1 A Methodological Framework for Transdisciplinary Urban Planning

Jacques du Toit, Amy Pieterse, and Sandile Mbatha

1.1 Introduction

Urban planning is an applied social science with a strong normative orientation to improve the human condition through the restorative, equitable and sustainable management and development of land. One of the broader trends in research since the 1990s, including the applied social sciences, has been a shift from Mode 1 knowledge production, the positivist conception of a singular body of knowledge produced by researchers and feeding neatly into practice, to Mode 2 knowledge production, the realist conception of multiple bodies of knowledge co-produced by researchers, practitioners and other stakeholders across various contexts (Newiga et al., 2019). In the ideal world, Mode 2 implies urban planning researchers and practitioners collaborating to co-produce research that is both scientifically rigorous and socially relevant to ensure robust policies and plans.

However, this is seldom the case in the complex and messy world of planning practice. Despite Mode 2, the urban planning literature points towards a gap between research and practice, with researchers and practitioners forming two distinct communities with different values and different understandings of and uses for research (Burton, 2018; Campbell, 2015; Forsyth, 2016; Goodman et al., 2022; Hurley et al., 2016; Porter, 2015). Researchers typically value rigour, whereas practitioners value relevance. How can urban planning research be both rigorous and relevant? This question is pertinent for Sustainable Development Goal (SDG)11, to make cities and human settlements inclusive, safe, resilient and sustainable, and SDG11.3 in particular, to enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management (United Nations, 2023). As such, it is also indirectly pertinent to other SDGs within and beyond SDG11 that intersects urban planning, such as housing, transport, public spaces, climate action and water sensitivity.

Transdisciplinarity aims to combine scientific rigour and societal relevance. Transdisciplinarity can be defined as collaboration between academic role players, such as planning researchers or researchers from other disciplines, and non-academic role players, such as planning practitio-

J. du Toit (✉)
Department of Town and Regional Planning, University of Pretoria, Pretoria, South Africa
e-mail: jacques.dutoit@up.ac.za

A. Pieterse
Smart Places Cluster – South African Council for Scientific and Industrial Research, Pretoria, South Africa
e-mail: apieterse@csir.co.za

S. Mbatha
Department of Cooperative Governance and Traditional Affairs [COGTA], Pretoria, South Africa
e-mail: sandilemb@cogta.gov.za

F. Frehse et al. (eds.), *Spatial Methods in Transdisciplinarity for Urban Sustainability*, Sustainable Development Goals Series, https://doi.org/10.1007/978-3-031-84367-9_1

ners and local communities, to research, learn about and work towards a common goal or structural change in a normative direction involving a complex societal or planning problem, such as urban sustainability (Cilliers et al., 2014, p. 261; Brink et al., 2018, p. 766). Transdisciplinarity therefore shifts from positivism and interpretivism to realism and pragmatism and assumes a more critical role for research methods, one in which methods are not only about rigour but also relevance to bring about systemic change towards urban sustainability.

Yet, how should urban planning researchers, practitioners and other stakeholders collaborate and conduct transdisciplinary research? In this chapter, 'spatial methods' are regarded as social research methods applied to questions involving spatial phenomena. This may include various methods that depict physical as well as social spaces, with the potential to transform such spaces towards greater sustainability. Instead of advocating specific methods, this chapter presents a holistic and flexible methodological framework for transdisciplinary urban planning. In this chapter, 'transdisciplinary urban planning' is regarded as academic and non-academic role players, from or beyond planning, collaborating to produce knowledge for urban planning purposes, especially in terms of addressing urban sustainability at local government level. This chapter first reviews the literature on transdisciplinarity for urban sustainability, after which the framework is presented and discussed. The heuristic framework serves to help urban planning stakeholders navigate transdisciplinarity and make more considered decisions for conducting transdisciplinary research, especially with regard to leveraging the transformative potential of research methods towards achieving urban sustainability. Practitioner reflections on the framework are provided using the example of Planning Support Science (PSSci) and a customised Planning Support System (PSS) for climate resilient planning at the local government level. The PSS was developed by the South African Council for Scientific and Industrial Research (CSIR) for eThekwini Municipality in Durban, South Africa.

1.2 A Review of Literature on Transdisciplinarity for Urban Sustainability

The urban planning literature cited above conceptualises the relationship between research and practice as a cultural gap between researchers and practitioners that limits the rigour and relevance of research. A recurring theme is that greater collaboration between researchers and practitioners may help bridge this gap, and that collaboration is *inter alia* a function of methodology. Transdisciplinarity is intended for this purpose; however, urban planning literature has largely overlooked this topic. We therefore reviewed literature across interdisciplinary fields such as urban and sustainability studies for examples of transdisciplinarity for urban sustainability, including successful or at least partially successful stakeholder collaborations. Instead of including or excluding particular examples, we reviewed articles published over the last decade with 'transdisciplinary' and 'urban sustainability' as our main keywords and grouped examples from these articles under four headings, including the Social Polis, African, cross-country and institutional examples. We subsequently describe these examples and synthesise their methodological implications into principles for a methodological framework.

1.2.1 Examples of Transdisciplinarity for Urban Sustainability

1.2.1.1 The Social Polis Example

'Social Polis' was an international transdisciplinary project between 2007 and 2010 that aimed to set a research agenda for urban social cohesion using an open social platform involving researchers, practitioners, policymakers and civil society, the majority of which were based in Europe. Setting the research agenda first involved a broader objective with high-priority themes, followed by a focused agenda that included two major societal challenges and five specific themes (Cassinari & Mouleart, 2015). The project was

challenging for both practitioners and researchers. Practitioners found the themes abstract and removed from their normal experience of applied research to solve tangible problems, while researchers found it difficult to exchange the traditional linear approach of knowledge production for a cumulative-circular approach of mutual learning. Cassinari and Mouleart (2015) conclude that considering methodological aspects during the agenda setting can help address such challenges on a conceptual level.

A methodological framework that considers the contextual, epistemological and methodological dimensions of research can therefore help guide transdisciplinary research agendas. Social Polis is a predominantly European example, whereas examples elsewhere in the world, especially in Africa, face unique challenges.

1.2.1.2 African Examples

Transdisciplinarity for urban sustainability faces critical methodological challenges in an African context. Reflecting on the African Centre for Cities, Parnell and Pieterse (2016) put forward the notion of 'translational urban research praxis' to suggest a form of research beyond applied and even transdisciplinary research, which encompasses and integrates conception, design, execution, application and reflection. Together these form a 'singular research/practice process that is, by its nature, deeply political and locally embedded' (Parnell & Pieterse, 2016, p. 236). 'Translational' means directly engaging the transformation of urban practices through producing knowledge to inform change as well as knowledge about change itself, i.e. critical reflection. They, however, also point out a lack of methodological consensus, weak or missing data in the African context, and few researchers or practitioners having sufficient quantitative and qualitative skills. Yet they argue that integrating theory and method remains a meta-paradigmatic concern for urban sustainability. This holds three implications for a methodological framework. First, it suggests that a framework should include basic or fundamental research to critically reflect on change itself, in addition to applied or problem-driven research to inform change. Second, it should be methodologically flexible to accommodate possible data and skills shortages, yet coherent to ensure some degree of integration between theory and method. Third, it should leverage the skills of researchers to improve the rigour of data collection and analysis.

Besides these implications, it should also be noted that transdisciplinary approaches from developed countries cannot necessarily be replicated to developing countries or settings characterised by informality, fluidity and social conflict. Van Breda and Swilling (2019) conducted a transdisciplinary case study between 2011 and 2016 in Enkanini, an informal settlement in Stellenbosch, South Africa. Enkanini formed when people occupied municipal land and erected informal dwellings. As it could take several years for the municipality to provide formal municipal services to the settlement, the question driving the project was: what could residents do while awaiting services? Over the course of 3 years, the research team in collaboration with a loose network of residents implemented three small-scale experiments in alternative service delivery, including electricity, sanitation and waste management. Reflecting on their experiences, the authors argue for 'emergent transdisciplinary design research', i.e. the research is designed as it unfolds, transforms and emerges *from* and *within* the local context. Yet they also suggest that contextually relevant guiding logics and principles are still needed for conducting transdisciplinary research. A number of principles are formulated, two of which have implications for a methodological framework, including 'allowing for emergence' and 'absorbing complexity'. Research planning and design, although a collaborative effort, should, if possible, preferably be led by local practitioners or community members who are better positioned to allow and absorb such emergence and complexity, i.e. anticipating and working with uncertainty and unexpected circumstances. A methodological framework should therefore also be flexible with regard to research designs and methods, and incorporate some of the broader principles of transdisciplinary research. Van Breda and Swilling (2019, pp. 827–828), however, make an important

conceptual distinction between methodology, i.e. the critical reflection on the reasoning or logic behind a chosen method, and the method itself, whereas method is instrumental and does not reveal why or how it should be used.

Although this chapter argues for methodological flexibility and plurality, the complexity and fluidity of transdisciplinary and sustainability problems still require careful consideration of the logic behind a chosen method. A methodological framework should therefore provide guidance on how a prototypical research design or method is more-or-less related to the research context, purpose and logic so that stakeholders can be more considered in their methodological decisions.

1.2.1.3 Cross-Country Examples

Transdisciplinary research is further complicated when conducted comparatively between countries and cities. Mistra Urban Futures (MUF) is an international research centre that facilitates applied transdisciplinary research towards implementing the SDGs at city level through a series of 'Local Interaction Platforms' in Gothenburg, Malmö, Lund and Stockholm (Sweden), Sheffield and Manchester (UK), Cape Town (South Africa), Kisumu (Kenya), Buenos Aires (Argentina) and Shimla (India) (Simon et al., 2018; Valencia et al., 2019). Some of the lessons and generalisable principles for practitioners and researchers include being (1) locally appropriate and embedded, (2) open to change and renewal and (3) able to straddle disciplines, bridge the gap between research and practice and accept that there is no single right way of doing transdisciplinary research. This highlights the potential of planning researchers to help bridge this gap, considering that planning is foremost a practice-oriented discipline. It also suggests the need for a flexible methodological framework that, rather than advocating specific methods, allows for various methods that may be applicable. Another important lesson is that the delineation of urban boundaries for transdisciplinary research has implications in terms of which stakeholders and urban processes are being included or excluded. Again, local practitioners who are better positioned to grasp and appreciate these dynamics should perhaps lead the research planning and design, which includes delineating the research. As part of accountability towards stakeholders, Valencia et al. (2019) suggest effective SDG coordination mechanisms, which include monitoring and evaluation using both qualitative and quantitative assessments of progress with measurable indicators that are contextually relevant. A methodological framework should therefore include evaluation research, considering also that it is a well-established form of applied research in urban planning. The role of researchers in building capacity for rigorous data collection and analysis is critical. Simon et al. (2018) also draw attention to the role of researchers in terms of public engagement and science communication, i.e. to expose practitioners and stakeholders to new perspectives through succinct literature reviews, thereby improving the relationship between research and practice to achieve greater social impact, which also relates to the European Union's efforts towards Responsible Research and Innovation.

In essence, MUF also provides a critical reflection on transdisciplinary research. This again suggests the need to include basic or fundamental research in a methodological framework to create reflexive knowledge.

Comparative transdisciplinary research across African countries also confronts urban sustainability challenges. Thondhlana et al. (2021) reflect on two transdisciplinary projects related to climate change and household energy use that were implemented in Kumasi (Ghana), Durban and Makhanda (South Africa) and Harare (Zimbabwe), as part of the Leading Integrated Research for Agenda 2030 in Africa. Two lessons were that asymmetrical power dynamics between stakeholders may influence outcomes, and that partnerships therefore require clearly defined agreements to govern structure and process.

This is perhaps contrary to notions of 'emergent' and 'adaptable' approaches in the examples above. Yet it suggests that establishing a clearer role division between planning researchers and practitioners, based on the methodological strengths each party brings to a project, may help

mitigate possible asymmetrical power dynamics or the need for rigid agreements.

1.2.1.4 Institutional Examples

Transdisciplinary research can be challenged by institutional aspects influencing teleology and methodology. The Institute for Sustainable Urban Development (ISU) was a collaborative project between Malmö University and the municipality to facilitate research and planning collaboration for urban sustainability and education. The ISU resulted in different internal and external understandings of the institution as either a dependent bilateral but invisible project, or as a high-profile independent institute. Organisers, however, felt it did not result in a 'self-organising network across sectors', and that it was teleologically aimless (Mehling & Kolleck, 2019). Patel (2022) similarly reflects on a city-university knowledge partnership for urban sustainability in Cape Town, arguing that although 'third spaces' between academia and practice are generally accepted as integral to transdisciplinarity, researchers occupying such spaces may be peripheralised from their academic institutions, limiting the potential of transdisciplinary research to affect urban change. The notion of a 'portal' is put forward to suggest the need for dynamic exchange between researchers and their institutions to affect urban change. Brink et al. (2018) provide a self-assessment of a joint project across four universities and seven Swedish municipalities, titled Ecosystems Services Concept at the Municipal Level, and identify lessons for supporting university-municipality collaboration. One of these is that greater attention to the purpose of stakeholder participation, whether functional, deliberative or emancipatory, can help justify and clarify roles. They also suggest that researchers clearly articulate their epistemological, ontological and methodological positions.

This, again, suggests the need for a holistic framework that provides methodological coherence between the different dimensions of research, and that clarifies the role of researchers and practitioners in terms of participation and methodological contribution.

1.2.2 Principles for a Methodological Framework

The methodological implications from the examples above can be synthesised into four principles for a methodological framework. Ideally, there should be:

- Methodological coherence between the different dimensions of research
- Methodological role division between stakeholders
- Contextuality, flexibility and plurality with regard to research designs and methods
- Critical reflection on transdisciplinary urban planning

The literature suggests that for transdisciplinary research to be scientifically rigorous, a degree of methodological coherence is necessary, which requires a matrix-like framework that aligns concomitant research contexts, paradigms, purposes, designs and methods. Greater clarity regarding the role of different stakeholders is called for, which requires a framework that leverages the respective positions and methodological strongpoints of different stakeholders. The complexity of urban sustainability challenges requires a framework that allows stakeholders to choose and experiment with research designs and methods that are contextual, flexible and plural. The need to not only affect change but also to learn about change requires a framework that allows critical reflection on transdisciplinary urban planning. Each of these four principles is considered in the subsequent framework.

1.3 A Methodological Framework for Transdisciplinary Urban Planning

Methodological frameworks are useful to help stakeholders navigate complexity, especially transdisciplinarity for urban sustainability. They furthermore help to position research methods

and how these may apply to spatial phenomena as 'spatial methods'. While methodological frameworks (Wiek & Lang, 2016) and principles (Kudo et al., 2019; Von Wehrden et al., 2017) have been proposed for sustainability research in general, the literature lacks specific frameworks for transdisciplinary urban planning. The framework proposed here incorporates the four principles from the review above and draws on existing typologies of designs for planning research (Du Toit, 2015). The framework (see also Table 1.1) is structured around four dimensions of social science research, including:

- The sociological dimension, i.e. the research context and audience
- The epistemological and ontological dimension, i.e. the research paradigm and focus
- The teleological dimension, i.e. the research purposes, principles or logics
- The methodological dimension, i.e. the research planning, design and methods

Table 1.1 shows the framework.

The research context pertains to whether research is primarily applied or basic. Applied research involves problem-driven or solution-oriented research primarily for a practitioner or community audience, whereas basic research involves fundamental research primarily for an academic audience to improve the intrinsic understanding about transdisciplinary urban planning (Neuman, 2020). Planners are familiar with applied research, while transdisciplinarity for urban sustainability is typically applied at local government level (see, e.g. Cilliers et al., 2014; Brink et al., 2018; Thondlana et al., 2021). A distinction, however, is made between applied research primarily involving practitioners, which tends towards intervention and evaluation research (the two main forms of applied planning research) and applied research primarily involving communities, which tends towards participatory action research (PAR), and community-based research (Leedy & Ormrod, 2021; Neuman, 2020). Westin and Joosse (2022, pp. 392 & 401) point out that planners are well positioned to mediate between experts and citizen authority, and to facilitate the process of participation. Several authors also point out the need for researchers to critically reflect on transdisciplinary projects and to conduct basic research *on* planning to theorise experiences and change, which can be either in tandem to or after a transdisciplinary project (Parnell & Pieterse, 2016; Brink et al., 2018, pp. 767–769; Simon et al., 2018; Lawrence, 2021, p. 205). Applied and basic research therefore form a continuum to re-enforce knowledge *for* urban sustainability and knowledge *on* transdisciplinary urban planning itself.

Considering its applied focus, intervention and evaluation research tend to be non-paradigmatic or pragmatic, as the purposes are to intervene in urban settings and to evaluate such interventions to create instrumental knowledge for planning. As in the social sciences, PAR in the context of transdisciplinary urban planning is associated with realism (Brink et al., 2018, p. 779), also known as critical social science (Neuman, 2020) or pragmatism. According to Popa et al. (2015, pp. 47–48), pragmatism 'distances itself from value neutrality and value relativism by conceiving knowledge production as a social and reflexive process, whereby criteria of scientific credibility and legitimacy are jointly defined within a community of inquiry'. The focus is on research *for* the community to create either instrumental or reflexive knowledge. Realism, pragmatism and involvement of the community imply democratic principles such as participation, deliberation and eventual transformation or emancipation. Transdisciplinarity implies praxis, i.e. creating knowledge through action and experimentation to see if theory works in practice and to refine theory if necessary. The actual benefits for the community, however, need to be continuously discussed (Brink et al., 2018, p. 779). Although basic research may involve empirical case studies to critically reflect on transdisciplinary urban planning, research that focuses *on* planning to create reflexive knowledge is more likely meta-paradigmatic, especially if the emphasis is on non-empirical work such as theory construction (Van Breda & Swilling, 2019, p. 828), methodological reflection (Von Wehrden et al., 2017, p. 35; Van Breda

Table 1.1 A methodological framework for transdisciplinary urban planning

Sociological dimension (research context)	Epistemological and ontological dimension (research paradigm and focus)	Teleological dimension (research purposes, principles or logics)	Methodological dimension	
			(Research planning and design)	(Research methods)
Applied (problem-driven/solution-oriented) research primarily involving *practitioners* as key stakeholders, particularly in the context of practice and local government	Non-paradigmatic or pragmatic Research *for* planning to create instrumental knowledge	Intervention Evaluation	LED BY PRACTITIONERS *Intervention research* Building/site/settlement analysis (incl. Environmental scanning) Plan/policy analysis Normative/exploratory forecasting *Evaluation research* Clarificatory evaluation Implementation evaluation / Programme monitoring Impact evaluation	LED BY RESEARCHERS Literature reviews, science communication (engagement) and tools such as Planning Support Systems, to offer practitioners new perspectives and evidence Various quantitative and/or qualitative data collection, analysis and mapping methods that are (1) pragmatic, (2) experimental, (3) longitudinal, (4) ethical and (5) driven by practitioners' policy and planning imperatives
Applied (problem-driven/solution-oriented) research primarily involving *communities* as key stakeholders in a localised context, with planners as mediators and facilitators	Realist or pragmatic Research *for* communities to create instrumental/reflexive knowledge	Participation/ deliberation Action/ experimentation (praxis) Transformation/ emancipation	LED BY COMMUNITIES *Participatory (action) research* (e.g. functional, deliberative or transformative/ emancipatory) *Community-based research* Course-based action research Community-based participatory research	LED BY RESEARCHERS Literature reviews and science communication (engagement) to offer communities new perspectives and evidence Various quantitative and/or qualitative data collection and analysis methods that are (1) emergent, (2) iterative, (3) collaborative and (4) ethical
Basic (fundamental) research conducted by *researchers* in an academic context	Meta-paradigmatic Research *on* planning to create reflexive knowledge	Critical reflection	EMPIRICAL *Case studies* of transdisciplinary urban planning NON-EMPIRICAL *Theory construction* *Methodological studies* *Normative argumentation*	Various empirical case study methods

& Swilling, 2019, p. 826) or normative argumentation.

The methodological dimension is divided into research planning, design and methods. 'Research design' refers to the prototypical study and can be defined as a logical plan involving strategic decisions to maximise research purposes, applications or the validity of findings (Du Toit, 2015, p. 61). Prototypical evaluation designs, for example, include clarificatory, implementation and impact evaluations. Prototypical PAR designs include participatory or action designs and community-based research (Brink et al., 2018, p. 779; Leedy & Ormrod, 2021). 'Research methods' refers to data collection and analysis procedures as part of research design. Several authors, however, point out issues around stakeholder roles in transdisciplinary research, and that this is often a matter of differential expertise and a need for greater clarity in terms of process and methodological contribution (Mitchell et al., 2015; Popa et al., 2015; Parnell & Pieterse, 2016, pp. 241–242; Brink et al., 2018, pp. 774–775 & 781; Simon et al., 2018, pp. 484–487; Mehling & Kolleck, 2019; Valencia et al., 2019, pp. 6–7). The framework therefore proposes a collaborative partnership between planning researchers and practitioners with a role division in terms of their respective methodological contribution, with practitioners ideally leading the research planning and design (establishing relevance and aligning research activities with local policy and planning imperatives), and researchers leading the methods (establishing rigour by ensuring reasonably valid and reliable (quantitative) or credible and trustworthy (qualitative) data collection and analysis procedures) (Von Wehrden et al., 2017, pp. 39–40). The intention is not to create an asymmetrical relationship in terms of methodology, but rather to leverage the relative positions and strengths that each party brings to the collaboration. The intention is also not that research planning and design should be left completely for practitioners or communities. More structured designs such as surveys or field experiments, in which the validity of findings tend to be strongly tied to the planning and design thereof, may still benefit from researchers' expertise and inputs (as the CSIR and eThekwini authors similarly remark in Sect. 1.4.2).

Researchers may provide succinct literature reviews in response to specific practitioner or community needs, thereby enabling otherwise arcane research to have greater societal impact through what Simon et al. (2018, pp. 487 & 494–495) refer to as 'engagement' or 'science communication'. Researchers may also develop and facilitate tools such as PSS to assist practitioners with planning and decision-making. Considering the complex and fluid nature of transdisciplinary research, the framework proposes various rather than specific methods, as long as methods are appropriate and aligned with other research considerations considering criteria for good qualitative or quantitative research (Von Wehrden et al., 2017, pp. 37–39). For applied research involving practitioners, it is important that methods are pragmatic, ethical and driven by practitioners' policy and planning imperatives (Parnell & Pieterse, 2016, p. 240). Where applicable, methods should also be experimental to determine change (Wiek & Lang, 2016, p. 32; Von Wehrden et al., 2017, p. 39) or longitudinal to track change (Von Wehrden et al., 2017, p. 40). For applied research involving communities, it is important that methods are emergent, iterative, collaborative and ethical.

The heuristic framework serves to help stakeholders navigate transdisciplinarity and make more considered decisions when conceptualising, planning and designing research for transdisciplinary urban planning. The framework is not meant to be prescriptive or rigid. Additional methodological considerations beyond those outlined in the framework may be taken into account. Furthermore, elements from one section may be applicable to other sections. For example, participation as a purpose or principle, although typically associated with action research involving communities, may also apply to intervention research involving practitioners. Still, the framework provides some methodological coherence, i.e. how key methodological considerations more-or-less fit together, which is important for research to be both rigorous and relevant (Von Wehrden et al., 2017, p. 37). Practitioners subse-

quently reflect on the framework to illustrate how the framework may apply to a tangible example of transdisciplinary urban planning.

1.4 Practitioner Reflections on the Framework Using the Example of Planning Support Science (PSSci) and a Customised Planning Support System (PSS)

1.4.1 The Concept of PSSci and PSS

PSSci is the application of scientific knowledge, methods and tools to support decision-making in urban planning. PSSci recognises the multi- and trans-disciplinary nature of urban planning and aims to integrate various scientific disciplines to support practitioners. It emphasises the collection and analysis of data, modelling, simulation, participatory decision making and evaluation practices. PSSci is concerned with the overall theoretical and methodological framework that guides the use of scientific knowledge in planning processes. Recent developments in PSSci highlight the need for closer collaboration between government, knowledge institutions, industry and civil society to better integrate the governance, application and instrumentation components of PSSci (Geertman & Stillwell, 2020).

PSSs, on the other hand, refer to the technological tools and computer-based systems that aid decision-making in planning processes. PSSs are interactive software systems designed to assist planners in analysing data, visualising information, modelling scenarios and evaluating planning alternatives. These systems often incorporate geographic information systems (GIS), data management tools, modelling software and visualisation platforms (Geertman, 2015). PSSci concepts and methods are therefore applied in PSS. The current focus, however, has shifted from PSS as mere instruments and technologies (the means of support) to the position of PSS within the context of planning (the goals of support).

> The focus has changed to one in which we question how PSS can be embedded in a specific application field, what role can PSS play given the particular governance procedures in force, what methodological relationships exist between PSS and other associated instruments, and what impact does the contextual setting have on PSS design and use. (Geertman & Stillwell, 2020, p. 1329)

Planning issues are often complex and multi-dimensional, requiring integrated responses. PSSs provide knowledge for integrated responses and support the communication and analysis of that knowledge (Vonk & Geertman, 2008). PSSs typically offer an integrated framework of planning theory, methods, instruments, data, information and knowledge (Geertman, 2015). Vonk and Geertman (2008, p. 155) argue that PSS can support planners in 'developing well founded plans for an increasingly complex socio-physical environment in increasingly complex planning process environments'. PSS and the processes in which they are developed serve as a transdisciplinary bridge between planning research and practice. Zheng and Sieber (2020) argue that it is the inter- and trans-disciplinary collaborations that truly drive urban innovation. Reflecting on the methodological framework in Table 1.1, PSSci serves as an example of applied research involving practitioners. The concern in PSSci with an overall theoretical and methodological framework to guide the use of scientific information in planning, reflects the methodological dimension in Table 1.1, particularly the research planning and design. PSS, on the other hand, reflects research methods, considering the role of researchers in developing tools such as PSS. PSSci and PSS together serve as a methodological vehicle for intervention and evaluation research.

1.4.2 eThekwini GreenBook MetroView

In 2021, a collaboration between the CSIR and eThekwini Municipality led to the development of a customised PSS for climate-responsive strategic planning, known as the eThekwini GreenBook MetroView. The MetroView forms

part of the larger GreenBook initiative that provides evidence for local government in South Africa through a functional web-based platform to inform the planning and development of climate-resilient settlements. As part of the GreenBook, the MetroView includes two tools, the Climate Risk Profile Tool and the Climate Actions Tool. The Climate Risk Profile Tool, depicted in Fig. 1.1, provides a baseline and future profile of climate and climate change, the likelihood of certain climate hazards to occur, the exposure and vulnerability of people and infrastructure, and combined risk. The profile information is quantified and spatialised at three planning scales including municipal, regional and ward levels. The Climate Actions Tool provides customised adaptation and mitigation actions to be mainstreamed into municipal plans and strategies to reduce exposure and vulnerabilities and build long-term resilience. The 2022 Durban Climate Change Strategy (eThekwini Municipality, 2022a) informs the inclusion and structure of the different climate change adaptation and mitigation actions. These tools therefore provide data-driven climate risk assessments of eThekwini using a combination of GIS, modelling and visualisation techniques. Together, the two tools offer a strong evidence base in the form of communication and analysis to assist practitioners, policymakers and decision-makers to effectively inform and add value to climate change adaptation and strategic planning. The tools also provide a foundation for developing a shared understanding of the potential impacts of climate change and the decisions needed to respond to them (CSIR, 2023a).

Reflecting on the methodological framework in Table 1.1, the development of the eThekwini GreenBook MetroView was problem driven, solution oriented and customised for eThekwini to support evidence-based strategic planning for a climate-resilient city. Therefore, the focus of the research was to create both instrumental and reflexive knowledge for urban sustainability. Instrumental knowledge was created through the development of an evidence base *for* planning and decision-making in the city, whereas reflexive knowledge was created *on* planning around broader systemic dynamics, power structures and ethical considerations that shape decision-making processes. Both types of knowledge benefit stakeholders in the research process. Instrumental knowledge provides practical guidance and decision support to eThekwini stakeholders, while it supports technical expertise and the optimisation of research for the CSIR researchers. Reflexive knowledge offers eThekwini stakeholders a critical lens through which they can better understand and shape the implications of their decisions, while for CSIR

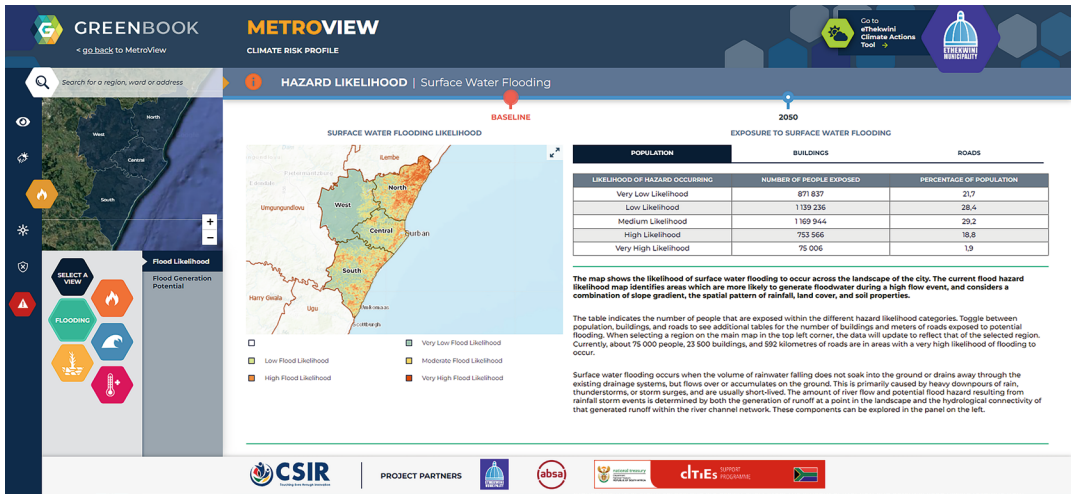

Fig. 1.1 An excerpt of the Climate Risk Profile from the eThekwini GreenBook MetroView. (Source: CSIR, 2023b)

researchers it offers a normative and evaluative lens to consider the implications of the research process and outputs.

The CSIR, the research partner and developer of the GreenBook, mostly conducts applied research in the local government sector. Since the development of this PSS in 2016 (Van Niekerk et al., 2020), the CSIR has designed and updated its methodologies for the development of the PSS to be in line with the latest research in urban planning, adaptation and climate change sciences. A reliable theoretical and methodological base for the development and refinement of the PSS was an essential part of the process. The methodology for the eThekwini GreenBook MetroView is in line with the latest Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC, 2021). Through close collaboration with eThekwini, the methodology was adapted to fit the data available to the research team.

The successful development of the eThekwini GreenBook MetroView was largely dependent on stakeholder buy in and collaboration at municipal level. It leveraged existing initiatives of city-level data integration, which demonstrated institutional capacity to use data for insight-driven decision-making. The development process was also enabled by other mechanisms that made resources available to support this transdisciplinary collaboration, which may otherwise have been stifled by procurement systems and other local government legislative requirements. Development of this PSS was facilitated by funds made available from the CSIR as a research partner, the Absa Group as a private sector stakeholder and the National Treasury's City Support Programme as a government stakeholder.

To ensure that the eThekwini GreenBook MetroView was internalised within the local government machinery, a series of internal workshops were conducted. The purpose of these workshops was threefold; first, to identify and develop the most appropriate methods and data sources for the various components of the Climate Risk Profile Tool; second, to validate findings; and third, to ensure buy in and ownership within the municipality. The workshops involved a multidisciplinary team of CSIR researchers, as well as municipal officials and practitioners from various departments. A transdisciplinary co-development approach was followed to ensure transparency in the development of the PSS and its tools and to avoid municipal silos or underutilisation. The PSS was eventually located within existing municipal platforms to further strengthen its ownership. The PSS is currently shared through the municipality's eThekwini Strategic Hub data platform (eThekwini Municipality, 2022b). The most significant co-development between practitioners and researchers is related to establishing and developing the research design and methods. Thus, although the methodological framework in Table 1.1 suggests that practitioners and researchers should lead the research design and methods respectively, the eThekwini experience suggests that co-development is simultaneously important (as the academic author similarly remarks in Sect. 1.3). It may also at times be necessary to go beyond intentional designs or purposes such as intervention, evaluation and participation and allow for flexibility and unintended or serendipitous outcomes of the research. The project experienced significant delays as the process of co-development was more time intensive than the team originally anticipated, which necessitated effective and transparent communication between researchers, practitioners and funders. Although not an aspect in the framework, users of the framework should emphasise open and regular communication to ensure that all stakeholders are aware of potential delays, changes or serendipitous outcomes.

The eThekwini GreenBook MetroView has also been workshopped with civil society and community stakeholders to support grassroot planning processes. Existing relationships between the municipality and these stakeholders determine whether instruments such as PSS are accepted or rejected. In the context of a functional relationship, stakeholders are more likely to accept the use of such instruments for their own planning purposes. In some instances, they may even provide critical data required to enhance instruments. A trust deficit may, however, lead to a rejection of an instrument. Thus,

the methodological framework in Table 1.1 highlights the importance of community stakeholders leading the planning and design of participatory and community-based research, which would include using a PSS such as the eThekwini GreenBook MetroView for grassroot planning processes.

1.5 Conclusion

Considering the need for greater collaboration between researchers and practitioners to achieve urban sustainability, this chapter presents a methodological framework for transdisciplinary urban planning. The literature as yet offers little with regard to such a framework. Literature from interdisciplinary fields, such as urban and sustainability studies, offers examples of transdisciplinarity for urban sustainability, from which we synthesised principles for a methodological framework. The framework is structured around four dimensions of social science research (i.e. sociological, epistemological, teleological and methodological) to help align context, paradigm, purpose and research planning, design and methods. Applied research involves practitioners and communities as primary stakeholders to create instrumental knowledge *for* planning and communities. Prototypical designs particularly suited to transdisciplinary urban planning include intervention, evaluation and participatory research, in which practitioners and communities, considering their unique position, should ideally lead the research planning and design by coordinating research efforts and practical gains. Researchers, on the other hand, should offer succinct literature reviews and ideally lead methods for data collection and analysis considering their expertise. Rather than advocating specific methods, the framework encourages a plural and flexible approach, as long as these methods are appropriate and responsive to the needs of practitioners and communities. It is about the pragmatic and ethical application of a method rather than the method itself. Basic research is conducted by researchers parallel or subsequent to applied research to create reflexive knowledge *on* planning. This is typically done through meta-paradigmatic case studies of transdisciplinary urban planning to contribute towards theory, methods or norms for future transdisciplinary research.

Reflections on the framework are based on the example of PSSci and a customised PSS. PSS facilitates transdisciplinary urban planning by aligning practitioner needs with research methods and techniques. This marks a departure from highly technical tools such as GIS that do not always meet the planning needs at local government level. The CSIR and eThekwini Municipality collaborated on the eThekwini GreenBook MetroView, a web-based instrument for strategic planning in terms of climate responsiveness at local government level. From a practitioner's perspective involved with this PSS, the framework may help to conceptualise and design transdisciplinary urban planning research while leveraging unique practitioner and researcher capabilities. The framework, however, should not be prescriptive and cannot foresee all the contextual and unique challenges that a transdisciplinary project necessarily begets. In South Africa, transdisciplinarity at local government level is hindered by complex political and governance dynamics. Local government is constrained by municipal service backlogs and the lack of resources to respond. Legislation related to procurement processes also challenges researcher-practitioner collaboration. These challenges stifle practitioners' ability to collaborate and innovate, while transdisciplinarity and urban sustainability simply become secondary under such circumstances. A methodological framework can therefore at best propose plurality and flexibility with regard to methods to help mitigate such challenges. Even then, transdisciplinarity at local government level is largely dependent on institutional maturity and the willingness and capability to break internal silos and incorporate research into planning and decision-making for urban sustainability.

These reflections on the framework raise questions beyond methodology around the societal impact of transdisciplinary urban planning, especially in terms of urban sustainability at local

government level. Transdisciplinarity implies praxis, but considering the challenges, especially at local government level, what is the actual impact, and how should it be evaluated? While the framework suggests that researchers should critically reflect on cases of transdisciplinarity, this is more likely to focus on planning processes, and not necessarily the impact thereof. There may also be a difference between evaluating the impact of a planning intervention and evaluating the impact of the research behind the intervention. As evaluating the impact of transdisciplinary research is probably beyond the framework in its current form, researchers may have to draw on science and technology studies, particularly the field of research evaluation. Notions such as productive interactions and impact pathways (Muhonen et al., 2020) may be useful to evaluate the impact of transdisciplinary research, including the role of methods in bringing about change. Hansson and Polk (2018) argue that impact depends on the quality of the research process, particularly in terms of how practitioner motivation, participant openness or flexibility and in-depth exchanges of expertise contribute to research that is internally relevant, credible and legitimate. These attributes, however, should also be related to external dynamics, institutional factors and political context. Urban planning has yet to see systematic evaluations of transdisciplinary research, which may in turn serve to refine methodological frameworks for transdisciplinary urban planning.

As a closing thought, we consider how our positionality may have played a role in constructing the framework and reflecting on it. The academic author, who trained as a planner and subsequently a methodologist, may have a more purist take on methodology and prefers the application of prototypical social research designs and methods in urban planning research, albeit in a pragmatic manner. The CSIR and eThekwini authors, who actively participated in the development of the GreenBook MetroView, may be predisposed towards emphasising the successes and positive outcomes of the process. This predisposition is driven by a personal investment in the success of the project. As a researcher and practitioner respectively, they recognise their need to balance the interests of various stakeholders, including the funders, the municipality and other stakeholders, which may influence the framing of their narrative.

References

Brink, E., et al. (2018). On the road to 'research municipalities': Analysing transdisciplinarity in municipal ecosystem services and adaptation planning. *Sustainability Science, 13*, 765–784.

Burton, P. (2018). Striving for impact beyond the academy? Planning research in Australia. In T. W. Sanchez (Ed.), *Planning knowledge and research* (pp. 51–65). Routledge.

Campbell, H. (2015). It takes more than just looking to make a difference: The challenge for planning research. In E. A. Silva, P. Healey, H. Neil, & P. Van den Broeck (Eds.), *The Routledge handbook of planning research methods*. Routledge.

Cassinari, D., & Moulaert, F. (2015). Enabling transdisciplinary research on social cohesion in the city. In E. A. Silva, P. Healey, H. Neil, & P. Van den Broeck (Eds.), *The Routledge handbook of planning research methods* (pp. 414–425). Routledge.

Cilliers, S., et al. (2014). Sustainable urban landscapes: South African perspectives on transdisciplinary approaches. *Landscape and Urban Planning, 125*, 260–270.

CSIR. (2023a). *eThekwini municipality climate risk profile*. Available at: https://ethekwini-riskprofile.greenbook.co.za/?view=about-the-tool. Accessed 30 May 2023

CSIR. (2023b). *eThekwini Municipality Climate Risk Profile*. [Online] Available at: https://ethekwini-riskprofile.greenbook.co.za/hazards?view=flooding&subview=flood+likelihood. Accessed 14 June 2023

Du Toit, J. (2015). Research design. In E. A. Silva, P. Healey, H. Neil, & P. Van den Broeck (Eds.), *The Routledge handbook of planning research methods* (pp. 61–73). Routledge.

eThekwini Municipality. (2022a). *Durban Climate Change Strategy*. Available at: https://www.durban.gov.za/storage/Documents/Climate/DCCS_Strategy.pdf. Accessed 13 June 2023

eThekwini Municipality. (2022b). *eThekwini Strategic Hub: Our single source of truth*. Available at: https://strathub.durban.gov.za/. Accessed 30 May 2023

Forsyth, A. (2016). Investigating research. *Planning Theory & Practice, 17*(3), 467–471.

Geertman, S. (2015). Planning support systems (PSS) as research instruments. In E. A. Silva, P. Healey, N. Harris, & P. Van den Broeck (Eds.), *The Routledge handbook of planning research methods* (pp. 322–334). Routledge.

Geertman, S., & Stillwell, J. (2020). Planning support science: Developments and challenges. *Environment and Planning B: Urban Analytics and City Science, 47*(8), 1326–1342.

Goodman, R., Freestone, R., & Burton, P. (2022). Planning practice and academic research: Views from the parallel worlds. *Planning Practice & Research, 37*(4), 497–508.

Hansson, S., & Polk, M. (2018). Assessing the impact of transdisciplinary research: The usefulness of relevance, credibility, and legitimacy for understanding the link between process and impact. *Research Evaluation, 27*(2), 132–144.

Hurley, J., Lamker, C. W., & Taylor, E. J. (2016). Exchange between researchers and practitioners in urban planning: Achievable objective or a bridge too far? *Planning Theory & Practice, 17*(3), 447–473.

IPCC. (2021). *Climate change 2021: The physical science basis. Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change*. Cambridge University Press.

Kudo, S., et al. (2019). Moving towards transdisciplinarity: Framing sustainability challenges in Africa. In M. Nagao, J. L. Broadhurst, S. Edusah, & K. G. Awere (Eds.), *Sustainable development in Africa: Concepts and methodological approaches* (pp. 1–14). Denver: Spears Media Press.

Leedy, P. D., & Ormrod, J. E. (2021). *Practical research: Planning and design* (12th ed.). Pearson.

Lawrence, R. J. (2021). *Creating Built Environments: Bridging Knowledge and Practice Divides*. Routledge.

Mehling, S., & Kolleck, N. (2019). Cross-sector collaboration in higher education institutions (HEIs): A critical analysis of an urban sustainability development program. *Sustainability, 11*(4982), 1–24.

Mitchell, C., Cordell, D., & Fam, D. (2015). Beginning at the end: The outcome spaces framework to guide purposive transdisciplinary research. *Futures, 2015*, 86–96.

Muhonen, R., Benneworth, P., & Olmos-Peñuela, J. (2020). From productive interactions to impact pathways: Understanding the key dimensions in developing SSH research societal impact. *Research Evaluation, 29*(1), 34–47.

Neuman, W. L. (2020). *Social research methods: Qualitative and quantitative approaches* (8th ed.). Pearson.

Newiga, J., et al. (2019). Linking modes of research to their scientific and societal outcomes. Evidence from 81 sustainability-oriented research projects. *Environmental Science and Policy, 101*, 147–155.

Parnell, S., & Pieterse, E. (2016). Translational global praxis: Rethinking methods and modes of African urban research. *International Journal of Urban and Regional Research, 40*(1), 236–246.

Patel, Z. (2022). The potential and pitfalls of co-producing urban knowledge: Rethinking spaces of engagement. *Methodological Innovations, 15*(3), 374–386.

Popa, F., Guillermin, M., & Dedeurwaerdere, T. (2015). A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science. *Futures, 65*, 45–56.

Porter, L. (2015). Unsettling comforting deceits: Planning scholarship, planning practice and the politics of research impact. *Planning Theory & Practice, 16*(3), 293–296.

Simon, D., et al. (2018). The challenges of transdisciplinary knowledge co-production: From unilocal to comparative research. *Environment & Urbanization, 30*(2), 481–500.

Thondhlana, G., et al. (2021). Facilitating urban sustainability through transdisciplinary (TD) research: Lessons from Ghana, South Africa, and Zimbabwe. *Sustainability, 13*(6205), 1–18.

United Nations. (2023). *THE 17 GOALS | sustainable development*. Available at: https://sdgs.un.org/goals. Accessed 14 June 2023

Valencia, S. C., et al. (2019). Adapting the sustainable development goals and the new urban agenda to the city level: Initial reflections from a comparative research project. *International Journal of Urban Sustainable Development, 11*(1), 4–23.

Van Breda, J., & Swilling, M. (2019). The guiding logics and principles for designing emergent transdisciplinary research processes: Learning experiences and reflections from a transdisciplinary urban case study in Enkanini informal settlement, South Africa. *Sustainability Science, 14*, 823–841.

Van Niekerk, W., Pieterse, A., & Le Roux, A. (2020). Introducing the green book: A practical planning tool for adapting south African settlements to climate change. *Town and Regional Planning, 77*, 103–119.

Von Wehrden, H., Luederitz, C., Leventon, J., & Russell, S. (2017). Methodological challenges in sustainability science: A call for method plurality, procedural rigor and longitudinal research. *Challenges in Sustainability, 5*(1), 35–42.

Vonk, G., & Geertman, S. (2008). Improving the adoption and use of planning support systems in practice. *Applied Spatial Analysis and Policy, 1*, 153–173.

Westin, M., & Joosse, S. (2022). Whose knowledge counts in the planning of urban sustainability? *Planning Theory & Practice, 23*(3), 388–405.

Wiek, A., & Lang, D. J. (2016). Chapter 3: Transformational sustainability research methodology. In H. Heinrichs, P. Martens, G. Michelsen, & A. Wiek (Eds.), *Sustainability science* (pp. 31–41). Springer Science+Business Media.

Zheng, Z., & Sieber, R. (2020). Planning support systems and science beyond the smart city. In S. Geertman & J. Stillwell (Eds.), *Handbook of planning support science* (pp. 199–212). Edward Elgar.

Jacques du Toit holds a PhD in methodology and is an Associate Professor in the Department of Town and Regional Planning, University of Pretoria, South Africa. His substantive research interest is in urban sustainability, particularly water-sensitive planning and design, and his procedural research interest is in evidence-based urban planning. He teaches infrastructure planning, policy analysis and research methods, and coordinates final year research report and mini-dissertation projects. Part time he also conducts applied research and serves on various institutional and faculty level committees.

Amy Pieterse holds an MA in Town and Regional Planning from the University of Pretoria and is a Senior Knowledge Applicator in the Smart Places Cluster at the Council for Scientific and Industrial Research, South Africa. Her expertise includes climate change adaptation planning, mainstreaming, policy analysis, and local government planning. She has a specific research interest in how local governments use research and evidence in planning and policy, with a focus on adaptation. Amy is an innovator, developer and manager of the GreenBook (greenbook.co.za), a practical online planning support system for the development of climate-resilient South African cities and towns.

Sandile Mbatha is the National Chief Data Officer at the Department of Cooperative Governance and Traditional Affairs, South Africa, where he is responsible for establishing the National Strategic Hub. The core of his work is to integrate, transform, analyse and visualise country-level data to extract value for informing strategic decision-making on planning, resource allocation, implementation and monitoring. He is responsible for building the National Strategic Hub which is the country's single source of truth. Previously he served as Senior Manager, responsible for Data, Research and Policy Advocacy in eThekwini Municipality where he supported evidence-based policy development processes through city-wide research and strategic planning.