

Various Article

## Transdisciplinary Synthesis Research

### Challenges and Approaches of Impact-oriented Urban and Spatial Research

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#### Growth, change, and impact

Urbanization is one of the main drivers of change in the 21st century the global urban population is projected to grow to 6.7 billion people by 2050, meaning that 70 percent of the world's population will then live in cities. At the same time, 96 percent of urban growth is taking place in previously less-developed regions of East, South and Southeast Asia, and Africa. The physical extent of urban areas is growing even faster than their population (see Figure 1). However, cities are not only places of change and challenges, but can also be seen as an opportunity for sustainable and inclusive growth (BMBF 2021b; UN DESA 2018; UN-Habitat 2020: xvi; United Nations 2016: 6-7; United Nations 2019: 44; WBGU 2016a: 6).



Figure 1: Expansion of urban areas, Moganshan Road, Shanghai. Own photograph, Anika Slawski.

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In order to contribute to a sustainable urban development, concepts for the sustainable transformation of fast-growing regions are being researched at the federal level as part of the FONA strategy (research for sustainability) of the German Federal Ministry of Education and Research (BMBF) among others through the internationally oriented funding priority Sustainable Development of Urban Regions (SURE). In cooperation between science and practice, ten collaborative projects (SURE projects) elaborate in six different thematic focus topics locally adapted solution strategies for a sustainable use of resources and an increase in the quality of life in urban regions of Southeast Asia and China. (BMBF n.d.; BMBF 2021a; BMBF 2021b; SURE Website). The funding priority is accompanied by a networking, transfer, and synthesis project, which acts as transdisciplinary synthesis research (SURE Facilitation and Synthesis Research) and pursues, among other things, the aim of encouraging the scientific classification and synthesis of findings.

The authors are part of the SURE Facilitation and Synthesis Research and in this article, they assess how impacts in the context of sustainable development of urban regions can be observed. The impact to be captured is embedded in the context of global challenges, transdisciplinary urban and spatial research, and addressed by a comprehensive funding priority that includes ten projects and numerous interventions and actors. To achieve continuous learning processes and thus process quality, impact-oriented monitoring is proposed. Terms of impact research as well as established methods and models that are already used for impact monitoring will be introduced to comprehensively outline this argumentation. Based on this, approaches are derived for the conception of an impact-oriented monitoring in the SURE funding priority. As a part of the synthesis research, the task of the SURE Facilitation and Synthesis Research is to develop a reference and reflection framework (SURE Framework), whose conceptual approaches complete this article. A key challenge in the development of the SURE Framework is the transdisciplinary and intervention-oriented character of the SURE funding priority, which is why the theoretical framework for transdisciplinary urban and spatial research is outlined in the following part.

## When will we ever learn? The logic of transdisciplinary urban and spatial research

The SURE funding priority and the SURE projects are exemplary for a genuinely actor-oriented and transdisciplinary research approach, in the sense of Mode 2 research – according to Gibbons (1994) – in a context of application as well as definition of problems and beyond disciplinary boundaries. Whereas Mode 2 research is transdisciplinary, Mode 1 research generates knowledge based on basic research within its disciplinary boundaries and in the protected space of the respective institution as well as without compelling practical application. Mode 2 research, however, generates knowledge in a broad context. This knowledge is gained with the approach of becoming useable in economy, politics, and society. Mode 2 research is thus application-oriented in being the result of the interplay

between the need for a solution and the supply of knowledge and produces over the specific demand as well as the disciplinary boundaries socially and societally usable knowledge (Gibbons 1994: 4; Langemeyer 2021: 185–186). The SURE funding priority pursues these same approaches by gaining knowledge in multidisciplinary research associations that lead to technological, social, and societal innovations that can be implemented and, at best, scaled up. For the specific implementation, an independent project phase in the SURE funding priority (implementation phase) is planned. The research approach also emphasizes the importance of actor orientation. For this reason, not only researchers from different (scientific) disciplines, but also additional practitioners work jointly in the research process, either as a member of the project team or as external stakeholders. This represents an essential characteristic in the differentiation from transdisciplinary to interdisciplinary research (see Figure 2) (Defila and De Giulio 2018a: 10–11).

## RESEARCH

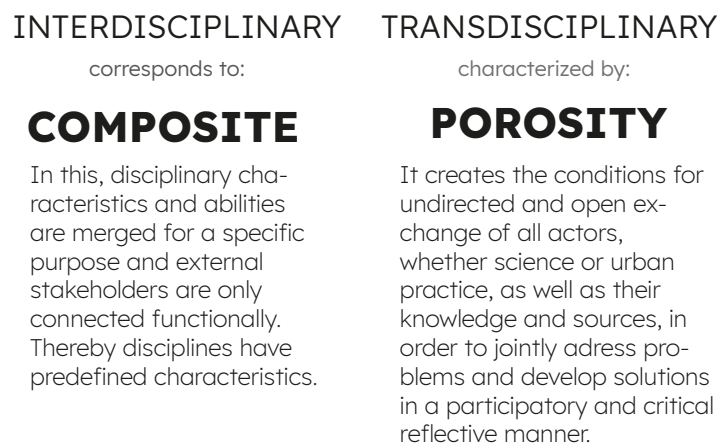


Figure 2: Interdisciplinary and transdisciplinary research. Own illustration, SURE Facilitation and Synthesis Research.

In addition, transdisciplinary research is closely connected to the notion of transformative science and sustainable urbanization. In Germany, the *Wissenschaftliche Beirat der Bundesregierung Globale Umweltveränderungen (WBGU, The German Advisory Council on Global Change)* refers in its report *Der Umzug der Menschheit: Die Transformative Kraft der Städte (Humanity on the move: Unlocking the transformative power of cities)* (2016) on the importance of generating knowledge through basic research testing theories as well as application-oriented research and implementation strategies to make global urbanization sustainable and achieve livable cities (WBGU 2016b). Research – here focused on urbanization and beyond in the context of coping with the climate change and achieving the Sustainable

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Development Goals – is understood as an active process of intervention that works directly in practice or indirectly through generating knowledge and learning. In conjunction with a concept of Mode 2 research, transformative research focuses on the close linkage between intervention, learning, and the generation of new bodies of knowledge and thus extends this to a broader understanding, which is then called Mode 3. This stands for learning processes of higher order, reflexivity, and reflectiveness in processes of change (Langemeyer 2021: 189). The emphasis is placed on research as a reflexive practice that generates insight for a change from an internal view of the systems rather than from an external view of the problem (Fazey et al. 2018: 58).

In specific terms, this approach is expressed in the transformative concept of labs (Reallabor), in which transdisciplinary research is expanded to the extent that the goal is no longer only to gain knowledge, but also to develop practical impulses and contributions for sustainable development during research (Parodi and Steglich 2021: 258). Thereby, there is a close relationship of transdisciplinary research to other forms such as action and intervention research (Defila and De Giulio 2018b: 44). Characteristic of action research is that the strategic approach in which the improvement of a practice, the improved understanding of the practice by its actors, and the improvement of the situation are linked as three goals. Essential for this is the (self-)reflection that emerges in feedback loops from a process of conception, action, observation, and reflection as well as knowledge – inseparably associated with the practice actors – that is derived and checked (Carr and Kemmes 2004: 165).

These and other formats build – in various forms and concepts – essential parts of the SURE projects and are therefore conceptually in the context of transformative and transdisciplinary research for sustainable urbanization. In this context, the transdisciplinary and transformative research practice will be critically discussed both conceptually and in terms of content. Besides fundamental questions about a normative turn in science, it is above all questions of the reference framework that offer the possibility to evaluate results and their validations (Strohschneider 2014: 186). Within the framework of the normative approach of the SURE funding priority, as in Mode 1 research (gaining knowledge through basic research), the question of objectifying the findings and their impact is of highest relevance. This question addresses both the research process as well as the outcome, which is not free of purpose and not only knowledge-oriented, but carries the claim of having a transformative effect. Transdisciplinary research is subject to a broader framework of criteria in terms of quality control and requires a process of reflection on the production of knowledge (Gibbons 1994: 4). A justification that by raising awareness on impact, the participation of the actors is already guaranteed by their participation itself is not sufficient here. Rather, questions of power relations (especially in funded research projects) and the handling of different forms of knowledge from the respective scientific disciplines and professional and political practice play a role which need to be clarified, so that new forms

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of knowledge can be used as expertise – in this case for sustainable urban regions – and not a kaleidoscopic structure of different elements (Langemeyer 2021: 189–190).

It is obvious that researchers must critically reflect on and make evident their actions, their decisions, and their normative attitudes, since these are necessarily embedded in, and not separate from, the systems they seek to observe (Fazey et al. 2018: 56–57). This is an aspect that can quickly become a practical test of endurance in the context of research projects with defined specifications from funding sources and the associated predefinition and evaluation.

In transdisciplinary research contexts, the task of accompanying research lies in providing a framework of reference in order to secure and to verify findings.

(Eckhart et al. 2018: 118f)

At best, this should allow the actors in this research process, reflection, and feedback loops in the sense of action research and generates insights and *learnings about the own action and its impacts*. Unlike in Mode 1 research, the criteria for assessing classical institutional and disciplinary frames of references must be supplemented. The WGBU calls for guiding transformative research by criteria derived from upcoming challenges. These, too, are to be respectively recorded and named as an input size for a framework of reference, to enable critical reflection on the impact and relevance of the new knowledge in transdisciplinary research contexts.

## Complexity and impact – a challenging relationship

In the understanding of science, impacts are all changes that occur after an intervention (*measure*) and unfold in change of structures, processes, or individual behavior. Impacts can be differentiated according to parameters like type of impact, the duration of impact or the level of the impact. In addition to expected impacts, i.e. impacts explicitly intended by the definition of the intervention's goal, and direct impacts, for which a clear cause-effect between the measures and the observed impacts is identifiable, unexpected and indirect impacts also occur (Reade 2008: 3–4; VENRO 2002: 35, 37–39, 51). Determining the impact of a project in a definite way is a complex task that often relies on higher-level and established procedures of monitoring and evaluation. Evaluation is understood as an assessment carried out as systematically and impartially as possible of an activity, project, program, strategy etc. (UN-Habitat 2018: 4). In the context of evaluation, social science methods are used to assess an object of evaluation according to certain criteria (e.g. effectiveness, sustainability) (Döring and Bortz 2016: 979; Rossi et al. 2004). In spatial development, an evaluation comprises an evaluative assessment of spatial interventions to draw conclusions for future action (Weith 2018: 624). In distinction to this, monitoring assumes a continuous function based on collecting and evaluating of data on relevant indicators to show information on actual

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development of predicted impacts and is performed internally. In the context of spatial development, the monitoring implies a cyclical viewpoint, in which spatial planning becomes an iterative learning process that enables reflection. In the context of spatial development, monitoring implies a cyclical approach in which spatial planning becomes an iterative learning process that allows for reflection, adapts to change, and evolves (Hanusch 2018: 1563–1565; UN-Habitat 2018: 4).

Even though established approaches exist (also in Germany), and evaluation activities have been increasingly observed in the field of urban and spatial planning in recent years, it is often stated that both acceptance and established methods for impact monitoring of complex programs are lacking, which find its reasons in the characteristics of spatial development processes (Bamberger et al. 2016: 44–45; Weith et al. 2019: 183, 185; Weith 2018: 623; Weith 2004: 245):

The application of an impact-oriented monitoring in urban regions shows theoretical and application-related as well as methodological challenges.

These include the diversified nature of problems, the large number of actors involved, the fullness of different spatial starting conditions, a range of physical and social changes, and a variety of direct and indirect impacts. Furthermore, spatial developments do not take place under laboratory conditions, which makes it difficult to – also due to long impact periods – record changes and the assignments of intervention effects almost impossible (Einig and Zaspel 2012: 31; Hanusch 2018: 1573; Kühn 2004: 39, 41–42; Weith 2018: 628–629; Weith et al. 2019: 186, 191). The process dimension of spatial interventions also complicates the documentation, analysis, and evaluation of impacts, so that the complexity of the planning process must be reduced for data collection or indicator evaluation. Qualitative changes as, for instance, learning processes, frame setting- and coordinating impacts or corporation activities are rarely recorded (Einig and Zaspel 2012: 31; Hanusch 2018: 1573; Kühn 2004: 41–42; Weith et. al 2019: 191). Moreover, western ideas and standards cannot be applied unquestioningly to cities in the Global South without adapting them to regional and local institutions, geography, and culture (Stiftel 2021: 433). Connected to the cultural context, Stiftel reflects on the New Urban Agenda (2016) of the United Nations:

“Most importantly, we must ask whether the assumptions about urban development and planning underlying the New Urban Agenda are sufficiently accurate to inform and guide positive urban growth and change. The empirical history of urban planning intervention in rapid urbanization contexts raises real questions about the efficacy of its underlying ideas [...]” (Stiftel 2021: 433).

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To capture impacts within complex processes of urban development, it requires a modification and further development of the existing theoretical and methodological instruments (Weith et al. 2019: 191). Particularly against the backdrop of urbanization and the associated spatial change, the question raised at the beginning of this article gains prominence: what could an impact-oriented monitoring in the context of transdisciplinary urban and spatial research for sustainable development of urban regions – especially in the SURE funding priority – actually look like? The overarching goal of *this* impact-oriented monitoring is to show the impact achieved in the planning as well as implementation process and to open up the possibility of intervening at an early stage to lead to process quality. An impact evaluation in the middle and/or after the completion of the projects does not seem to be very purposeful, since action-oriented and transdisciplinary research is based on the generation of knowledge through collective learning and that transformative research seeks current solutions with a long-term perspective. To arrive at *methodological* approaches of impact-oriented monitoring, established models will be looked at in the following part of this paper.

## Across theory – from methods and models

Classical evaluation research was developed in education in the 1940s (Watras 2006: 1–2). In contrast, the orientation towards the monitoring of impact is a rather young field of activity within the evaluation research. Nevertheless, various methods of the impact monitoring established in medical research, social welfare, development research, and other fields over the past decades. In the field of urban and spatial planning, only a few examples of models and methods that operate in the context of sustainable urban regions can be found. The impact-oriented monitoring of the SURE Facilitation and Synthesis Research can therefore not fall back on comparable empirical values from the literature, although certainly there are starting points through established theoretical models in the fields mentioned above.

The starting point of an impact-oriented monitoring is often a *logic model* that shows the relationship between a programme's activities and its impact or results (Julian et al. 1995; Kaplan and Garrett 2005; Wyatt et al. 2013; McLaughlin and Jordan 1999, quoted after Chen 2015: 80). A logic model comprises an impact chain consisting of *inputs*, *activities*, *outputs*, and *outcomes*. Here, inputs are defined as resources (e.g. money) that are brought into the programme. Activities include, for instance, services that the programme provides or contributions to meet programme goals. Outputs are defined as the direct products of program activities (for instance, number of clients served). In addition, a logic model includes outcomes as those benefits that result from programme activities (for instance, improved health). Logic models are adapted and specified depending on the context, so that in some models, outcomes are differentiated into short-term and long-term outcomes. In other models, long-term outcomes are also referred to as impact in the sense of long-term impact. Logic models are linked by a chain of *if-then* statements (cause-effect relationship), whereby

impact hypotheses about expected impacts are formulated in advance (Chen 2015: 59). A frequently-used and established logic model is the *Log Frame Approach* which became the binding standard for impact evaluations by *Deutschen Gesellschaft für Technische Zusammenarbeit* (GTZ) in the 1980s (Roduner et al. 2008: 5). In the planning process of the Log Frame Approach, the intended impact of a project is condensed to a simplified and linear impact model. Core elements and the mode of operation are summarised in a standardized matrix, whereby defined goals, results, and changes can be followed (Roduner et al. 2008: 4,8).

Criticism of the causality of the Log Frame Approach, in particular, has led to international organizations such as the United Nations increasingly having used the *Theory of Change* for the monitoring of impact since the 2010s (UNDG 2016: 3; UN-Habitat 2018: 9–10). The Theory of Change articulates assumptions about the process by which changes occur and specifies the type and way in which all required short- and medium-term outcomes are brought and documented in relation to achieving the desired long-term changes. In the process of Theory of Change, a *path of change* emerges that illustrates the relationship between actions and outcomes and how outcomes are linked over the life of the project. Based on an overall objective as well as project objective, *preconditions* that the project must achieve are defined so that the impact objective can be reached at the next level (Anderson 2005: 1,3). At the end of the process, an *impact tree* develops with long-term goals, preconditions for achieving the goals and several successive impacts (Anderson 2005: 12, 35; Clark and Taplin 2012: 2–3).

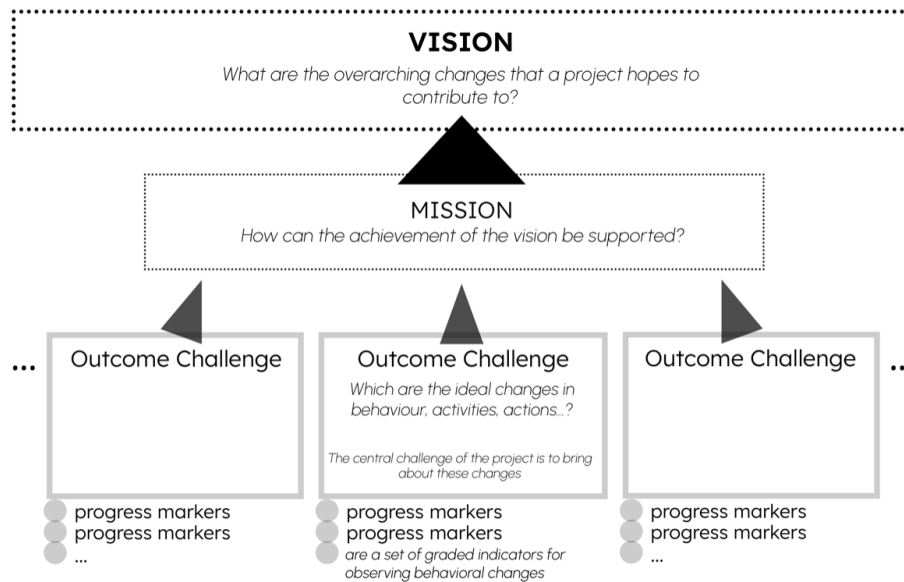


Figure 3: Key elements of Outcome Mapping. Own illustration, SURE Facilitation and Synthesis Research, based on: Earl et al. 2001 and Hearn 2015.



The question of the specific achieved results in international development cooperation also leads to the use of Outcome Mapping (see Figure 3) (Roduner et al. 2008: 3). The Outcome Mapping focuses, as the name already suggests, on the observation of achieved outcomes and concentrates in particular on the relationship between human behaviour and their environment. Here, the importance of a change of state as the overarching goal of a programme is not belittled but argues that for every change of state a correlating change in human's behavior can be observed (Earl et al. 2001: 1–2). The method of Outcome Mapping is primarily applied when the focus is on human-centered development and on the stakeholders involved (Jones and Hearn 2009: 1–2). In the context of Outcome Mapping, it is assumed that non-linear activities lead to changes, which is why no explicit assignment of interventions is made (Earl et al. 2001: 12). For reflection and for regular monitoring, three survey methods are used: the Strategy Journal with Strategy Maps, the Performance Journal with Performance Maps, and the Outcome Journal with Progress Markers. Progress makers are a set of graded indicators used to determine behavioural change and are being recorded in the Outcome Journal. They are used to systematically collect information on the achieved change (ibid: 54, 76, 89).

The Log Frame Approach and the Theory of Change are both based on a cause-effect relationship and, when applied effectively, serve as a basis for high-quality impact-oriented monitoring, through which the (causal) relations of the impact of programmes can be observed.

Mayne 2012, quoted after Freer and Lemire 2019: 341.

Although logic models reduce complex projects to meaningful and manageable components, in practice they nevertheless exhibit different degrees of complexity. While classical logic models draw a relatively rigid framework, differentiated models attempt to not only answer the question if a programme has an impact but above all where and how it operates (Dössegger et al. 2017: 100–101, quoted after Balibasa and Diller 2019: 197–198). A major criticism of the Log Frame Approach lies in the strong reduction of complexity, which results in the attempt to represent the cause-effect relationship in a simplified way. This reduction of complexity is made to account for the so-called *assignment problem*, meaning that impact, if detectable at all, can only be determined delayed or conditionally, and that the impact achieved cannot be attributed to specific inputs or activities (Earl et al. 2001: vii). Therefore, a Log Frame Approach can often be used to describe *how much*, but not *how* and *which* inputs, activities, or outputs the respective outcomes achieve (Freer and Lemire 2019: 340). An effect observed in the field of development cooperation during the application of the Theory of Change is the definition of vague or too generic assumptions. One reason for this may be the difficulty of balancing the perceived need for simplification with the real context of the programme. Additionally, there is the challenge of making explicit and detailed assumptions without disregarding risks or other environmental impacts. In contrast to the

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Log Frame Approach and the Theory of Change, Outcome Mapping does not pursue a cause-effect relationship and focuses on outcomes that can be determined directly or in medium-term and not on long-term effects (or impact). In this context, Outcome Mapping requires the permanent adaptation of programmes to their environment. For this reason, project impacts are much more difficult to predict than when using the Log Frame Approach or the Theory of Change and require a constant reflection, adaption, and iterative learning by the project teams (Roduner et al. 2008: 4, 16). What the models have in common is that they are used as a framework for monitoring impact, that they include indicators to measure impact – even if these are of different nature – and that they follow a participatory approach.

Since the listed models include different strengths and weaknesses, users are facing the challenge of using the advantages of several models through so-called hybrid or synthesis models (Bakewell and Garbutt 2005). These include the joint consideration of the Log Frame Approach and Outcome Mapping (Roduner et al. 2008: 4, 16) and the synthesis of the Log Frame Approach and the Theory of Change (Freer and Lemire 2019). Freer and Lemire thereby notice that the attempt of combining several models often results in the application of two models standing side by side, whose mutual integration is forgotten. Therefore, they propose a handling in which the individual models are not viewed as *authorities* but rather as collaborative and supportive tools that can be used in parallel by programs to explain and implement more comprehensively (Freer and Lemire 2019: 344–345). This approach seems particularly purposeful in the context of the normative turn of transformative research and the overcoming of the tension between scientific excellence and social relevance. Only by integrating these two aspects of scientific excellence and societal relevance can research be performed responsibly and thus contribute to sustainable development (Feretti et al. 2016: 6). Following the understanding of Freer and Lemire, the developed SURE Framework, whose methodological approach described in the following part, is based on a synthesis model.

## The SURE framework – criteria and culture, references and reflection

Assessment in the sense of evaluation, executed by external advisors that carry out an independent examination of the impact, is not a task and subject of the SURE synthesis research. In the context of transdisciplinary research, impact-oriented monitoring rather pursues the goal of constantly qualifying the interventions in the sense of action research, becoming aware of changes, analysing their causes, and initiating internal as well as ongoing reflection and learning processes, in order to strengthen intended impacts and be able to react to unexpected impacts on short notice. Accountability to donors plays a subordinate role in this context (Döring and Bortz 2016: 979; UN-Habitat 2018: 4; VENRO 2010: 5–6; VENRO 2002: 34, 40–45, 50–55). It is the goal of the SURE synthesis research to make both the impact of the individual SURE projects and of the funding priority visible. The SURE Framework therefore supports the individual projects in monitoring, identifying and

optimizing their self-set impact goals and enables reflection on the impact process. At the same time, the SURE Framework creates the preconditions for highlighting the holistic impact of the SURE funding priority, i.e., the long-term outcome of new concepts and solutions for the development of sustainable regions in Southeast Asia and China.

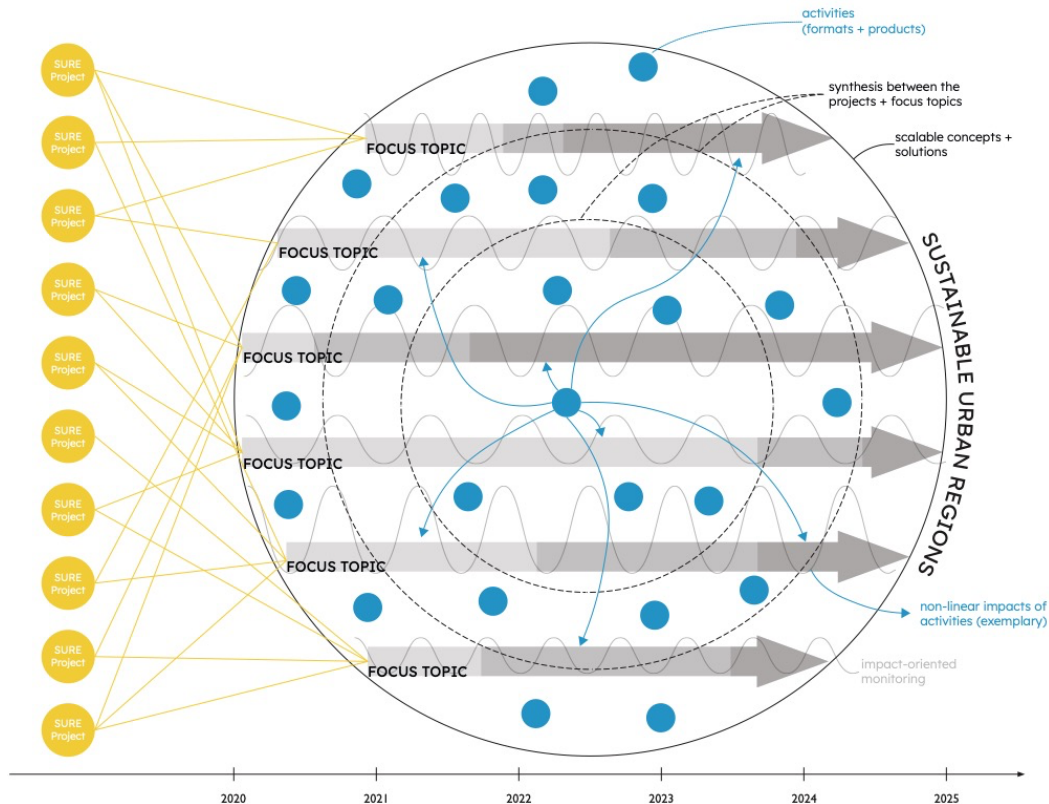


Figure 4: SURE reference and reflection framework (SURE Framework). Own illustration, SURE Facilitation and Synthesis Research.

The architecture of the SURE framework (see Figure 4) therefore includes both the project level and the level of the funding priority. Since the impact of the funding priority results from the effective approaches of the SURE projects, the two levels are linked inseparably. The SURE projects work visibly through activities and outputs (formats and products) on the six focus topics that contribute to the achieving of the long-term outcome of the funding priority. The activities and outputs are made possible by the input of the BMBF, as it provides the SURE projects with resources. The SURE projects, for their part, aim to have an impact by developing concepts and solutions within the framework of the focus topics and the respective spatial contexts. These local-specific outcomes on the level of the focus topics can be considered as medium-term impacts and preconditions, whereby each SURE project defines the outcomes to be achieved by itself. The outputs of the SURE projects contribute

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non-linearly and not only to a single outcome but may unfold their impacts in retrospect or become relevant again at a later stage.

The impact of the individual focus topics increases over the course of the funding period and will be strengthened by exchange and cooperation between the SURE projects and by content synergies. If a project-specific concept becomes applicable beyond the project through synthesis measures and can thus be *scaled up*, there is an impact of the SURE funding priority, which goes beyond the spatial focus of the individual SURE projects. The impact-oriented monitoring is part of the SURE framework and is done on an ongoing basis for the six focus topics.

This monitoring requires both criteria (references) and a culture (reflection): In the next step of the development of the SURE Framework, the actual references of all ten SURE projects will be highlighted, for which the SURE Facilitation and Synthesis Research will conduct a qualitative questionnaire. A result of this survey *could* be that in the focus *topic sustainable behavior and action* a sustainably changed energy use pattern is targeted. Another example could be that in the focus topic *integrated planning and development* impact is to be achieved through the implementation of information-based planning decisions.

Once all references have been highlighted, the ability to reflect and the associated culture of reflecting on one's own actions, to intervene and possibly change the approach arises. Only through such a culture, a dynamic framework can be created that ensures feedback, learning and renewal processes and thus the best possible achievement of the references. The impact-oriented monitoring includes for the purpose of this reflection a portfolio of tools and methods to allow dynamism, flexibility, and adaptation to the various thematic and local contexts of each SURE projects. Since each of the ten SURE projects has different necessities, a variety of different tools of reflection are provided. The toolbox makes use of established methodological approaches of the Log Frame Approach, the Theory of Change, and the Outcome Mapping. An example for a tool could be – besides the already introduced such as the Outcome and the Strategy Journal – the *Historical Scan*. Here, in a timeline the most important milestones, turning points and shifts, high and low points are drawn in, in order to derive findings for the future planning of the project (Earl et. al 2001: 25). Through another tool preconditions are highlighted, to achieve an explicit, but more long-term goal. Through this process of *Backwards Mapping* an impact tree arises that concretizes the steps of the target achievement (Anderson 2005: 12,35; Clark and Taplin 2012: 2–3). Tools like these are available to SURE projects on an ongoing basis once they have been introduced and tested through a collaborative workshop.

The SURE framework is currently in the early stages of development whereby its architecture will be filled with life in the next step. After the references have been highlighted, the tools

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will be used to develop an individual methodology for the culture of reflection and thus the project-specific reference and reflection framework.

The urban challenges presented at the beginning of this paper, the theoretical framework on transdisciplinarity, and the models outlined make it clear that there is no blueprint for an impact-oriented monitoring in the context of urban and spatial research for the sustainable development of urban regions.

The approach of the SURE synthesis research to emphasize effective interventions and methods is a processual one, in which references are sharpened, progress is continuously reflected and for this purpose, needs-adapted tools are provided. However, although the complexity of the framework makes a uniform solution difficult, urban, and spatial research must set out and prove that their interventions and strategies work, make them transferable and, above all, bring them into practical applications.

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