actors are often consulted only after the research project is financed and framed**; leaving little room to manoeuvre. In many cases, stakeholders are involved once the solution has already been developed, as the following researcher explains:

[4] Serious games are often described as games for serious purposes beyond pure entertainment values (e.g van Noordwijk et al., under review, Speelman et al. 2018, Rodela et al. 2019). These games facilitate inclusive discussions among a wide variety of stakeholders, in which the game functions as a boundary object through which participants can explore consequences of decisions in a condensed, often stylized, representation of a real-life situation in the safe environment of the game (Rodela and Speelman, under review).

> "Solutions are often initiated from top-down, imposed. That is not appropriate if you work in a very different context than your own, for instance in the Global South. That context may require different solutions, because the people there might see the problem differently." (Int 12)

A few participants of the event mentioned that many researchers do not realise the importance and potential danger of the **power imbalance between researchers and societal actors**. A question that came up in the majority of the sessions during the WIFI event is that there are no clear protocols or guidelines – especially in the design phase of new projects – on how to make decisions about defining the scope and focus of research projects. Who is **legitimised** to influence such decisions? Should it be the funder, a (group of) researcher(s), or the user/affected group? This question was debated, but no definite conclusions were reached. In this context, some participants raised the points of academic independence, implying that too much donor or societal influence could compromise the neutrality of science. Thus, it is difficult to determine who should be making decisions in transdisciplinary projects.

Another challenge that came up in the interviews and some sessions, was that researchers are not well **equipped** to move outside their disciplinary frame in trying to understand 'the other'. Respondents mentioned that many researchers are not motivated or interested to accept someone else's way of knowing. This point was among others expressed during the opening speech of WUR's Dean of Research, who said:

> "I know inter- and transdisciplinarity is important and it is the way to go in the future, but I find it difficult to understand. And, to be honest, as a researcher, I am highly motivated by my disciplinary field of research and less by interdisciplinary research."

Another researcher reflected:

> "We have big egos. Instead of really listening and trying to see the value of what others bring, we often want to bring our own perspective and convince the other about the pertinence of it. We do not ask questions with the intention to really understand the other..." (Int 18)

This attitude hampers effective collaboration in boundary crossing research.

4.1.4 Motivation to engage in transdisciplinary research

Despite the emphasis on challenges and bottlenecks in this report, it is important to stress the positive vibe that most researchers mention when working across sectors, disciplines, and knowledge types, as becomes clear from the following quotes:

> "Working transdisciplinarily gives me the freedom to be myself 100%. Rather than being afraid that some other researcher might steal my idea, I now feel more free because I know that I can build on what I know and what others know. Together we can find new angles and ideas to solve the problems that we work on." (Focus Group 2)

> "As a water scientist I started from water-related perspectives. When I started to study drought, I soon realized that drought is much more than a water-related problem only, it is a societal problem with many different dimensions. Since I wanted to do serious science I had no other option than to get involved in interdisciplinary teams. Interdisciplinary science is exciting, contributing to progress by learning from each other." (follow-up mail after FGD)

4.1.5 Problem tree of challenges

When analysing the data further, we realised that some challenges could be considered symptoms, caused by other challenges, which in turn could be related to deeper rooted causes. In the figure below we present the findings in a so-called problem tree.

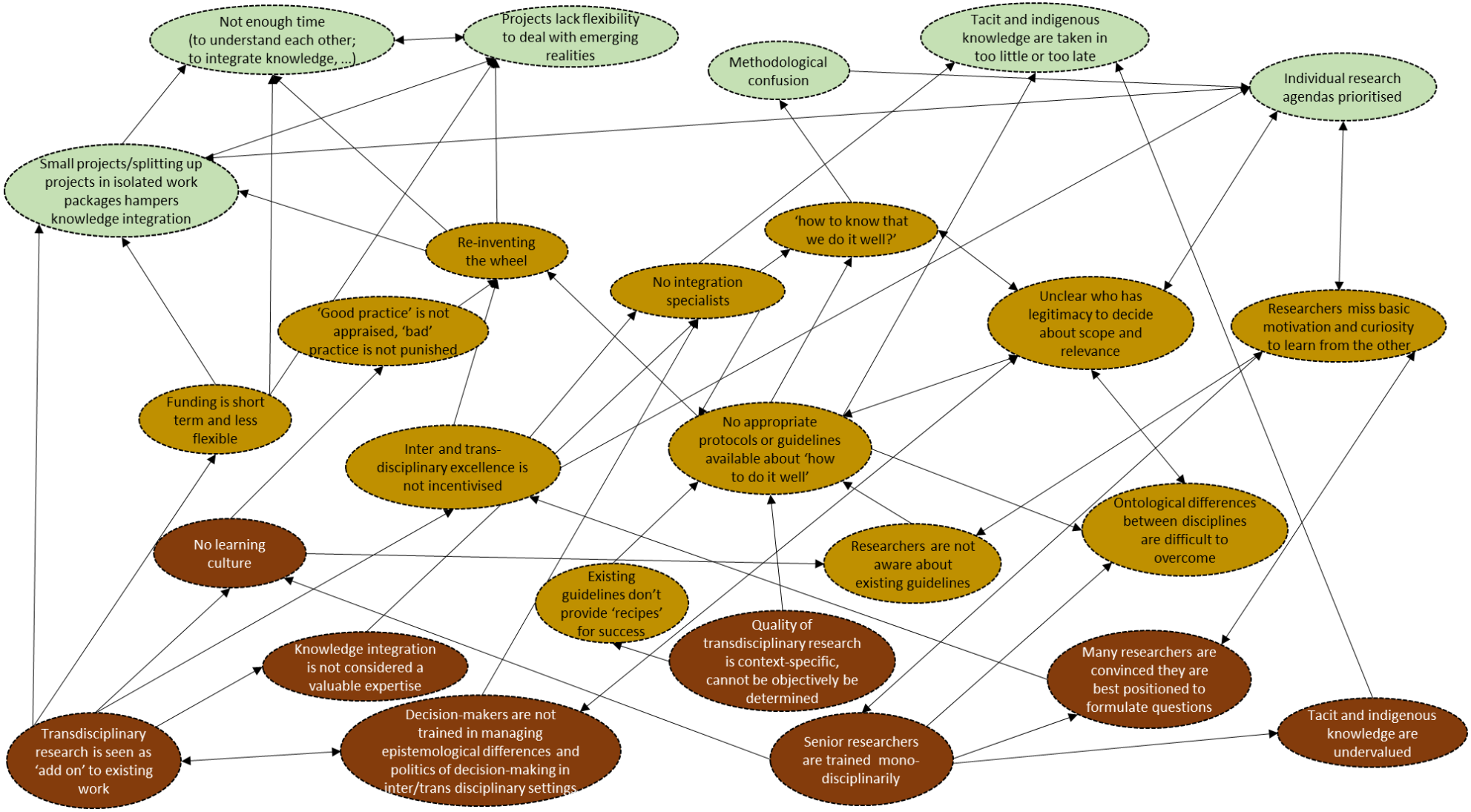

Figure 1 *Problem tree of challenges in working transdisciplinarily.*
Legend: The green colours refer to symptoms (the leaves of the tree), the light brown colours refer to direct causes (the stem) and the dark brown colours refer to the root causes (the roots). The arrows represent relations between the different symptoms, causes and root causes.

Figure 1 shows that time pressure, lack of flexibility and methodological confusion could be considered symptoms that follow naturally from the organisational culture and the ways that researchers have been trained in the past. Interviewees experience the absence of a learning culture. They miss a culture where lessons on 'how to do it right' are openly discussed and documented, and mistakes are seen as learning opportunity. One of the key messages from the WIFI event was the **appreciation for the open space to share and learn from each other** on the approaches and methods used in transdisciplinary research, and the challenges faced while attempting to work with stakeholders. The problem tree helps to see the underlying causes for the experienced lack of learning: transdisciplinary research is perceived as an add-on and not as a core expertise of its own. Most researchers are trained in a monodisciplinary way, but also researchers who have been trained interdisciplinarily may not have the required skills to critically reflect on their own position (and possible bias). Furthermore, decision-makers are not selected because of their quality in managing transdisciplinary projects, but because of their (monodisciplinary) expertise.

4.2 Strategies and leverage points to overcome challenges

Along with challenges, respondents shared potential strategies. These strategies were mostly aimed at the institutional and organisational level. Two strategies were mentioned multiple times: 1) change the incentive system for researchers so that doing transdisciplinary research is no longer seen as an add-on to existing work, and 2) the need for knowledge brokers and process facilitators to help the process of knowledge integration (before a project starts and during a project). Creating space was also suggested by having a physical 'place to go', or even a chairholder specifically on transdisciplinary research and education.

In Figure 2 we transformed the symptoms, their direct causes, and root causes into entry-points for change. They are entry-points, as working on these root causes will have a (positive) effect on multiple challenges.

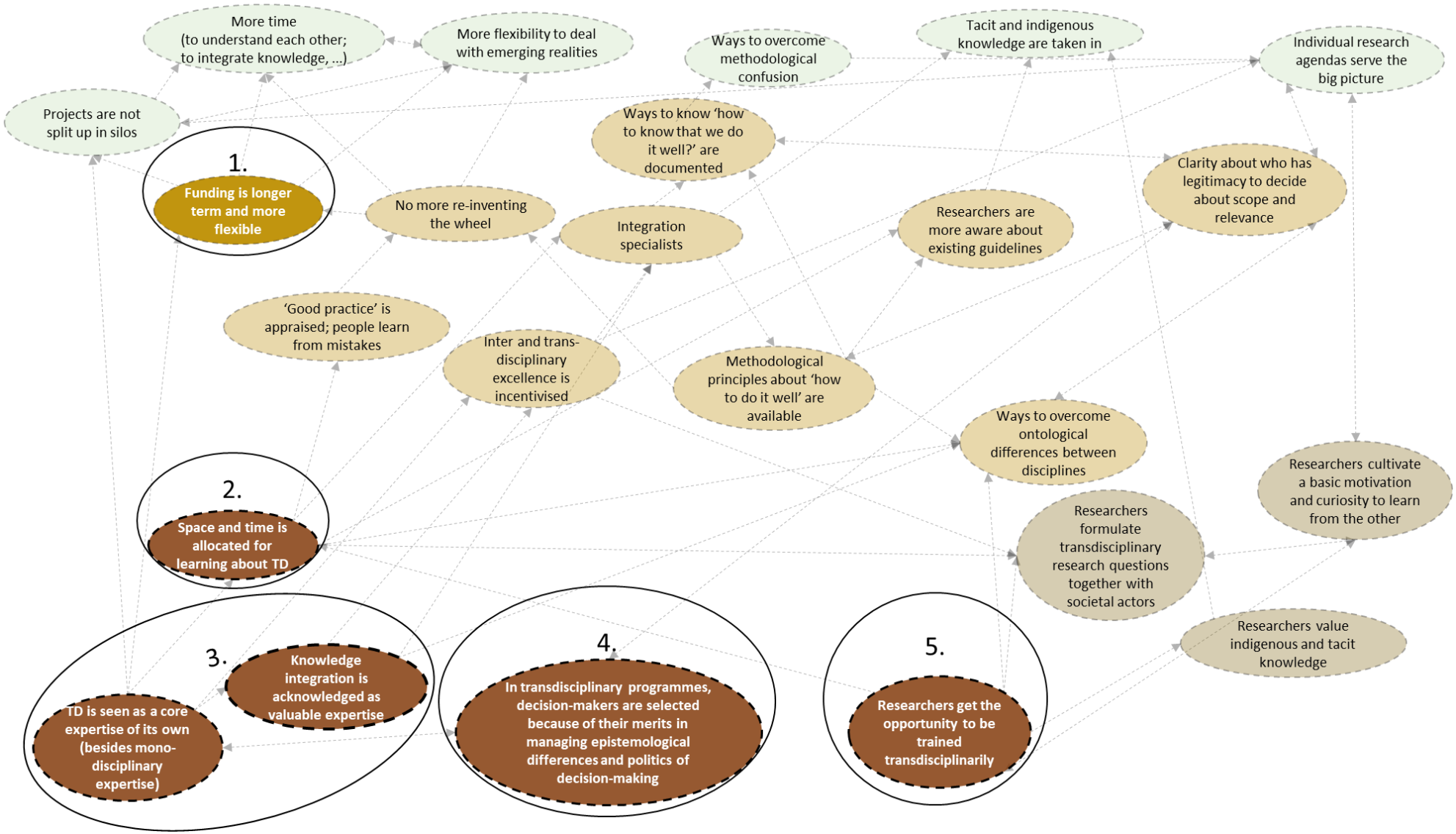

Figure 2 *Strategic entry-points to address root causes.*

From the results, we find five key entry-points. First, a key institutional strategy is to **ensure longer-term research investments, with sufficient flexibility**, so that transdisciplinary research can have the time needed to bring on board different types of knowledge and make changes to the process based on emerging insights. This strategy was mentioned by many interviewees. Adaptive management, where methods & means can shift according to insights gained, has the potential to overcome the perceived lack of time and flexibility to deal with emerging realities, which is often experienced in short term projects. However, funding alone is insufficient to remove the multitude of challenges of transdisciplinary approaches.

Second, a strategy which did not emerge directly from the initial data, but which emerged from the reflection sessions and analysis of root causes, is **establishing and nourishing a learning culture within the organisation** (and within projects). A learning culture would entail an online resource space where appropriate guidelines and lessons learned are made available, but also the organisation of learning events and informal learning moments between junior and senior researchers and/or project leaders to exchange (informally) about methods, approaches, and project management issues specific for transdisciplinary research. This could help prevent mistakes from being repeated and researchers from having to once again re-invent the wheel. Moreover, a learning culture, could provide guidance to newcomers to transdisciplinarity.

A third organisational strategy is to **acknowledge that knowledge integration is an expertise of its own**, and not something that everyone can do 'on the side'. According to the respondents the current incentive structure encourages researchers to excel in a specific field of expertise. Once a researcher has established a reputation, this reputation becomes a self-reinforcing mechanism whereby the individual researchers is incentivised to continue with their specialised expertise. This process is well-known in the sociology of science, and is referred to as the cycle of credit in science, as described by Bruno Latour (Latour and Woolgar 1979). To break through this self-reinforcing cycle, it is important to first acknowledge that knowledge integration is an expertise of its own. It is important to invest time in people with the experience of supporting knowledge integration, and for all people in the project to participate the knowledge integration. Training on how to communicate different knowledge to various audiences would assist experts in bringing different forms of knowledge together. In organisational terms, this could imply making room in project budgets for experts who become responsible for the integration of different types of knowledge, and who support individual researchers and research teams to do this well. Moreover, acknowledging the expertise of knowledge integration by management and strategic programme leaders could result in creating more space in transdisciplinary research for different types of knowledge, including different disciplines but also including lay-people and experience-based knowledge (where relevant).

A fourth strategy is **to include specific selection criteria with respect to transdisciplinary competences for the selection of project and programme leaders of transdisciplinary research programmes**. One of the key issues here is the competence of navigating decision-making in transdisciplinary research processes, which has ontological, epistemological and political dimensions (see also (Hirsch Hadorn et al. 2008; Scholz and Steiner 2015). Decision-making about scope and time scales when addressing wicked problems is by definition political, as value and knowledge conflicts are often intertwined (Montana 2019; Siebenhüner 2018). Guidance on how to deal with the politics of knowledge in the transdisciplinary research process would be much welcomed by the respondents. The interviewees did realise that there is no perfect recipe for transdisciplinary research, but at a more generic level some principles and lessons learned could be made available to project leaders and researchers.

Finally, a long term strategy would be **to give students and young career professionals the opportunity to be trained in doing transdisciplinary research**. In the long run this would create a pool of well-equipped researchers who are familiar with concepts, approaches and methods of working in transdisciplinary teams. We should train students now because education is changing and these skills are needed (see Daneshpour and Kwegyir-Afful 2022, the Network for Transdisciplinary Research (https://transdisciplinarity.ch/en), and the Global Alliance for Inter- and Transdisciplinarity (https://itd-alliance.org for more information on education initiatives). Several education initiatives are already being implemented, both at WUR level and inter-university level[5].

Promoting this further can give WUR a competitive edge as it will help meet the demand of future researchers and practitioners (they will also be better equipped to work with researchers). It goes beyond the purpose of this report analyse these initiatives in depth.

[5] Some examples at WUR level are: the Academic Consultancy Training course and related courses as a compulsory component in many MSc programmes (Fortuin and van Koppen 2016; Tassone et al. 2022); the Comenius leadership project Boundary Crossing @ WUR (https://www.4tu.nl/cee/innovation/project/13156/boundary-crossing-wur) which aimed to improve the competence development to learn and co-create with people who have a different cultural, disciplinary or professional background; and various PhD courses at the Research School for Socio-Economic and Natural Sciences of the Environment (SENSE): Grasping sustainability; Transformative research course. At inter-university level there is the Challenge Based Education at BSc and MSc level and the National Coordination of Education Research (NRO) has funding to stimulate Transdisciplinary education, see an example here.

5 Synthesis of findings

The identified challenges and subsequent strategies that were identified during our process show a rather different reality than the idealised frameworks that are commonly referred to in the literature on transdisciplinary research. The observation that researchers who engage in transdisciplinary research have the feeling that they reinvent the wheel, and face barriers that could have been prevented, gives reason for concern. One of the key underlying causes that we found is that the vast majority of researchers who work transdisciplinarily perceive it as an add-on to their existing work. At WUR, there is no one department or unit that sees transdisciplinarity as its core expertise. This organisational challenge has not been described in the literature about transdisciplinary research, but emerges from this practical inquiry.

Similarly, more symptomatic challenges such as lack of time and flexibility, methodological confusion, and limited incentives to work transdisciplinarily, do not naturally relate to the project phases that are often used in the literature on transdisciplinarity (Carew and Wickson 2010; Horcea-Milcu et al. 2022; Lang et al. 2012). These obstacles are persistent throughout the research cycle, and even before research projects begin. Thinking in projects only is not helpful for addressing challenges that emerge at the level of individuals or organisations. There is a clear need to support individual researchers who are motivated to take the extra effort of doing transdisciplinary research.

We also see a mismatch between researchers who are willing to engage in transdisciplinary research without having the conceptual background or training, and a group of researchers who consider themselves experts in the field of transdisciplinary research. This latter group is unable to be of relevance to those who are participating in transdisciplinary research projects and facing the challenges of integrating perspectives and knowledges in the science-society interface (either because their publications are too context-specific, or too conceptual, or too idealised…). Moreover, there is still a general lack of common understanding on what transdisciplinary research is or should be; the topic in itself is not discussed sufficiently.

The need for an organisational culture that encourages learning was identified as an important entry-point to address the barriers that were described in the findings. In other domains, the importance of a safe space to learn, share and experiment, has been widely acknowledged in the context of power laden research for instance (Brouwer et al. 2016) or in stakeholder dialogues (Isaacs 1999). In the context of transdisciplinary research, Roux and colleagues mention the importance of 'third places', places which are neutral ground, where people from different backgrounds feel safe to share and learn together (Roux et al. 2017). A culture of learning is broad. It spans from preventing that mistakes are repeated or that the wheel is reinvented. It is also about enabling researchers to identify different lenses to study a phenomenon, and being reflexive about their particular lens. For learning, it is particularly important that a safe space is provided where people can share what needs to be shared, without being afraid that this will be used against them (Scharmer 2016). However, in the literature on transdisciplinary research, learning is mostly geared towards learning within projects (see for instance (Herrero et al. 2019; Westberg and Polk 2016) or linked to specific topics or learning networks (Goldstein et al. 2016; Mooney et al. 2014). The results of this study seem to point to the need for culture and mechanisms that encourage learning at organisational level as well. The need for an open organisational learning culture was also found important in a study conducted by Dena Fam and colleagues, who interviewed 20 researchers from a wide range of universities who engage in transdisciplinary research (Fam et al. 2020).

We noted that in our sample of research practitioners, there was limited attention for dealing with power dynamics and politics that are inherent to transdisciplinary research (i.e. the politics of knowledge that often prevail and which make wicked problems so wicked). The question of how to make decisions in case of epistemological or value-related conflicts between disciplines or between science and societal actors emerge before or during a research project, popped up in several sessions during the WIFI event.

In one of the sessions it was concluded that:

> "The politicisation of knowledge is dangerous. What is our responsibility as researchers and knowledge institute in ensuring research has societal value? Who drives the research: who asks the research questions and what is their legitimacy? We need to do more research into this ourselves". (notes from WIFI session).

Such knowledge conflicts have also been identified by (Siebenhüner 2018), who suggests that the issue of legitimacy is the most subtle type of knowledge conflicts. Dealing with such conflicts in appropriate ways requires a high awareness by the researchers involved to understand claims of lacking fairness, e.g. in North-South projects, and perceptions of bias that might not be understood from within scientific contexts, but from the perspective of societal stakeholders ((Siebenhüner 2018). In any case, from the interviews and WIFI event itself, we could identify limited strategies to deal with the politics of decision-making. One strategy that was mentioned referred to the multiple evidence approach, as developed by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES; also described by Tengo (Tengö et al. 2014). This approach may be helpful in situations that explicitly deal with co-creation processes which involve both scientific and indigenous knowledge.

6 Bold actions that knowledge institutes could undertake to advance good transdisciplinary practice among researchers

At organisational level:

1. Embed learning about transdisciplinary research better in the organisational culture. There are many ways in which this could be promoted at organisational level.
    a. Promote learning across projects and programmes in safe spaces (not linked to individual projects), for instance through peer coaching. This could be part of career development for researchers. A yearly or bi-annual event organised by major transdisciplinary programmes could create momentum for researchers to share their successes and failures.
    b. Ensure that there is a place to go for practitioner-researchers and project leaders where they can find tools, guidelines, examples, and people with experience in transdisciplinary research.
    c. Improve the tagging structure of the library system so that transdisciplinary literature is easier to find and promote tagging of individuals in their we@wur and pure profiles.
    d. Link experts in transdisciplinarity with newcomers so that colleagues can learn from each other in informal ways.
    e. Dedicated staff to facilitate the above. Without dedicated staff, all this work to build learning spaces faces the same challenge as doing transdisciplinary research: it will have to be added to already packed work schedules.
2. Acknowledge and value the expertise that is required to bring together different types of knowledge. The recognition and reward system is changing already, it is important to continue this trend by creating space in individual careers and in research programmes for a role of 'knowledge broker', and/or 'process facilitator' who are responsible for the process of knowledge integration. This role does not necessarily need to be a full time job (that depends on the size of the programme), but the key is to acknowledge this role as a unique role for which specific expertise is required. One way to build organisational expertise could be to install a chairholder on transdisciplinarity, or on crossing borders in research.
3. Identify and apply selection criteria for project leaders or acquisition leaders, business developers, who are responsible for decision-making (and subsequent knowledge politics) during the formulation and execution of transdisciplinary projects and programmes. Making it explicit that this type of projects requires a certain kind of expertise, this also improves the status of such projects.
4. Lobby for more flexible and longer-term funding. Start with improvements in the funding structure of internally funded research programmes (such as INREF or KB) to allow for more flexibility and adaptive management. Flexibility in terms of budget allocation, exact outputs and outcomes, adaptive management, team composition, and changes in partners.
5. Acknowledge that politics are part and parcel of transdisciplinary research (and other forms of normative research), and develop a clear vision on how to navigate knowledge politics as WUR.
6. Strengthen and professionalize transdisciplinary education at BSc, MSc and PhD level, as students are the future. Some first steps to incorporate transdisciplinary education in curricula are made, but more is needed. Moreover, support for early career professionals who consider to engage in transdisciplinary research is needed because developing a career in the inter- or transdisciplinary field is not (yet) very common. Besides early career professionals, other researchers involved in transdisciplinary research would also benefit from training on transdisciplinary competences. Support could take the form of mentoring, providing a safe space to learn and share experiences, career advice and career opportunities. It starts with the acknowledgement that transdisciplinary education requires specific competencies and support teachers to become familiar with transdisciplinary education.
7. Build on and nourish the positive energy that exists within knowledge institutes among a growing group of researchers who is eager to work transdisciplinarily. This is not meant to discourage monodisciplinary experts, as this type of expertise is still much needed too and should not be lost! Rather, this is an opportunity for increased synergies among those who are disciplinary experts and those who engage in inter- and transdisciplinary research to help address wicked problems.

The above mentioned suggestions could result in a (WUR) community which, on the longer-term, could contribute significantly to the co-creation of societally relevant solutions but also to bringing the conceptual discussions about transdisciplinarity to a higher level.

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Report WCDI-23-253

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