Robert Bosch Stiftung

Participatory design of people-centered cities

Mapping of scientific research and relevant theories, scientists and actors

Final report

July 10th 2019 | Rotterdam, The Netherlands

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Preface

In the upcoming three decades, global settling dynamics will heavily influence whether or not we will be able to transform our habitats in a just, sustainable and livable way. The successful implementation of the Agenda 2030 will primarily be decided in our cities. Science and research play a pivotal part in this mission by fostering society-related research questions, developing practical solutions, generating visionary ideas, and assessing their effectiveness. In order to play this role, we are convinced that an active empowerment and engagement of citizens, administrative bodies, civil society, and decision-makers in the scientific discourse is indispensable.

At the Robert Bosch Stiftung, we determined participatory design as an important aspect within our work in the area of "Transformative Urban and Rural Spaces". From a scientific point of view, the idea of social based design has great potential, with many questions still unanswered. We are particularly interested in these questions at the interface of science and urban practice.

Therefore, in 2019, we engaged a mapping in the field of participatory design creating value for urban societies. We wanted to look at theories and models that have the capability to generate measurable impact on urban challenges and stimulate sustainable urban transformation.

In the Dutch Research Institute for Transition (DRIFT) we found an excellent scientific partner who brought in their wide expertise in the field of transformation and transdisciplinary research as well as their broad experience in urban research.

The compiled mapping not only identifies the key academic actors and institutions, the state-of-the-art theories, models and methods but also includes possible future research pathways in the field of participatory design of people-centered cities. It proofs that participatory design is an interdisciplinary theme, which builds upon very different bodies of knowledge and varying communities, bringing together knowledge and research results far beyond boarders of traditional academic approaches.

We are pleased to share these results in order to help address the urban challenges we are facing.

Robert Bosch Stiftung
Science and Research
Transformative Urban and Rural Spaces

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Key findings

The 'field' of Participatory design of people-centered cities (PDPC) is not (yet) existent as such. It is not recognized as a delimited field of research or knowledge. Instead, the majority of interviewed experts consider PDPC as an interdisciplinary theme or set of methods and practices, which builds upon very different bodies of knowledge and scientific communities.

The key bodies of knowledge and scientific communities informing PDPC work are:

- Communicative and collaborative planning
- Citizen Science
- Community Psychology
- New Urban Governance
- Urban (co-)design
- Sustainability Transitions
- ICT & Smart Cities
- Transdisciplinarity
- Urban Sociology, Geography, Design, History

A table with a global representation of scientists and academic institutions that conduct state-of-the-art scientific work on key aspects of PDPC is provided. Their work is characterized for example by:

- Being theoretically informed by the rich historical tradition in urban studies.
- Having a future orientation, including envisioning and development pathways.
- Taking an inter- or transdisciplinary and multi-actor research perspective.
- Applying participatory approaches, co-creating, and co-designing (urban) futures.
- Following a sustainability and/or resilience and/or urban justice agenda.
- Taking a spatially explicit or place-based approach to sustainable urban transformation.
- Having a coupled understanding of place change as a co-evolving phenomenon.
- Acknowledging interrelated levels or scales of influence in urban transformation.
- Setting human well-being, the quality of life and inclusive places center stage.
- Starting to make use of big urban data, digital decision-support tools and ICT.
- Considering the uniqueness of places and cross-cultural differences between contexts.

The key urban challenges (to be) addressed with PDPC are presented along four categories:

- Sectoral
- Processes
- Social
- Coupled

Four main rationales why tackling these challenges with a PDPC lens are presented:

- Co-creating sustainable urban futures as a design challenge.
- Participatory design as a tool for citizen involvement and decision support.
- Bringing back the human focus into the digital cities approaches.
- The inter- and transdisciplinary manner and future orientation.

Recently developed methods are described in the following clusters:

- Platforms to experiment with and co-create sustainable solutions for cities
- Urban imaginaries and approaches of envisioning
- Participatory digital methods, citizen science and the Smart City
- Collaborative and participatory planning and design methods
- Further examples of relevant methods such as the community champions approach

Relevant theories and conceptual models are summarized, for example:

- Peer-to-Peer Urbanism
- Tactical urbanism and Urban acupuncture
- Urban Citizen Design Science
- Urban social capital framework
- Sense of place and urban transitions model
- Urban social sustainability framework
- Framework for adaptive co-management and design

Diverse relevant theories, methods and conceptual models have been developed by the "traditional fields" addressing urban change, such as Urban planning and design, Urban sociology, and Urban Geography. These works provide a rich body of knowledge that should be acknowledged when further developing the emerging theme of PDPC. Their analysis was not part of this study.

Eight future research themes and trends for PDPC are presented:

- Urban commodification and financing the city
- Democracy, just processes and inclusive cities
- New urban governance & institutionalization of novel practices
- Digitalization, Smart Cities and participatory design
- Scale and multi-scalarity in urban transformations
- Capacity-building and educating the future generation of urban experts
- Science-practice collaborations in transformative urban research
- Impact evaluation of participatory design of people-centered cities

Three critical perspectives on PDPC are identified:

- "Type of participation": Future participatory work in cities is not about more participation but about just, inclusive, legitimate and impactful participation that matters to people and their cities.
- "Understanding of Design": Design is often still considered as a series of incremental steps of improvements, often manifesting in (urban) artefacts. However, the idea of having design contributing substantially to the sustainable and livable urban systems of the future requires an understanding of design that fundamentally questions the existing social practices, cultures and structures, aiming for deep-structural changes in cities.
- "Responsibilities in urban governance": One of the key challenges in overcoming path-dependencies of the current urban development is a serious lack of responsibilization in urban governance in general, and in urban policy-making in particular. Current ways of participatory urban development need to critically reflect how to address aspects of 'taking responsibilities' for the future of the urban realm and the necessary transformative capacities to be build up.

1. Project objective

The main objective of this project is to compile a comprehensive mapping of the scientific research at the interface of science and urban practice across disciplinary boundaries, identifying the key academic actors and institutions, the state-of-the-art theories, models and methods as well as future research themes in the field of participatory design of people-centered cities.

2. Introduction & background

It is increasingly being recognized that urban areas worldwide face some of the most pressing sustainability challenges regarding energy consumption, air and water pollution, urbanization and livability in general (McCormick et al. 2013). At the same time, cities have started to design and deploy localized responses to address these transformative pressures. In fact, latest research has pointed to the importance of cities in transition processes arguing that urban areas do contain the necessary resources, spaces as well as interconnectedness of various actors, sectors, and infrastructures that will help stimulating deep transformations towards more just, livable and sustainable urban habitats (Frantzeskaki et al 2017).

The persistent urban challenges and the urgently needed transformative responses in and from cities are addressed in international policy plans such as the UN-Habitat New Urban Agenda, the EU Urban Agenda, and the UN Sustainable Development Goals. These plans strongly emphasize the role of inclusiveness and participation of diverse urban actors in creating city futures collaboratively. Such processes of participating in the design of urban habitats has, in principle, been seen as a "cornerstone of democracy" already for decades (Arnstein 1969, p. 216). Diverse scientific disciplines have contributed theory and practice-oriented approaches that address the challenges of co-designing cities for human well-being. Nevertheless, research on participatory approaches to pressing urban challenges and new ways of collaboratively designing solutions for the urban fabric remains a flourishing and further expanding field.

"It is clear that transforming our world for the better means transforming our towns and cities. That means better urban governance, planning and design."

UN Secretary General Ban Ki-moon, 2016

Designing such solutions is one of the core elements of participatory design for cities, an evolving theme situated at the science-practice-policy interfaces. This interdisciplinary theme builds on different knowledge sources from disciplines such as Design studies, Urban design and planning, but also includes knowledges from different Social sciences, Human Geography, as well as Citizen Sciences and Governance studies. Integrating these knowledge sources requires a broad understanding of design as a means to co-create societal transformation and to navigate through complex, multi-actor challenges of public interest in cities (Rodatz & Smolarski 2018). The notion of people-centered cities originates from the context of designing and planning for smart cities. It emphasizes that urban planning and designing for smart city solutions should be informed directly by the needs, desires, habits and practices of people and include local communities.

This study conceives Participatory design of people-centered Cities (PDPC) as a theme that draws upon different bodies of knowledge across disciplines and scientific fields. In recent years, a diversity of new theory, methods and procedural frameworks have evolved, which can be considered as contributions to a possibly emerging PDPC field. For example, within the Smart City research community, scholars have pointed to the role of participatory design techniques in order to address appropriate ways of combining big data with the tacit knowledge from citizens in participatory urban planning processes (Moore & Elliot 2016), while Fredericks (2018) presented new ideas of integrating pop-up urbanism with participatory interventions, by applying digital and analogue media for inclusive community engagement (Fredericks 2018).

In the context of citizen-centered design tactics, Andreani (2018) recently presented a design research model towards human-centered smart cities, which also points to new methodological attempts to link speculative scenarios with urban interventions. Likewise, novel approaches such as 'Participatory design visioning' (Gaziulusoy & Ryan 2017) and conceptual novelties such as 'crowd-creative urban design' (Mueller et al. 2018) are emerging. When mapping relevant scientific knowledge about participatory design of people-centered cities, recent contributions from neighboring scientific fields also come into play. Conceptual research on spatial co-production (Watson 2014), urban transition labs (Nevens et al. 2013), urban living labs (von Wirth et al. 2019), participatory urban governance (Certoma et al. 2015), design for sustainability transitions (Ceschin & Gaziulusoy 2016), design thinking for urban transformation (Stimmel 2015), but also novel forms of design studios, and urban planning charrettes (Kennedy 2017) aim to provide new platforms and frameworks in order to include different types of knowledges, and to create impact through co-creation and design on the livability in cities.

Given the diversity of new emerging research in the field of participatory design of people-centered cities, mapping the current research landscape creates an important fundament to build further research and funding activities upon.

3. Approach & Mapping procedure

This knowledge mapping was conducted over a project period of 4 months between March and June 2019. Our work followed a systematic procedure structured into three work packages (WPs). In WP 1, we focused on collecting the relevant insights from academic experts in a series of semi-structured interviews, while complementing these and other insights with additional information from a 2nd round of verification interviews with hybrid institutions and urban frontrunners at a later stage. In WP2, we conducted a systematic literature review across different bodies of knowledge and across different disciplines in addition to a systematic review of international EU funded research projects as well as conference themes related to field of PDPC. The third WP guaranteed the project management and reporting as illustrated in Figure 1. In terms of the key deliverables, this mapping provides answers to three main guiding questions:

1. **Who are the relevant scientists and academic institutions as well as practice oriented think tanks in the field (or theme) of PDPC?;**

2. **What are the addressed problems and the methods, theories and models currently being relevant for the theme of PDPC?; and**

3. **What are trends and future research themes of academic work in PDPC on an international level?**

In order to give answers to these guiding questions, we describe our approaches in more detail below.

Figure 1: Procedure of conducting the knowledge mapping

Procedure of expert interviews with scientific experts and hybrid institutions (WP1)

We conducted two rounds of expert interviews. During the first round we interviewed leading scientists currently working on research topics such as participatory design, urban governance, urban sustainability transformations, urban design, or urban planning in different world regions. Based on a semi-structured interview questionnaire, we conducted n=9 interviews. The majority of interviews was carried out in personal conversations via skype, two interviewees filled out the questionnaire remotely. The interviews lasted between 40-70 minutes and addressed the state-of-the-art research themes, theories and models as well as the key actors and institutions. We also asked for additional academic and hybrid institutions in the field and identified the main objectives aimed for and assumptions taken in the field of PDPC.

During the second round of interviews, we spoke with leading experts and innovative pioneers from urban practice as well as with representatives from hybrid institutions that combine applied research with participatory processes and social challenges in cities. We asked them about their experiences with participatory processes in practice, how their practices address social outcomes, the methodologies they apply, how they verify methods and concepts for their practical applicability and their prospects with respect to the role of PDPC towards livable and just cities. These interviews lasted between 30-60 minutes and were also guided by a structured interview guideline that contained seven questions.

Procedure of the systematic review of literature, projects & conferences (WP2)

Systematic Literature review

We conducted a systematic literature review and used the SCOPUS database to get to a final selection of n=25 scientific articles. The literature review was carried out in two steps. First, we identified scientific articles, conference papers, books and book chapters published between 2010 – 2019 with diverse combinations of the following search terms: participation or participatory design, people-centered cities, co-creation, urban transition, inclusive city, smart city or cities, collaborative planning, communicative planning, human-centered cities, social sustainability, urban transformation. We then retrieved a collection of n=177 relevant documents. Within this first collection we searched with additional keywords as for example retrieved from the first round of expert interviews (WP1). This led to a collection of n=70 documents.

For this list, a "light content analysis" was conducted, which included documenting and analyzing title, abstract and the document keywords as well as the author's affiliations. In a second step, for reasons of efficiency, the sample was focused to n=30 relevant papers. To reduce the sample of literature for a detailed analysis, we used the insights from the expert interviews in WP1. Based on the analysis of the first round of expert interviews, and including guiding principles provided from the Bosch foundation, we selected the subsample which particularly addresses procedural and social aspects of urban transformation. With the 'short list' of n=30 articles, we conducted a refined, more detailed analysis in order to describe and understand the relevant scientific theories, models and methods as well as their potential (or verified) impact upon urban challenges. The list of identified papers can be found in Table A3 in the Appendix.

Systematic procedure of reviewing EU projects and conference themes

We conducted a systematic mapping of large research projects related to PDPC aspects in EU funded projects between the year 2010 and today. Moreover, we carried out a review of the current themes at international conferences in the field. For the mapping of the EU-funded projects, a systematic search procedure in the CORDIS database was conducted. The Community Research and Development Information Service (CORDIS[1] is the European Commission's database containing ongoing and past projects funded by the EU's framework programs for research and innovation. It holds extended information on the EU funded projects such as factsheets, participants, reports and links to open-access publications. A set of diverse keywords were used for example 'participatory design', 'urban regeneration', 'co-creation', 'social cohesion', 'people-centered cities', or 'capacity building for local communities' in different combinations to generate the set of results. A total of n=1077 EU-funded projects were found with the used keywords, of which n=30 relevant projects were explored in more detail. The largest amount of EU projects was retrieved with the keywords of 'capacity-building for communities' and 'co-creation' in combination with 'cities' or 'urban', while no results came up for the keywords 'people-centered cities' or 'human-centered cities'. This suggests that the notion of 'people-centered cities' is still relatively new, while co-creation and capacity-building for urban communities are more established principles.

With regards to the systematic review of conference themes, we identified international conferences based on a search procedure with keywords directly linked to the theme of PDPC. We also scanned meta-websites[2] listing (international) conferences sorted by topic to identify relevant conferences taking place in 2019 or in the near future. A total of n=15 conferences were selected to be explored in more detail. Conference websites were then used to gather information on the conference main theme and program, the date and location of the conference, and keynote speakers.

1 https://cordis.europa.eu/about/en

2 For example: https://www.worldconferencealerts.com/urban-studies.php

4. The emergence of an interdisciplinary theme

The underlying scientific communities and bodies of knowledge

A first insight is the general feedback from basically all interviewed experts that the 'field' of Participatory design of people-centered cities (PDPC) is not (yet) existent as such. Most of the experts did not recognize it as a delimited field of research or knowledge. Instead, the majority of interviewed experts considered PDPC as an interdisciplinary theme or set of methods and practices, which builds upon very different bodies of knowledge and scientific communities. This interdisciplinary and emerging theme resonates strongly with recent developments to reconsider a 'new (transformative) urban science'. One of the interviewees provided a convincing short definition:

When considering a diversity of bodies of knowledge influencing PDPC, we summarize some of the key scientific fields that were mentioned during the interviews as well as informed by the literature review in the following Figure 2. This illustrates the diversity of perspectives and scientific bodies of knowledge coming into play, when establishing future research tracks.

PDPC addresses "Urban development that puts people at the heart of cities – both in terms of process and the objectives of urban design, planning and implementation."

Prof. Lars Coenen, Melbourne

Figure 2: Scientific bodies of knowledge informing PDPC, following the expert interviews and a systematic literature review. (Please note that this figure does not claim to be exhaustive, as diverse as PDPC is a highly interdisciplinary, emerging field that builds upon several influences)

The emerging theme of Participatory design of people-centered cities

In the application of participatory design to 'the urban context', more emphasis has been put on the interactional aspects of design. This held particularly true when involving communities and local stakeholders in place-making, urban regeneration efforts but also addressing the co-design of materialized artefacts for example in the context of public interest design as an element of architectural practices. Several interviewees addressed the evolution of the concept of participatory design towards the more frequent use of the notions of co-design or co-creation nowadays. Participatory design was related in the past to a more passive involvement of users, citizens or civil society compared to the more inclusive and empowering aspects around co-creating. Ideally, as one of the interviewees describes it, a participatory design process leads to some form of social innovation and addresses multi-actor power dynamics. This social focus of participatory design for cities resonates with a large body of knowledge around (new) urban governance processes and work that has been conducted on communicative & collaborative planning.

Another developing body of knowledge mentioned by several interviewees in the context of PDPC is that of (urban) sustainability transitions. This field emphasizes the urgency and need for more fundamental transformation of thinking, doing and organizing in spatial planning and urban development processes to guarantee sustainable outcomes for the urban future. This body of knowledge builds on complexity science, systems thinking and focusses on long term visions and how these can be achieved by short term interventions in the cultures, structures and practices of urban contexts.

Participatory work towards people-centered cities does also build on principles and ideas from the field of Citizen Science, which is sometimes also referred to as crowd-sourced science and overlaps with principles of participatory action research. Despite the absence of a single definition, citizen science revolves the idea of scientific citizenship, which addresses the claimed necessity of opening up science and science-policy processes to the public. The outcomes of these processes are supposed to lead to advancements in scientific research, as well as an increase in the public's understanding of science. We also see a relevant link to the research field of community psychology, which addresses the individual and social contexts within communities and often includes a local, spatially embedded perspective. This also involves studying the relationships of the individual to communities and society in order to understand and enhance the quality of life of individuals, communities, and society through collaborative research and action.

Cross-cutting these bodies of knowledge, more recently, the emphasis seems to move towards the transdisciplinarity (td) of participatory design and td-based science-practice collaborations in urban contexts. In processes referred to as co-design, collaborative design, cooperative design, or td-based real-world research, different disciplines, expertise, experiences and types of knowledges are valued and integrated. In these formats, citizens and other actors are invited to participate in and co-create for their immediate living environments. Some interviewees directly referred to the origins of the 'people-centered cities' in the context of designing and planning for 'smart cities', addressing the increasing scientific critiques around the ICT focused Smart City concept. Such critiques revolve around the idea that urban planning and designing for smart city solutions should be informed directly by the needs, desires, habits and practices of people, rather than being driven by the application of new ICT technologies in urban environments and the generation of business cases thereof.

This collection of bodies of knowledge presented here, which feeds into the emerging theme of PDPC, does not claim to be exhaustive. In particular, we are fully aware that there is a long research tradition and diverse relevant knowledge sources from the established fields of Urban Sociology, Urban Design and planning, Urban History, Urban Geography and others. Yet, providing a synthesis that even traces the emerging field of PDPC back to its roots in these traditional "urban research fields" was beyond the scope of this mapping project. Still, we would like to emphasize that the rich literature from these research traditions plays an essential role when identifying guiding theories and future research pathways for people-centered cities.

The concepts of 'participatory design' and the 'people-centered city'

While the concept of 'participatory design' builds on an evolution within design studies (from product design to architectural and urban design), the notion of 'people-centered cities' is less established (or instead referred to as human-centered cities). Participatory design has a long-lasting tradition in the Design studies (Sanders & Stappers 2008). Traditionally, the participatory aspect referred to the involvement and feedback of the end-users in the design of for example industrial products or in the context of designing for the built environment (i. e. architectural and urban design).

Gradually, the focus within design studies has expanded also to the human interaction and processes of change as outcomes of (co-) design. In this perspective, the material artefact is a boundary object of the actual design process and both process and outcome are somewhat equally important. Recent notions such as (participatory) social design and policy design refer to a shift towards more integrative understandings of the goal and means of design processes. For example, when designing for policy or social impacts, enriching social interaction becomes a goal as such, while social interaction remains rather a means in participation for designing urban artefacts, e. g. a public space in a city.

A long tradition of participatory design within design studies can be traced back for example to work of Prof. Pelle Ehn and colleagues from the Scandinavian School of Participatory design (originally referred to as 'cooperative design'). For example, as part of a post-war political movement to strive for better industrial working conditions, trade unions and metal workers got involved in the research process to collaboratively re-design technical and organizational work environments. This tradition built upon principles of participatory action research and systems thinking and its followers emphasize for example the importance of the democratization of decision making, e. g. giving people influence on matters in their everyday lives.

Participatory design can be located between the domains of 'research-led' versus 'design-led' (Sanders & Stappers, 2008). It therefore can be considered as inherently driven by real-world, practical challenges to (co-) design artefacts and human interaction and organization, starting from what is already existent. On the other hand, participatory design is partly also research driven, seeking to identify radically new solutions to prevailing challenges. Participatory design can be clearly associated with design approaches that consider users (or: urban actors) as partners in conducting the design research and actions, rather than conceiving these users solely as research or design subjects.

The notion of 'people-centered cities' resonates with an earlier established concept of human centered cities, which emerged in the context of the seminal scientific work by Jane Jacobs and in practice by Jan and Ingrid Gehls (Gehl Architects). While Jacobs during the 60s criticized existing mechanisms of urban renewal in US cities due to their lack of respect towards the human needs of the city-dwellers, she also introduced the sociological concept of "social capital" in cities with her book 'The Death and Life of Great American Cities' (1961). A decade later, Danish architect and urban planners Jan and Ingrid Gehl established a "human-centered approach" to urban planning in practice. This meant studying and including human behavior in public space as a guiding principle towards prioritizing people in urban planning, as outlined for example in the books 'Life between buildings' (1971) and 'Cities for people' (2010). Recently, the notion of the human-centered city was picked up again from the UNESCO referring to 'A human-centered city is a culture-centered space' (2016). In the context of the New Urban Agenda, the UNESCO advocated for a culture-based approach to urban planning and development as "culture lies at the heart of urban renewal and innovation, embodying the soul of a city, allowing it to progress and build a future of dignity for all" (UNESCO 2016).

It should be noted that the notion of 'people-centered' (urban) development can also be identified in other scientific discourses. For example, in the context of development studies, the concept of a 'people-centered development' was proposed as an approach to international development that focuses on improving local communities' self-reliance, social justice, and participatory decision-making. Within the development debate, the concept addressed already during

the 1980s and 90s that economic growth does not inherently contribute to human development but calls for changes in social, political, and environmental values and practices. Within these debates, it is also argued that 'Sustainability' is an inherent component and explicit goal of people-centered development as people-centered development calls for the establishment of self-supporting social and economic systems, key elements of a sustainable society. Based on the identified underpinning of the notion of people-centered cities we propose the following working definition:

A people-centered city puts human well-being at the heart of inclusive processes of urban governance and transformation while prioritizing people's needs and the human scale in urban planning and design.

Figure 3: The concept of a people-centered city among diverse existing city visions (Please note that this figure does not claim to be exhaustive. There do exist many more city visions such as the sustainable city, or the sponge city)

The concept of 'people-centered cities' addresses an imaginary, a future vision or narrative of city futures that adds to a large amount of already existing visions of urban living environments. These city visions include concepts such as the 'resilient city', referring to the urban capacities to absorb future shocks and stresses; or the 'smart city', which puts information and communication technologies at the center of optimizing the efficiency of city operations and services. The following Figure 3 illustrates the diversity of city visions and narratives we identified in the literature. This diversity reflects some of the afore mentioned knowledge communities and scientific disciplines that address urban challenges.

The diversity of existing city visions also brings about trade-offs and conflicting pathways between these different visions. For example, a healthy city perspective might strongly argue for a large amount and good accessibility of green spaces to enable active, urban citizens who can recreate in green environments. The same urban area might be envisioned differently from a just city perspective, where space to develop affordable housing in dense urban areas might be a higher priority. It seems promising to identify the synergies and trade-offs between the notions of a 'people-centered city' and the diversity of other visions, in order to detect potential conflicts as well as overlapping aspects, which allow for alignment. In addition, working with city visions within a participatory design context requires making these visions tangible imaginaries for different target groups. This is relevant in order to connect the vision with a concrete agenda on the ground that allows the vision to unfold its guiding potential for action (McPhearson et al. 2016)

Addressing an emerging field of PDPC resonates with recent calls for a "new science of cities" (Batty 2012, 2013) or a new "urban systems science" (Groffman et al 2017). While the first takes a data-driven and analytical lens to study cities as complex, yet quantifiable systems, the latter conceptualizes cities as socio-ecological systems, in which humans are dynamic elements of urban ecosystems. Both claims are not yet setting social well-being and human needs, hence, livability, justice and social sustainability of cities center stage. Proposing a newly emerging field of PDPC also relates to recent steps towards creating new scientific journals addressing transformative urban change. "Urban Transformations" is an example of a novel inter- and transdisciplinary open access journal that offers a publishing and discussion platform for people engaged in science, policy and practice, targeting at real-life impact in cities. This new forum proposes an action-oriented, co-creative and transformative lens to urban science, which acknowledges but also challenges the existing fields of urban studies. Similarly, PDPC asks for a fundamental shift in how we think, govern, plan, and co-design our cities; it refers to the ideas of reclaiming the right to the city and setting human needs, inclusion and equity into the focus of city development.

5. Scientists and institutions

Relevant institutions and scientists contributing to the theme of PDPC

We provide a summary of the relevant academic institutions and scientists working on themes directly related to the proposed PDPC field in Table 1. We have based the selection on a guiding set of criteria, which distinguish the work of these organizations and scientists from other urban scholars. These criteria were developed based on the analysis of the first round of expert interviews, during which we explicitly asked for these distinct characteristics and complemented them with information from the literature review. The selected academic institutions and scientists promote a work on urban contexts that fulfils several of the following criteria: the research work is conducted theoretically informed by the rich historical tradition in urban studies.

While acknowledging the historic and existing knowledges on cities, a future orientation is chosen that aims to contribute to understanding prospective characteristics of more livable cities and pathways towards moving into these future directions. Many of these academic actors promote an inter- or transdisciplinary and multi-actor research perspective involving science and practice actors from diverse scientific disciplines and urban practice domains. This leads to the necessity to conceptualize and structure the collaborations between different urban actors for example from science, policy, private sector and civil society, hence, the notions of participatory approaches, co-creating, co-producing and co-designing (urban) sustainability futures within these multi-actor constellations are become applied in their work.

The identified institutes and scientists tend to build on a coupled systems perspective of cities that integrate for example socio-spatial, socio-ecological, socio-technical or socio-institutional system theories to describe the (co-) evolution and co-designing of the urban fabric. The work of several of these scientists and institutions is characterized with an action and intervention-oriented understanding of science that aims at generating transformative or action-oriented knowledge for cities. Research on people-centered cities is often driven by a sustainability and / or resilience and / or justice agenda in its perspectives on urban system change. These sustainability, resilience or justice perspectives are often combined with taking a spatially explicit or place-based approach to sustainable development and urban transformation. This place-based approach then requires a conceptual underpinning of spaces and places and their change.

Several of the identified academic actors follow a coupled understanding of place change as a co-evolving phenomenon in which the physical environment (buildings, artefacts, nature elements) and social life as well as the social construction of space constantly interact and are considered as inter-relational aspects. The selected academic actors often conceptualize cities as complex, geographically embedded and dynamic systems that feature multiple interrelated levels and / or multiple interacting scales of influence. This means that local dynamics and strategies are to be embedded and interconnected with regional or national contexts and vice versa. When addressing aspects of people-centered cities, some of these institutions and scientists already apply a human-centered lens to their research, in which human well-being, the securing and improvement of the quality of life and inclusive places are set center stage.

Several of the identified academic actors consider big urban data, digital decision-support tools and ICT enhanced research on urban transformations as essential tools, however, others also take a critical view on notions such as the Smart City, as currently being at odds with the idea of a people-centered, livable and just city. Several of the selected institutions and urban scholars share as well their involvement in international research programs, multi-cultural project environments and their consideration of cross-cultural differences, acknowledging the place specificities and uniqueness of socio-spatial contexts being under study (e. g. between cities in the Global South and the Global North, shrinking cities vs. growing cities). The following Table 1 provides an overview of the selected academic institutions and scientists based on the afore mentioned selection criteria.

Table 1: Academic Institutions and Scientists (in alphabetical order, institutions and/or scientists were mentioned by interviewees during the series of expert interviews or identified during the literature review)

Institution	Short description	Scientists
Aalto University Finland, NODUS & ENCORE research groups	Transdisciplinary design research for sustainable futures; and creative collaborative design.	Prof. Idil Gaziulusoy Prof. Tuuli Mattelmäki
ELISAVA at Barcelona School of Design and En ELISAVA at Barcelona School of Design and Engineering (ES) gineering (ES)	Elisava is a centre attached to the Pompeu Fabra University, Barcelona active in the fields of design, engineering and communication.	Prof. Ezio Manzini
Erasmus University Rotterdam, DRIFT	As a world-leading institute for research on and for sustainability transitions, DRIFT conducts inter- and transdisciplinary research to better understand and facilitate new ways of thinking, doing and organizing in (urban) transitions.	Prof. Derk Loorbach Dr. Timo von Wirth
ETH Zurich Td Lab	The ETH TdLab conceptualizes and tests educational and research approaches to tackle complexities of sustainable development, e. g. by applying td research and learning formats such as urban living labs.	Prof. Michael Stauffacher Dr. Pius Kruetli
Future Cities Lab (FCL) Singapore	Sustainable Future Cities – Through Science, By Design, In Place: The rationale for FCL emerges from the challenges of urbanisation and its consequences for Singapore, the ASEAN+ region and the world.	Prof. Gerhard Schmitt Prof. Adrienne Gret-Regamey
Harvard University, Graduate School of Design	The Graduate School of Design educates leaders in design, research, and scholarship to make a resilient, just, and beautiful world.	Professor Neil Brenner
MEDEA Lab, Malmoe University, Sweden	Medea is a transdisciplinary research lab at Malmö University, Sweden, where researchers address societal challenges through experiments and interventions.	Prof. em. Pelle Ehn Prof. Per-Andres Hillgren
MISTRA Urban Futures, Gothenburg, Sweden	Mistra Urban Futures is an international research and knowledge Centre for sustainable urban development through the co-production of knowledge.	Prof. Thomas Elmqvist (Stockholm Resilience Center)
Politecnico di Milano Department of Design, DESIS Lab	The POLIMI-DESIS Lab is composed of a group of researchers adopting a strategic and systemic approach to design, with a specific focus on design for services and design activism.	Ass. Prof. Anna Meroni (human cities project)
Swinburne University, Center for Urban Transitions, Melbourne (AUS) & Smart Cities Research Institute	The Centre for Urban Transitions investigates innovative planning and governance strategies for creating more liveable, sustainable, equitable, healthy and productive cities.	Prof. Niki Frantzeskaki
Technical University of Delft, Netherlands; idStudio Lab	idStudioLab is a design research lab at TU Delft, which works experience-centered and design-driven.	Prof. Ingrid Mulder Ass. Prof. Jotte de Koning
The New School New York, Parsons School of Design, DESIS Lab	The Parsons DESIS Lab, an action-research laboratory created at The New School to advance the practice and discourse of design-led social innovation to foster more equitable and sustainable cities and practices.	Ass. Prof. Timon McPhearson (Director of the Urban Systems Lab)

Institution	Short description	Scientists
University of Melbourne, Victorian Eco-Innovation Lab, Australia	The Victorian Eco-Innovation Lab (VEIL) is a research-design-action group focused on innovation for more sustainable and resilient future cities.	Prof. Christopher Ryan
The University of Sydney, Sydney School of Architecture, Design and Planning	The Design Lab at the University of Sydney is an interdisciplinary research group within the Faculty of Architecture, Design and Planning.	Ass. Prof. Martin Tomitsch (Head of Design Lab)
University of Cape Town, African Center for Cities	The African Centre for Cities (ACC) is an interdisciplinary research and teaching program focused on quality scholarship regarding the dynamics of unsustainable urbanisation processes in Africa, with an eye on identifying systemic responses.	Dr. Andrew Tucker (Director)
Technical University Berlin, Chair for Urban Design and Urbanization	The Chair for Urban Design and Urbanization is focused on socially just and climate conscious urban design for people (...), cooperative and community-based design processes are investigated, developed and tested in teaching, research and practice.	Prof. .Dr. Joerg Stollmann
Technical University of Munich, Chair of Sustainable Urbanism	Professor Michaeli is interested in transformation processes of urban, rural and peripheral spaces, infrastructures and settlements, and furthermore in instruments that enable resilient urban and rural planning.	Prof. Mark Michaeli
Sungkyunkwan University, Urban Transformations Lab	Addressing the dynamics of urban change and the strategies and approaches for steering such change towards sustainability.	Ass. Prof. Dr. Marc Wolfram (from July 2019 at TU Dresden)
Carnegie Mellon University, Transition Design Institute	The School of Design at Carnegie Mellon is among the oldest and most respected programs in North America. The School places design for society and the environment at the heart of its program.	Prof. Terry Irwin (Director)
Tongji University, Tongji DESIS Lab, College of Design and Innovation, China	Tongji DESIS Lab has developed full-scale projects with a focus on rural-urban interaction, public space and urban resilience, urban food sustainability: these are still critical domains of research in China, although the country had evolved from an emerging economy to a stable global player.	Prof. Lou Yongqi (PhD. Dean of the College of Design and Innovation)

We emphasize that this list does not claim to be exhaustive and provides an overview of selected academics.

6. Addressed challenges, theories, conceptual models and methods

based on the answers provided during the series of expert interviews and
based on the systematic review of literature, EU funded projects and conference themes

Urban challenges addressed in the PDPC theme

The urban challenges mentioned in the scientific literature and during our expert interviews not surprisingly cover a broad range of issues and are often considered to be addressing wicked, complex, contested and persistent urban problems. That means, the diversity of influencing factors, diverging actor interests and interactions of effects between and across multiple scales creates a complexity, in which simple solutions based on narrow cause-effect assumptions often fail. Examples are the implementation of integrated mobility solutions based on slow traffic combined with substantial reduction of individual car traffic in cities; the interaction between land use change in cities and suburban areas and the generation of additional transport demand; or the trade-offs between urban growth, necessary densification of the built environment and the availability and accessibility of green spaces for the urban quality of life. Such urban challenges occur on different socio-spatial scales but also have interrelations between and across scales. In addition, the complex nature brings about trade-offs between different functional preferences (e. g. recreational green spaces versus densification for affordable housing versus space for renewable energy infrastructures).

As most of the interviewees indicated, it is hard to define or distinguish specific 'urban problems' that PDPC can address at the current stage. Therefore, we distinguish between different 'problem-orientations'. We briefly summarize the findings for the four problem categories: sectoral, process, social and coupled. Nevertheless, sustainability and justice aspects are underlying themes in all four problem-orientations. Some issues in the urban context are referred to as problems in specific urban sectors, such as mobility, housing or energy. One urban expert referred to a project for a public transport provider and how their service could become more inclusive and could be more oriented towards new demand structures of current populations. Some of the reviewed scientific papers also stick to a sectoral focus when addressing urban challenges, as for example illustrated Ibeas et al. (2011) when referring to urban mobility problems such as environmental pollution or traffic congestion. Despite the sectoral distinctions made, a tendency towards integrated cross-sector analysis and nexus thinking beyond sectoral boundaries within cities is emerging. This nexus thinking also became apparent in the expert interviews. For example, one urban professional explained that the focus within urban healthcare should be broadened to questions of urban food provision and the influence of the urban environment on health and wellbeing (see also cross-sectoral challenges below).

PDPC themes address issues regarding processes that emerge in urban settings and that often involve future urban developments. A process-oriented problem that surfaced in this review was the lacking inclusion of often marginalized and overlooked groups in participation and decision-making processes. Several interviewees referred to these challenges, which are backed by the literature review. For example, Fredericks et al. (2018) address this with their hybrid

approach of digital and analogue pop-up interventions in the public space, in order to increase the involvement of "passers-by" in specific urban communities, who would otherwise not be included in voicing their opinions and preferences. One of the urban professionals also mentioned employing a PDPC lens for place making or as an instrument to co-create awareness for the urgency of urban change.

Apart from sectoral and process-related urban issues, PDPC themes entail a human- or social challenges focus in cities. Community cohesion is a returning theme that can be understood as an additional outcome of participatory processes in for example public space-, road- or housing redevelopment. Other recurring themes are equity and equality in as well as inclusivity of cities. Fragmentation and the complexity of urban life can exclude people to be part of a thriving and social city life, for example through increasing privatization of public spaces. This problem is amplified under pressure of individualization and aging patterns in society (e. g. Afacan & Afacan 2011). All in all, the human or social challenges are key to a PDPC lens and connect directly to a long-lasting tradition of urban research on quality of life (e. g. Afacan & Afacan, 2011 and Kontokosta, 2016) and wellbeing in cities.

Further urban challenges, which appear to be in the focus of a PDPC perspective can not merely be understood or described as a sectoral, process or social issues. A more interrelated perspective on the urban challenges can be described as coupled urban issues. These cover topics with for example a social-physical character that fit within the theme of urban justice (Carrol et al. 2017) such as homelessness, gentrification, affordable housing and socially and ecologically sustainable real estate. Attention is also directed to socio-ecological challenges in cities such as environmental issues, climate change, or trade-offs around urban ecosystem services, or urban low carbon futures (e. g. Brink et al. 2018, Gaziulusoy & Ryan 2017, Coulson et al. 2018 and Nevens et al. 2013). In the context of the smart city debate, concerns regarding privacy and flows of personal data are addressed (e. g. De Filippi, 2016) from a coupled city – data perspective.

Rationales for addressing urban challenges with participatory design

Several trends and persistent societal challenges (such as urbanization, climate change, retreating welfare states, wealth inequalities and the financial crisis) have increased the urgency of addressing these internationally, but also locally in urban contexts. As 'business as usual' approaches don't seem to sufficiently address these wicked problems, other approaches seem are needed. Different rationales can be identified that explain the promises of PDPC for becoming a relevant lens on these 'grand societal challenges', particularly when addressing them on local scale.

Firstly, co-creating sustainable urban futures can be considered as a design challenge. While Andreani et al. (2019) describe certain capacities: "Future urban scenarios are envisioned as design challenges that require strategic thinking, creative problem-solving, and citizen-oriented ideation" (Andreani et al. 2019: p.16), Gaziulusoy and Ryan (2017) theorize systemic transformation as a design challenge with a creative, technological and political dimension. With the creative dimension they refer to "(...) imagining entirely new socio-technical systems which will support a vibrant, culturally satisfying and productive urban existence in the future" (p.1298). The technological "(...) dimension involves selecting, designing and developing those system concepts that will support the resilience of communities (...)" and the political to: "(...) designing participatory processes for the purposes of deliberating and negotiating characteristics of those future systems as well as the strategies for achieving them with relevant stakeholders" (p.1298).

This brings us to the second rationale of participatory design: as a tool for democratic decision making and citizen-involvement. When human needs are put at the center of collaboratively developing city futures, questions about justice and equity come into play. Several urban professionals have explained this rationale as a criticism to neo-liberal planning and established practices in urban development. Following this rationale, participatory design is about collaborating, co-creating and co-designing the city together. It is a paradigm shift as earlier proposed for example in communicative and collaborative planning discourses.

Bringing back the human focus in digital cities is the third rationale for applying PDPC in cities. Many critiques on the notion of the smart city evolve around the technological, efficiency and infrastructure focus in the smart city paradigm. De Lange and de Waal (2013) propose to integrate the technological perspective with the social: "urban technologies engage and empower people to become active in shaping their urban environment, to forge relationships with their city and other people, and to collaboratively address shared urban issues (p. 3). Andreani et al. (2019) see potential to advance the technological smart city paradigm: "by employing a design-oriented and human-centric approach we offer an alternative perspective to this smart city paradigm, moving beyond the technocratic and universalist dimension that typically governs the debate." (p.16). Also, Fredericks et al. (2018) focus on how digital technologies can be employed for a citizen-centered approach in shaping urban experiences.

Fourthly, the inter- and transdisciplinary character of future approaches to all urban issues is another rationale for participatory design, cross cutting all rationales presented above. Different knowledges and transdisciplinary approaches are needed to address the grand societal challenges in their urban contexts. De Lange and de Waal (2013) speak in this context of social-cultural shifts between amateurs and professionals: "When grounds are shifting, urban design professionals as well as citizens need to reconsider their own role in city making" across disciplinary boundaries and together with non-scientific actors (p. 2).

Methods, theories and conceptual models with relevance for the PDPC theme

We present a collection of identified methods, theories and conceptual models currently developed or applied in the course of research on PDPC themes. This collection was found during the detailed literature review and we emphasize that this overview can only be an excerpt and broad collection of approaches, which does not claim to be complete. We start with documenting the recently developed and proposed methods based on the detailed literature review of n=30 scientific articles.

Platforms to experiment with and co-create sustainable solutions for cities

Nevens et al. (2013) propose 'Urban Transition Labs' as real-life urban settings, in which sustainable alternatives to current system configurations are simultaneously deployed and observed in local urban contexts. The transition management approach is used in the implementation, stepping through phases of (a) process design and system analysis, (b) problem structuring and envisioning, (c) backcasting, determining major pathways and agenda setting, (d) experimenting and identification of resistances to short-term action and (e) monitoring and evaluation. The experiments shaped and tested in the urban transition labs are co-created by a variety of actors (often referred to as 'frontrunners') including citizens, entrepreneurs, researchers and policy makers, in a transdisciplinary setting. This methodology places participatory city-making and learning-by-doing at the center of urban transformation.

Through the lens of transdisciplinary science and sustainability transitions, Schaeapke and colleagues (2015) present an overview about recent approaches connected around the notion of urban 'real-world laboratories. These settings are considered as research approaches and intervention sites in cities that facilitate transdisciplinary collaborations set up to experiment with solutions for different sustainability problems. One of the first larger set of real-world laboratories was implemented during the funding program by the federal state of Baden-Wurttemberg with a focus on urban laboratories. Real-world laboratories provide a geographically embedded site (in cities) that allows multiple urban actors to participate and conduct research on local sustainability challenges with an emphasis

on testing and experiencing alternative, more sustainable practices and infrastructures. By this, real-world laboratories promise to have a transformative impact within the involved actor groups but also within their socio-spatial contexts of intervention. However, the evaluation of these effects from collaborating in real-world laboratories still remains in its infancy and provides opportunities for future research.

Similarly, von Wirth and colleagues (2019) present the approach of Urban Living Labs (ULL) as sites in cities, where to test and trial alternative, more sustainable practices and technologies. The authors propose ULL as the urban platforms for co-creation, where the later diffusion and spread of these alternatives may become initiated through strategies of scaling, replicating and embedding within and across different urban contexts.

Urban imaginaries and approaches of envisioning

A future oriented and transformative approach is described by Eames & Egmose (2011). Their work presents the process design of the community foresight technique with an example from the UK. The authors combine theoretical perspectives from citizen science, sustainability transitions and transdisciplinarity. The method is proposed as an innovative approach to develop an inclusive 'bottom-up' community foresight process for urban sustainability research. Unlike most backcasting studies, the methodology was initially grounded in an exploration of the community participants' current lived experience and understandings of sustainability. Given the particular purpose of the study the primary outcome from the work was structured around the articulation of a 'community-led' agenda for urban sustainability research, rather than an explicit normative vision and transition pathway. However, the methodology could easily be adapted for use in other contexts and showed potential to contribute to the formation of local 'transition arenas' facilitating network formation and building capacity for local sustainability initiatives and experiments. As such, the work resonates with other proposed methods such as the Urban Transition Lab approach and the Transition Management process in general.

Likewise, Gaziulusoy and Ryan (2017) present a participatory envisioning process method situated at the interface of design and sustainability transition thinking. The authors demonstrate the application of the approach with an example of the Visions and Pathways 2040 project for the Australian cities of Sydney and Melbourne, which also integrates the planning charrette method as well (described later in this section). In a similar vein, McPhearson and colleagues (2016) propose the co-creation of visions (i. e. 'positive envisioning') as a key method in the context of guiding urban transformations towards sustainable futures. From a coupled system perspective, the authors promote that inspirational visions can become key components of transformations to sustainability that help shaping the very reality they try to describe or explore.

Positive visions can provide direction for actions and behavior and are vehicles to create identity and community. These social impacts are also addressed when arguing that positive visioning in urban contexts is critical to provide motivation, aspiration, and serve as a way finder to guide a course toward ambitious, positive trajectories that meet the normative goals for society and (urban) systems. Moreover, the authors argue that crafting urban sustainability visions through participatory processes fulfils an important function in research, planning, and decision-making, as it provides a shared reference point for developing strategies to transition from the current state to a desirable future state, and to assess progress.

Participatory digital methods, citizen science and the Smart City

With a focus on participatory elements in smart city solutions Kontokosta (2016) introduces the 'quantified community'. This method originates from ICT based smart city initiatives on the one hand, and the 'quantified self' movement on the other hand, which use data collections and feedback to improve personal health of city residents. In a quantified community, participatory sensing and other smart technology is applied at a neighborhood level, and after analysis and visualization the data is presented back to community representatives and other stakeholders. It aims to serve collective needs and shared challenges in these spaces, creating feedback loops between the sensory data and the needs of the community. However, issues of privacy and personal data protection are not extensively reflected in the approach.

With the lenses of citizen sciences and smart cities, Coulson et al. (2018) introduce a method called 'transformation design'. This form of citizen science allows citizens to interact with sensory, smart technology to collect data from their direct environment. What makes the method unique is that it does not just ask citizens to collect data used for

further research or policy making, but that the technology and data are directly interactive. It uses apps and other communication methods to present the data to citizens and empower them to change their environment based on this newly gained knowledge in a reflexive, iterative process. In this way, it combines participatory sensing with co-creation, in support of bottom-up movements of citizens who are supposed to be empowered towards engaging in transformations of societal systems. In this line, the method of 'mesh networks' is also exploring citizens' participation in the smart city context. De Fillipi (2015) propose the adoption of such mesh networks onto urban communities in order to facilitate co-creation and deliberate exchange processes between citizens and urban development institutions.

Collaborative and participatory planning and design methods

With the lens of the communicative planning field, Kennedy (2017) presents the 'planning charrette method' based on a thorough evaluation of forty-six conducted charrettes in Scotland. The charrette is an approach to community participation that typically lasts between four to seven days and involves a multidisciplinary team establishing a temporary design studio within the study area. It has been considered as "an agent of change" itself in the context of the New Urbanism discourse. The charrette team works collaboratively with community members and key stakeholders in a series of interactive workshops, often producing a masterplan that has been developed throughout a series of short feedback loops.

Proponents argue that these feedback loops condense the time between input and design to just hours, so not only do participants exercise more influence, but they can watch a transparent process unfold, thus ideally fostering greater trust among all actors involved. Benefits of this approach therefore do not center only on the physical outcomes; charrettes appear to commit to social goals embedded in New Urbanism (Talen, 2002), and communicative processes more generally. The author also reports about the participatory mechanisms applied throughout a charrette process.

Taking a participatory design perspective, Moore and Elliott (2016) argue that participatory design becomes a challenge when participant populations are large and when the need for legitimizing quantitative data is great. In urban and transportation planning, this has often been handled through citizen engagement enacted within the participatory design framework. Instead, the authors present an approach to couple participatory design with a listening rhetoric. Urban planners struggled to effectively employ participatory design methodology because they neglected to collect the tacit knowledge generated through the conducted participatory processes. By applying the active listening rhetoric in order to ensure that citizen knowledge is collected and subsequently incorporated into localized solutions. The listening rhetoric requires an active and infrastructural approach that builds active listening into the data collection process. Re-considering the relevance of active listening refers particularly to the mode of how planners and decision-maker listen to citizens and other stakeholders during participatory design processes. Coupling the participatory design approach with a listening rhetoric, the authors suggest a strategy for ethically drawing together the need for data collection in public planning projects with such a refocusing of communication patterns, as well as with representative decision making.

Another approach found in the literature puts participation of citizens at the center, yet, does not translate that into co-creative design. Instead, Ibeas et al. (2011) present an elaborate consultation technique, in which a converging method of 'mega focus groups' (i. e. large groups of citizens selected using a zoning methodology) is used. From these mega focus groups, in which broad themes like 'improving mobility in the city' are discussed, participants are selectively invited to join smaller focus groups based on shared interests, such as 'biking' or 'bus routes'. This method has the advantage of engaging both a broad, randomly selected group of citizens, as well as specific target groups. According to the authors, this method supports broad citizen interaction and the quality of the focus group output. The authors state that this method could ultimately contribute to greater social impact, by which they do not mean direct social impact due to participatory design, yet, refer to urban designers taking better qualitative information into account for their approach to co-designing cities.

In the context of co-designing urban artefacts and cities, for example in the disciplines of architecture and spatial design, Afacan & Afacan (2010) propose 'mat urbanism' as an approach that aims to promote inclusive space-making through 'universal design'. The mat urbanism methodology creates model designs of spaces that take into account all possible users throughout all stages of life, including childhood, adolescence, old age, but also life situations of disability and illness. Thereby spaces are created that do

not invoke a sense of separatism between people, making them inherently inclusive (Afacan & Afacan, 2010). However, the method does not propose direct participation, which still could be complemented.

Further examples of relevant methods

We also add further methods that were named during the 1st and 2nd round of interviews with academic experts and urban frontrunners. For example, interviewees mentioned the already established approaches of participatory human-centered design and systemic design. A valuable overview about these methods is for example provided in Sanders et al (2010) who present a comprehensive framework for organizing the tools and techniques of participatory design. These reach from methods of 'making' (or: co-creating) tangible boundary objects like mappings, models, or mock-ups, to techniques of 'talking, telling and explaining' such as storyboarding, diaries or narratives, to a group of tools around 'acting, enacting, and playing' such as participatory enactment, improvisation, and games. Interviewees also mentioned the approach of (urban) transition management as a set of methods and theory that can come into play in the context of PDPC. A good overview on Transition Management approaches in cities is provided in the book by Frantzeskaki and colleagues (2018) presenting Transition Management in and for cities as a new governance approach to address urban challenges. A broader theoretical embedding of the transition concepts can be retrieved from Loorbach et al (2017).

Other methods evolve around the concepts of well-being and happiness in cities. For instance, the HappyCities group has developed a set of approaches and guidelines based on the HappyCities 'well-being' wheel. This approach also builds upon participatory design work and couples planning and design deliberations with happiness and well-being visions for cities (further information is retrievable from https://thehappycity.com). Finally, interviewees mentioned as well the local or community champions approach as an element of community engagement and stewardship aiming at inclusivity and further empowerment. The community champion idea proposes that highly engaged 'community champions' can play a crucial role alongside professionals in leading change and co-creating within planning processes. A recent illustrative case is for example provided by Lindsay et al. (2019).

Theories and conceptual models

There exists a large body of theories from diverse disciplinary background connected to urban transformation and social aspects of life in cities, in particular from urban sociology, urban geography, spatial planning and other disciplines. However, identifying and synthesizing these theories was not part of this work. Instead, we illustrate some of the more recent theories and conceptual models defined by the eight bodies of knowledge as presented in Figure 2 and as identified through the systematic literature review. As the theme of PDPC is still emerging, we see the following summary as a set of proposed theoretical perspectives that may help shaping a PDPC field in the future.

As a recent theoretical contribution that relates to the theme of PDPC is the conceptual work conducted by Gaziulusoy and Ryan (2017). The authors developed a conceptual framework linking (urban) sustainability transitions with design thinking. In their model, a transition can be framed as a design challenge on 3 levels: creative, technological and political. While these three levels guide the design process, three key transition activities are presented as counterpart, being: strategic activities, such as the formation of long-term goals; operational activities, such as learning by experimenting, and Tactical activities such as implementing a change agenda. Based on a case study (envisioning low-carbon futures for Australian cities) they explain the role of (urban) designers in societal change processes as mediators between different perspective and knowledges. The conceptual model provides an important contribution in bridging the fields of (participatory) design and (urban) sustainability transitions. It also indicates a rich set of proposed methods that serve the respective design and transition activities. As such, it is a practice-oriented model that can be applied in diverse contexts.

A new theoretical framework that questions existing approaches for urban planning is proposed by Crowe et al (2016). Their framework for adaptive co-management and design is introduced as a basis for the operationalization of urban resilience, highlighting the need to actively solve problems collaboratively by exercising imagination and creativity, and presenting a new and potentially fertile source for innovation. Five experiments exploring urban planning practices relating to the framework are put forward as examples of urban resilience in practice: an online crowd-sourcing application for mapping underused

spaces; an interactive timeline tool for identifying drivers of change over time; a guidance and signposting tool to help community projects overcome resource barriers; an epistemic network of citizens that exchanges knowledge and resources relating to underused spaces; and an online portal that provides visibility for community groups or projects, and facilitates horizontal networking.

When addressing social aspects within urban transformations, the conceptual work done by Cuthill (2010) provides a relevant source of information, when addressing aspects such as the social capital, social infrastructure, social justice, and engaged governance within urban contexts. These four components appear to be key ingredients of an envisioned people-centered city. The author builds the framework on social sustainability concepts informed by an extensive literature review. With the intent of empirically testing the framework in mind, the four components are allocated with specific roles relating to social sustainability. According to the author, social capital provides a theoretical starting point for social sustainability, whereas social infrastructure provides an important operational perspective. Social justice and equity provide an ethical imperative and the notion of an engaged governance provides a methodology for 'working together'. The actual verification of the four components is not part of this work but could guide and inform future empirical work on social sustainability in cities.

Another recent theoretical contribution is bridging the research on sense of place, place-making and sustainability transitions in cities. Frantzeskaki and colleagues (2018) present a framework on how 'Sense of places' and the embedding of experiments and local grassroot activities for example as part of urban living labs can be conceptualized in a dynamic model. The authors link the sense of place and sustainability transition literatures and conceptualize that sense of place can be one outcome of experimentation fostering sustainability transitions. This model is verified in a longitudinal case study research, from which the authors conclude that experimental zones in cities (such as real world laboratories or in-between use agreements) can connect a sense of change (transformation) with a sense of place by co-creating new narratives of place, by co-producing knowledge on new practices and new relations between people and place, and by allowing the co-design or (re)establishment of places with symbolic meaning. Given the novel and explorative character of the research, the authors recommend that a long-term research horizon was crucial for examining in-depth slow-social processes of transformation such as the creation of symbolic places, the evolution of social relations and the trust building required for reciprocity and partnerships. This is relevant for future PDPC research as well, in particular when addressing social aspects of urban livability.

In their theoretical work on social capital in cities and intervention strategies, Agger & Jensen (2015) present a conceptual framework for studying how Area-based Initiatives (ABIs) can facilitate contact between networks in deprived neighborhoods and external forms of power (i. e. linking social capital). Area-based Initiatives (ABIs) are promoted already for quite some time for example by Western European cities as an instrument to tackle social exclusion and economic deprivation. Key to ABIs is that simultaneous and coordinated investment in different sectors, for example, employment, physical improvements and social initiatives in one urban area (e. g. a neighborhood) leads to extra benefits, enabling an increased social cohesion. However, the conceptualization of social capital within planning studies was still lacking an analytical framework for assessing the 'soft outcomes of ABI'. The authors here propose a conceptual framework for the different forms of social capital coupled to the role of ABI. The three main forms of bonding, bridging and linking are presented and verified with empirical case studies from Denmark in order to assess how ABI can work strategically by mobilizing such different forms of social capital.

Another recent theoretical body of knowledge addresses the concept of citizen design science as a strategy for crowd-creative urban design. Mueller and colleagues (2018) propose Citizen Design Science as a new strategy for cities to integrate citizens' ideas and wishes in the urban planning process. From an urban design perspective, the approach offers to combine the opportunity of crowdsourcing opinions and thoughts by citizens through modern information and communication technology (ICT) with active design tools. The authors present a system to merge Citizen Science and Citizen Design, which requires a structured evaluation process to integrate Design Science methods for urban design. By this, Citizen Design Science can be located in the realm of design research. The theory builds upon Sanders' topography of research areas in design (Sanders, 2006). The active design feedback from a city's inhabitants is identified as a yet missing but essential way towards a

responsive city. Mueller and colleagues demonstrate empirical examples of applying Citizen Design Science and present the Quick Urban Analysis Kit (qua-kit) as an application of this approach. This toolkit allows citizens and other users to move geometries in given environments and provide the opportunity for non-experts to express their ideas about form, volumes and spatial constellations for their neighborhood or city.

In the context of PDPC themes, the concepts of peer-to-peer urbanism and tactical urbanism are also coming into play, when considering recent conceptual approaches. While the first, in short, relates to "open source urbanism", by people and for the people, the latter refers to a city, organizational, and/or citizen-led approach to neighborhood building using short-term, low-cost, and scalable interventions to catalyze long-term change (see for example "The Tactical Urbanist's Guide" by The Street Plans Collaborative). Peer-to-Peer (P2P) Urbanism "is an innovative way of conceiving, constructing, and repairing the city that rests upon the five following principles (Peer-to-peer Urbanism Task Force, 2015). P2P-Urbanism is supposed to defend the fundamental human right to choose the built environment in which to live and argues that all citizens must have access to information concerning their environment so that they can engage in the decision-making process. This is made possible and actively supported by Information and Communication Technology. The citizens and urban actors should participate on all levels in co-designing and in some cases building their city. They should be stakeholders in any changes that are being contemplated in their environment by governments or developers. The practitioners of P2P-Urbanism are committed to generating and disseminating open-source knowledge, theories, technologies, and implemented practices for human scale urban fabric so that those are free for anyone to use and review. Finally, the users of the built environment have the right to implement evolutionary repositories of knowledge, skills, and practices, which give them increasingly sophisticated and well-adapted urban tools (Peer-to-peer Urbanism Task Force, 2015).

Tactical Urbanism is also known under terms such as 'Do-it-yourself (DIY) Urbanism', 'Planning-by-Doing', 'Urban Acupuncture', or 'Urban Prototyping' and has a strong focus on immediate action in a concrete urban setting, which can manifest in diverse forms. Prominent international examples include the highly visible and formalized efforts, such as New York's Plaza Program, or smaller-scale demonstration projects such as the Happy Streets project in the city of Rotterdam. In recent years, Tactical Urbanism projects and short-term interventions were also carried out as part of urban living labs or urban real-world laboratories. Actions in tactical urbanism can be led by governments, non-profit organizations, grassroots groups, or motivated (or: frustrated) residents. Yet, the degree of formality may vary.

The actions of Tactical Urbanism projects often share the characteristic of using low-cost materials and interventions to experiment with and gather input on potential street design changes and other infrastructure elements. Over the past decade Tactical Urbanism has become an international movement, bringing about a profound shift in how communities think about project development and delivery including a vital exchange and learning among tactical urbanism activists through global learning networks and best practice communities (see for example: http://tacticalurbanismguide.com/guides/).

Themes, methods and theories from EU funded research projects and conferences

EU funded research projects

All projects that were analysed in detail (n=31) are related to pressing urban challenges and the role of participatory processes therein. However, the projects use very different lenses and approaches to address these urban challenges. In short, the large European research projects that we analysed can be differentiated into two main categories. The first group of projects is focussing on ICT platforms as a means to facilitate participation processes for the co-design of cities. A second group of projects mainly focusses on tackling socio-spatial and/or environmental sustainability issues in the urban context such as socio-economic inequalities, segregation and socio-ecological resilience. These two main clusters of projects reflect the key funding themes as defined by the European commission over the last years.

Examples for the former cluster are the 'U_CODE' project, which addresses creative participation approaches of urban citizens in the co-design of cities made possible with ICT support on a large scale. Through online tools, citizens actively engaged in the design process and connected with professional experts. Another example of integrating ICT and urban challenges addresses the social aspects of the urban fabric. In the project 'MASELTOV', mobile services are studied and developed in an interdisciplinary consortium with the aim of facilitating local community building, raising awareness and knowledge for bridging cultural differences between immigrants and native citizens in European cities.

The latter cluster of projects is focused on social issues at a neighbourhood level that are addressing problems of social cohesion and urban inequalities. For example, the description pf the 'Justhood' project states: "Rapid urbanisation, growing process of globalisation, and the neoliberal hegemony have culminated in the omnipresence of socio-spatial inequalities at the neighbourhood scale regarding racial segregation, deprivation, stigmatisation, and degradation." Projects such as the Justhood project are mainly focused on researching the dynamics of the socio-spatial inequalities on a local level, rather than developing tools to overcome these inequalities. In the project 'SOCURB' (Social Dynamics in Urban Residential Neighbourhoods), the links between urban policies, institutional changes, and the residential dynamics in inner-city and post-war neighbourhoods are compared in Swedish and Estonian cities.

In several recently started projects (dating from 2018), Nature Based Solutions (NBS) were proposed as a means to contribute to urban social and environmental sustainability. For example, in the 'proGIreg' project, 'Living Labs' are being created in European cities that are facing the challenge of post-industrial regeneration. The Living Labs will develop NBS that are co-designed, co-created and co-implemented together with local communities, state, market and civil society stakeholders. Two projects were found that explored the potential of participatory processes for contributing to urban resilience. 'EcoDA' investigates methods for co-designing platforms that can stimulate collective civic actions of urban resilience and enhance the capacities of urban residents to become resilient. The 'TURaS' project aims to "bring together urban communities, researchers, local authorities and SMEs to research, develop, demonstrate and disseminate transition strategies and scenarios to enable European cities and their rural interfaces to build vitally-needed resilience in the face of significant sustainability challenges."

Other projects critically reflect urban policies and aim to contribute to policy changes towards more sustainability focused and participatory governance processes as a way to incorporate local community knowledge. The project 'CHANCE2SUSTAIN', addresses how utilizing participatory spatial knowledge can make urban governance and planning more effective and gain wider acceptance, by incorporating both expert and local community knowledge. The project 'RELOCAL' addresses the need for a better integration of the notions of local and localism into the European Union Cohesion Policy and Territorial Development policy with the aim of creating more support for community-based development and the facilitation of greater civic participation.

Furthermore, EU funded projects that refer to PDPC themes address social issues revolving around specific vulnerable minorities in urban areas. For instance, the 'MASELTOV' project, which aims to contribute to better integration of immigrants in European cities, and the 'GRAGE' project,

which is focused on the challenges of seeing to the needs of elderly citizens in achieving liveable and efficient future urban communities. The 'UrbanA' project aims to support different actors involved in city-making in creating inclusive and sustainable urban environments, through synthesising and brokering knowledge and experience generated in other EU-funded projects that have identified interventions that address just cities.

Current themes in international conferences on future urban development

In general, the current conferences themes relating to facets of PDPC cover the broad range of challenges that urban areas face today. Diverse megatrends such as the economic globalisation, climate change, loss of biodiversity, growing distrust in institutions, global migration, aging populations and questions of security issues related to terrorism have large effects on city lives today and in the future. The identified conferences highlight these developments as the challenging drivers and causes for adaptive responses in cities and for the search for new methods, theory and governance practices.

For example the AESOP Annual Congress states: "Contemporary cities and territories face significant challenges – natural disasters due to climate change impacts, ecological crises, growing socio-economic unrest, global migration, political rifts including a rise of right wing factions, ambitious public works and mega-projects – all of which require new capacities in dealing with such individual and multiple groupings of such challenging and profound changes."

Future work on the PDPC theme should therefore incorporate and explicitly relate to the 'grand societal challenges' of our time. Other challenges that international conferences focus on are the increasing pace of global urbanisation, leading to more megacities and subsequent pressures on urban ecosystems, increasing demand of more efficient and transparent urban governance, problems of gentrification and socio-spatial inequalities at the neighbourhood level. The socio-economic challenges within cities become more prevalent in form of further housing commodification and its severe consequences for large groups of urban residents to find decent and affordable housing, manifesting in sub-themes such as urban poverty, homelessness and more generally deprived or marginalized neighbourhoods. Moreover, increasing issues around mobility poverty and energy poverty as well as urban health issues related to socio-spatial inequality are also topics of interest at current conferences. When striving towards socially and environmentally sustainable cities, the NECTAR conference identifies urban transportation and the role of digital platforms and data technology therein as a crucial part of future cities. "With the constant growth of urban population worldwide, there is an increasing need to develop cities that are environmentally and socially sustainable, functional and supporting well-being of their inhabitants. When striving towards these goals, transportation and mobility play a crucial role."

Other conferences focus more on tackling socio-spatial inequality issues. For example, the TASA Conference on Diversity and Urban Growth, discusses questions about inequalities between Australians and indigenous people in their cities, or the International 'Making Cities Liveable Conference' in Portland, US, which addresses social housing, well-being and gentrification issues in American urban areas. The latter conference emphasizes that many current goals and efforts to make cities more liveable and healthy are not yet reaching the population groups that are most in need. A shared responsibility and a multi- or transdisciplinary approach to tackle these challenges is promoted in the 'Making Cities Liveable Conference', as well as in many of the other conferences. The original study provided an overview of all scanned conferences with their main themes, which is not displayed in this report.

7. Trends and future research pathways

Future research pathways of academic work on PDPC

As identified from academic expert interviews and the 2nd round of verification interviews as well as from the literature review and review of projects and conference themes

During the first and second round of interviews we asked scientists and urban professionals about emerging future research trends and relevant knowledge gaps both in science and practice. Moreover, we added insights from the literature review, when future research opportunities were indicated in the reviewed scientific articles. We identified eight clusters of future research themes that are not mutually exclusive and may include overlapping elements or are at least mutually relate to each in the particular urban contexts.

Scale and multi-scalarity in urban transformations
Participatory design processes often take place at a local scale level, for example as an element of a neighbourhood revitalization project. Their context however is shaped by regional, national or even international policies and specific socio-cultural contexts. For example, the Sustainable Development Goals (SDGs) provided by the United Nations or national policy goals to reduce poverty in marginalized communities may have effects on the local implementation context. From a scientific perspective, a better conceptual understanding of (multi-) scalarity, cross-scale interactions and contextualization of participatory approaches in different geographical locations are relevant topics to be further explored in future research. Attention can be paid for example to the local implementation of national policies, the translation of SDG frameworks to national levels or local scales and action programs, how SDG's interfere with existing regulations or which trade-offs can occur between different local SDG's or between a single, local SDG and existing urban regulations. At the same time, it also remains understudied, how local initiatives, sustainability movements and experimentation with sustainable alternatives in cities may diffuse and replicate beyond the scale of the actual pilot implementation. How best practices and radically re-designed urban contexts may become applicable in other geographical settings is still a key question to address. Moreover, socio-cultural contexts also influence participatory processes. More exploration is needed in doing research driven participatory design for example in the Global South (according to two interviewed experts), as well as investigating if and how the roles of designers and researchers adapt over time and differ per geographical context (Gaziulusoy and Ryan, 2017).

Democracy, just processes and inclusive cities
According to several of the interviewed urban experts, participatory design ideally manifest in a shift of power. Although practiced for a long time already and with some good practice examples documented, still challenges in addressing inequalities, justice, and power asymmetries in the urban fabric remain. We identified the following aspects for future exploration: how are "unusual suspects" included more regularly in participatory processes, what is the democratic legitimacy of such processes and how does the notion of active citizenship come into play? The inclusion of diverse stakeholders and the empowerment often overlooked groups remain challenging issues. In cases, when the inclusivity of participatory approaches is not treated as a significant aspect, the democratic legitimacy of the outcomes can be questioned. Participatory processes still need to be assessed better with respect to their outcomes (e. g. democratic, inclusive and just?) rather than on the process design. To assess the outcomes of participatory processes some of the interviewed urban experts also addressed the integration of psychological concepts in this context (e. g. place attachment, sense of place, happiness, well-being) as well as sociological concepts (e. g. social cohesion, justice, social change) to be further related to theories and methods of urban

transformation. Two interviewees mentioned the concept of the liquid democracy, which could be considered to become introduced into the research on urban governance. Future research needs to address as well the implications of diverse forms of human mobility in cities. Still, there is limited knowledge and little integrated action around the notion of 'Arrival Cities', which asks for further action research with migrant communities in the places, where they arrive in cities. One of the reasons, why participatory processes are initiated is to engage citizens or communities in or to become part of urban developments. Research on and experimenting how citizens can obtain agency to do so or how participatory processes actually can activate citizens to become involved in their local environment (e. g. place stewardship) remain topics for future exploration.

Digitalization, Smart Cities and people-focused participatory design

As the use of Artificial Intelligences, sensors, social media data, or ICT based tools for collaboration in public spaces are becoming already the next layer in the infrastructure of contemporary cities, the question arises how this digital dynamic relates or conflicts with the idea of a people-centred (smart) city. Various critiques on the smart city paradigm provide a fertile ground to explore how the smart city vision can integrate social aspects of human livability in cities. Different foci are identified: the use of digital technologies or media to support participatory processes and the manifestation of digital technologies in urban form and big data. The term 'digital place making' (e. g. Fredericks et al. 2018) addresses how digital technologies are employed for place making. Further exploration is however needed about applying digital tools in cities: e. g. what is the right balance between digital tools and organic face to face processes in co-creation and participatory city making? Andreani et al. 2019 speak of a socio-technical hybridization of the city. De Lange and de Waal (2013) refer to the question how the use of digital technologies will further affect the physical urban form of cities.

One of the urban experts raised concerns about a dystopian view around digitalization. When data remains in the hands of platform giants, or with the effort of some countries to increase digital surveillance in public space can become major threats to democracy. This is a question about further privatization versus urban commons in a digitalized world, which is still a largely undiscovered field in research. At the same time, allowing open-source access to urban data can become an empowering instrument for citizens to engage with their city environment as proposed in the P2P urbanism movement. Still, a thorough understanding of the ethics of an increasing digital urban governance need to be explored further, for example, to ensure that new inequalities e. g. in the form of a digital divide are not introduced into co-creative city-making.

Urban commodification and financing the city

There exists a long-lasting tradition of urban studies about cities as neoliberal battle-grounds and the tragedy of governing the (urban) commons. Still, in recent years pressing challenges of affordable housing and new forms of financing the city regained importance. The continuing privatization and urban commodification are strong drivers of urban change and urban in-equalities. When cities are conceptualized as dynamic systems, challenges such as gentrification, segregation and inequalities in accessing housing and urban land demand for more fundamental transformative research approaches that explore deep-structural changes in the distributive and financing mechanisms underlying urban development. Guiding questions can be: what are alternative mechanisms and funding schemes for a just urban development? Which visions and future pathways could describe a transition of the urban housing markets over the next decades? What will be the role of private sector actors in that transition, such as real estate developers, large housing companies and the building sector?

In this context, an interviewee mentioned 'the community land trust' as a good example to provide affordable housing, however more research and experimentation space is needed to test this concept in practice. Further research demand was as well indicated about the actual effects of affordable housing strategies and the sustainable governance of urban real estate markets. For example, how can price-balancing intermediaries become further enabled, e. g. housing cooperatives? In the context of research on participatory urban design, knowledge is lacking about the business community of the build environment, specifically project and real estate developers, large architectural and engineering offices and infrastructure planning groups. What are their logics, business models, strategies and constraints, when it comes to liveable, just city-making. When urban (re)development or infrastructure maintenance takes place, there is often little or no budget for planning and engagement, while these windows of opportunity can also be taken to include residents and stakeholders.

Figure 4: Overview of proposed research pathways in the emerging theme of PDPC

Science-practice collaborations in transformative urban research

A key topic for future research on participatory design of cities relates to transdisciplinary research and appropriate processes of science-practice collaborations. Future efforts could be directed to shaping or exploring the right conditions for science-practice collaborations and trans-disciplinary research. Specific settings for transdisciplinary research in cities such as real-world laboratories and living labs have proliferated over the last years, yet, there are still diverse questions left unanswered around these settings. For example, it remains unclear how the work in real world laboratories and settings alike can be appropriately moni-tored and how effects onto the local context and beyond can be evaluated. In addition, it still remains understudied, how the experimental work in urban living labs connects with formalized procedures of urban planning and decision making. Collaborative approaches as proposed by action research, citizen science and transdisciplinary research theory have in common that they include participants early in the process beginning with a shared problem framing and definition of common guiding questions involving actors from different backgrounds. These actors often do speak different (institutional) 'languages' and have different expectations, values, objectives and modes of conducting research. Therefore, building a common ground and mutual under-standing of the shared urban challenge and the (different) objectives and expected outcomes from the collaborative

work are key elements in future research processes. Co-defining the appropriate conditions e. g. by co-creating working principles finding ways to lower the thresholds for academia and practice to collaborate (e. g. by providing appropriate funding and timescales for all parties) are challenges still to be tackled in future work on urban transformation. In the transdisciplinary research context, attention needs to be paid to improving knowledge brokering.

A common critique to researchers is their disability to communicate their insights in an accessible manner with other societal groups. It hence remains a task to strengthen capacities for science – practice communication and more regular exchange and learning opportunities. For example, new ways of exchanging and/or co-funding transdisciplinary researcher in partnerships of universities and cities can be further explored. First attempts to offer PhD students the opportunity to embed and work in the city administration and vice versa are promising models to extend. Although diverse forms of real-life experimentation is taking place in cities, the processes of moving beyond experimentation towards substantial changes in the urban fabric need to be further stimulated. This also includes questioning the established yet often locked-in processes of co-designing the city. New ways of making the city together offer space for academics, civil society, policy makers, business and citizens to get together and collaborate on transformative agendas, which could not be set up and implemented by one actor alone. One way forward could be addressing the concept of boundary spanners, urban change agents that have the capacities to move between different urban actors and being competent in translating needs, objectives and different languages in order to co-facilitate collaborative processes.

New urban governance and institutionalization of novel practices

Many urban governance, design and transition scholars argue that envisioning alternative, desired urban futures needs to be an element of new ways to govern our cities. Ideally, such future imaginaries are developed in a co-creative process. Yet, complex urban challenges are situated across and with interactions between different spatial scales and involve different stakeholders. This complexity and the inherent change dynamics seem to overflow the existing institutional arrangements to govern cities. The existing capacities to govern cities towards more sustainable development pathways are limited and still fragmented. We could speak of a responsibility vacuum and a governance path dependency (or often failure) of the current attempts. Hence, co-creating cities demands for greater institutional flexibility and a more provisional, adaptive understanding of cities as an emerging and heterogeneous urban assemblage. Experimental governance provides one means by which diverse urban actors seek to navigate and co-create visions and solutions for future city life. Understanding how such experimental governance approaches can become institutionalized and complement existing procedures in cities is a research avenue, worth further studies. Therefore, further research is needed on how outcomes of urban experiments interrelate to more orthodox and formalized procedures and institutions such as strategic planning and urban design (von Wirth et al. 2019).

Future research should be undertaken on the long-term effects of experimental governance, its potential for place-making and urban regeneration, their abilities and limitations as an instrument for urban governance, as well as their implications for informal and institutionalized learning about sustainable city futures. At the same time, experimental approaches bear the risk of an organized irresponsibility, a situation, in which many people experiment but no one is taking responsibility for the outcomes and possible unwanted side-effects and consequences. In general, recent work on urban transformations proposed to look further into transformative capacities to navigate urban change processes. These capacities address the necessary resources and skills among different urban actors to conceive, communicate, and govern in the context of complex urban systems, which still remains a largely undiscovered terrain.

Our interviews also revealed a need to study, how the scaling and replication of promising urban innovations to other places evolves. In urban practice, the diffusion and sharing of lessons learned between cities (as encouraged by e. g. ICLEI and Eurocities) remains challenging, be it the spread of lessons learnt out of so called frontrunner cities, with innovative approaches functioning as role models, or the uptake of these lessons learnt into the practices of so called follow-up cities. It also remains an important question which governance capacities enable some cities becoming innovative frontrunners (e. g. Copenhagen for cycling), while other cities are considered as laggards that aim to catch up through city-to-city learning. How is this ideally being organized and enabled? How do laggard cities overcome path-dependencies towards becoming fast-follower cities in sustainability transitions and with making use of participatory design approaches? What are the evolving forms of learning alliances for developing sustainable cities? Finally, funding agendas need to continue and strengthen how they value these types of societally oriented learning alliances.

Capacity building and educating the future generation of urban experts

Working on complex challenges of urban transformation in a transdisciplinary and participatory manner requires capacities and skills of the persons involved. Urban experts still can extend their capacities to communicate, navigate and co-lead in these settings. This requires higher education programs to adapt and include knowledges and practice experiences around transformative urban approaches.
The future generation of urban change agents should be exposed early enough and regularly to complex, multi-actor, real world city challenges. Two focus areas can be emphasized: identifying and building capacities for current urban professionals and curriculum development for future change agents. Firstly, the capacities for urban professionals refer to complex systems thinking, communication and facilitation skills, and the integration of a holistic, long-term perspective onto urban transformation into disciplinary programs such as architecture, urban design and urban geography. Being able to work across disciplines and institutional cultures requires appropriate learning contexts. This could for example be reached by institutionalizing education and research in real world laboratories as an element of these study programs. Secondly, anticipating the work of future change agents, innovative educational programs need to (re)develop their curriculum. There is a need for design education to consider and take up the new roles of design relevant for societal transition (see e. g. Gaziulusoy and Ryan, 2017) and support students with developing the skills for co-creation and facilitation. These leaps in higher education programs of designers should also include capacity building for the work in transdisciplinary, contested multi-stakeholder contexts (e. g. Schauppenlehner et al., 2015). This means, being able to cope with conflicting value systems and interests of multiple stakeholder and still keeping a solution and outcome oriented perspective onto co-designing the urban fabric on the one hand, while on the other hand increasing the awareness for social innovations and the focus on human activities, needs and voices in cities.

Impact evaluation of participatory design of people-centered cities

We identified the need to better understand the social outcomes of participatory processes for people-centered cities. More elaborated forms of impact evaluations with a focus on social effects (e. g. on community building, trust, social cohesion) are still in their infancy. While many researchers and practitioners engage in co-creation processes with transformative action in cities, the methods, measurements and metrics for impact evaluations of such transformative intervention still lack behind. Particularly when operating within a complex and dynamic system of a city, traditional impact evaluations are not sufficient. For example, conducting a systematic evaluation of the social return on investment in public spaces or how to measure health and social cohesion, or social resilience effects of interventions in the urban fabric are yet to be further explored. New logics, indicators and instruments are needed as well as a combination of qualitative and quantitative research methods. Next to an impact evaluation of the outcomes, also impact evaluation of the process itself appears to be relevant regarding the intensifying science-practice relations. What are successful settings for urban experimentations, science-practice interfaces and which settings lead to desired social outcomes? What do different urban actors learn within such settings over time and how are these actors enabled to increase their reflexivity to challenge their own worldviews, assumptions and habitualized social practices.

Important note:

It appears to be important to distinguish the novelty and relevance of these research trends and future research themes according to the main scientific communities involved in these research endeavors. For some research communities (e. g. Smart City scholars) transdisciplinary research on participatory urban transformation can still be an innovative and novel approach, while for other scientific fields (e. g. scholars from communicative planning), this would not be a novelty as such, but could be a valuable continuation of existing research streams into the future, presupposing a more fine-grained differentiation of the future research demands. For example, within the communicative planning field, new ways of addressing and integrating overlooked groups into urban transformation can still be a relevant research niche.

8. Three critical perspectives on PDPC research

Participatory design of people-centered cities offers diverse promising lines of research and actions towards leveraging the transformation of our urban living environments. Nevertheless, there are also limitations and risks to be considered when advancing the field. Firstly, we critically address a set of already known risks and challenges in the context of any participatory (or: co-creative) work with different stakeholder groups. Aspects such as avoiding "participation fatigue" for example by ensuring the legitimacy and serious uptake of the outcomes and decisions taken from participatory processes are well documented in the literature, but again come into play with PDPC approaches. Central to many of these challenges of participatory work are the underlying questions of power, agency and biases in urban (or more general: human) decision making. In essence, we are emphasizing that to conduct beneficial participation in urban contexts, it is not about more participation but about more just, inclusive, and impactful participation that matters to people and their cities.

A second critical perspective can be raised around different understandings and interpretation of the role of design in societal (or here: urban) transformation. Still, design is often considered as incremental steps of improvements and progress of artefacts. However, the idea of having design contributing substantially to the sustainable and livable urban systems of the future requires an understanding of design that fundamentally questions the existing ways of social practices, cultures and structures in our cities, aiming for deep-structural changes as proposed for example in the context of theories on urban sustainability transitions and transformative research of urban socio-ecological systems.

Thirdly, we identify one of the key challenges in overcoming path-dependencies of the current urban development in a serious lack of responsibilization in urban policy making and beyond. By this, we mean the absence of individual policy maker or other urban actors that have a clear vision about the respective urban future and consequently take the responsibility and determine their actions towards reaching such envisioned future states. Meanwhile, other actors such as urban grassroot innovators (such as urban gardening initiatives, tactical urbanism groups) step into that vacuum and proactively start co-creating their city. However, the risk of irresponsibility in the urban realm is not dissolved then. In fact, several of these initiatives also struggle with the phenomenon of organized irresponsibility in experimental governance for cities. These are contexts, in which society becomes an experimental arena, but there is no one responsible nor held accountable for its outcomes. Given the increasing extent and range of actors involved in governing sustainability challenges in cities, we recommend for caution against post-political interpretations of urban transformations, as if urban change and participatory design would be happening in an institutional vacuum where 'anything goes'. This critical concern again points to give further attention to the democratic aspects of inclusion, legitimacy, power and transparency and how these institutional values relate to the roles of the different involved actors in participatory design for people-centered cities.

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Overview of content in the appendix

Table A1: List of interviewees / questionnaire respondents

Person	Position	Affiliation	Region
İdil Gaziulusoy	Assistant Professor Sustainable Design	Aalto University (FIN)	Europe
Marc Wolfram	Associate Professor, Urban Transformations Lab	Sungkyunkwan University (KOR)	Asia
Terry Irwin	Professor and Head of the School of Design	Carnegie Mellon University (US)	North America
Ezio Manzini	Professor on Design for Social Innovation	ELISAVA at Barcelona School of Design and Engineering (ES)	Europe
Sampson Oduro-Kwarteng	Associate Professor for Civil Engineering	Kwame Nkrumah University of Science and Technology Kumasi (GHA)	Africa
Jotte de Koning	Assistant Professor of Design for Sustainability	Delft University of Technology (NL)	Europe
Mark Michaeli	Professor for Sustainable Urbanism	Technical University Munich (DE), Lehrstuhl für Nachhaltige Entwicklung von Stadt & Land	Europe
Christopher Ryan	Professor, Sustainable Cities at the Melbourne Sustainable Societies Institute	University of Melbourne, Victorian Eco-Innovation Lab (AUS)	Australia
Lars Coenen	Professor, City of Melbourne Chair of Resilient Cities	Melbourne Sustainable Society Institute, University of Melbourne	Australia

The interview procedure is described in the Method Section of this report.

Table A2: List of interviewees for the 2nd round of interviews with hybrid and/or frontrunning organizations

Person	Position	Affiliation	Focus of Organization
Andrew Tucker & Warren Smit	Director and Research Manager	African Center for Cities (ACC)	The ACC aims to produce credible new knowledge on the drivers of urban crisis in African cities with an eye on systemic solutions.
Matthew Bach	Governance & Social Innovation Officer	Local Governments for Sustainability (ICLEI)	ICLEI is a global network of more than 1,750 local and regional governments committed to sustainable urban development.
Silvia Ganzerla	Policy director	EUROCITIES	EUROCITIES is the network of major European cities. Our members are the elected local and municipal governments of major European cities
Cynthia Nikitin	Senior Vice President	PPS – Project for Public Spaces	Project for Public Spaces (PPS) is a nonprofit organization dedicated to helping people create and sustain public spaces that build strong communities
Mitchell Reardon	Experiments Lead & Urban Planning and Design Lead	Happy City – urban wellbeing consulting	Happy City is an urban planning, design and architecture consultancy. We use the science of wellbeing to create healthier, happier and more inclusive communities.
Derk Loorbach	Director	Dutch Research Institute for Transitions (DRIFT)	As a world-leading institute for guiding sustainability transitions, DRIFT conducts inter- and transdisciplinary research to better understand and facilitate new ways of thinking, doing and organizing in (urban) transitions.
Kaisa Schmidt-Thome	Senior Expert for fair and sustainable urban futures	DEMOS Helsinki	Demos Helsinki is an independent think tank, working together with the public sector, private sector, and NGOs. We want to impact the ongoing global transformations actively and aim to build sustainable and fair post-industrial societies.

The interview procedure is described in the Method Section of this report.

Table A3: Long list of n=70 scientific articles and book chapters, incl. short list of n=30 papers *(in italic)*

The long list includes the selection from the systematic literature review, which was then complemented with recommendations from the 1st round interviews and additional seminal (e. g. highly cited) work from the 8 main bodies of knowledge, underlying PDPC themes (see Figure 2).

n	Scientific article / Book chapter
1	*Afacan, Y., & Afacan, S.O. (2011). Rethinking social inclusivity: Design strategies for cities. Proceedings of the Institution of Civil Engineers: Urban Design and Planning, 164 (2), 93 – 105. doi:10.1680/udap.2011.164.2.93*
2	Ahern, J., Cilliers, S., & Niemelä, J. (2014). The concept of ecosystem services in adaptive urban planning and design: A framework for supporting innovation. Landscape and Urban Planning, 125, 254 – 259. doi:10.1016/j.landurbplan.2014.01.020
3	Barelkowski, R. (2017). Reforging spatial identity for social sustainability. International Journal of Sustainable Development and Planning, 12 (3), 395 – 405. doi:10.2495/SDP-V12-N3-395-405
4	Boujdad Mkadem, A., Zakriti, A., & Nieuwenhuysen, P. (2018). Pay or preserve: A new approach to valuing cultural heritage. Journal of Cultural Heritage Management and Sustainable Development, 8(1), 2 – 16. doi:10.1108/JCHMSD-11-2014-0040
5	*Brink, E., Wamsler, C., Adolfsson, M., Axelsson, M., Beery, T., Björn, H., ... Thiere, G. (2018). On the road to 'research municipalities': Analysing transdisciplinarity in municipal ecosystem services and adaptation planning. Sustainability Science, 13(3), 765 – 784. doi:10.1007/s11625-017-0499-0*
6	*Carroll, P., Witten, K., & Stewart, C. (2017). Children are citizens too: Consulting with children on the redevelopment of a central city square in Auckland, Aotearoa/New zealand. Built Environment, 43(2), 272 – 289. doi:10.2148/benv.43.2.272*
7	Choi, H. S. S., & Reeve, A. (2015). Local identity in the form-production process, using as a case study the multifunctional administrative city project (sejong) in south korea. Urban Design International, 20(1), 66 – 78. doi:10.1057/udi.2013.38
8	Coates, G. J. (2013). The sustainable urban district of vauban in freiburg, germany. International Journal of Design and Nature and Ecodynamics, 8(4), 265 – 286. doi:10.2495/DNE-V8-N4-265-286
9	*Coulson, S., Woods, M., Scott, M., & Hemment, D. (2018). Making sense: Empowering participatory sensing with transformation design. Design Journal, 21(6), 813 – 833. doi:10.1080/14606925.2018.1518111*
10	Dassen, T., Kunseler, E., & van Kessenich, L. M. (2013). The sustainable city: An analytical-deliberative approach to assess policy in the context of sustainable urban development. Sustainable Development, 21(3), 193 – 205. doi:10.1002/sd.1550
11	*De Filippi, P. (2015). Community mesh networks: Citizens' participation in the deployment of smart cities. Handbook of research on social, economic, and environmental sustainability in the development of smart cities (pp. 298 – 314) doi:10.4018/978-1-4666-8282-5.ch014*
12	Derr, V., & Kovács, I. G. (2017). How participatory processes impact children and contribute to planning: A case study of neighborhood design from boulder, colorado, USA. Journal of Urbanism, 10(1), 29 – 48. doi:10.1080/17549175.2015.1111925
13	*Dupont, L., Morel, L., & Guidat, C. (2015). Innovative public-private partnership to support smart city: The case of "Chaire REVES". Journal of Strategy and Management, 8(3), 245 – 265. doi:10.1108/JSMA-03-2015-0027*
14	Fastenrath, S., Coenen, L., & Davidson, K. (2019). Urban resilience in action: The resilient melbourne strategy as transformative urban innovation policy? Sustainability (Switzerland), 11(3) doi:10.3390/su11030693
15	Golden, S. M. (2014). Occupied by design: Evaluating performative tactics for more sustainable shared city space in private-led regeneration projects. WIT Transactions on Ecology and the Environment, 191, 441 – 452. doi:10.2495/SC140371
16	González, A., Donnelly, A., Jones, M., Chrysoulakis, N., & Lopes, M. (2013). A decision-support system for sustainable urban metabolism in europe. Environmental Impact Assessment Review, 38, 109 – 119. doi:10.1016/j.eiar.2012.06.007
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20	Lombardi, P., & Ferretti, V. (2015). New spatial decision support systems for sustainable urban and regional development. Smart and Sustainable Built Environment, 4(1), 45 – 66. doi:10.1108/SASBE-07-2014-0039
21	Menny, M., Voytenko Palgan, Y., & McCormick, K. (2018). Urban living labs and the role of users in co-creation. GAIA, 27, 68 – 77. doi:10.14512/gaia.27.S 1.14
22	Nevens, F., Frantzeskaki, N., Gorissen, L., & Loorbach, D. (2013). Urban transition labs: Co-creating transformative action for sustainable cities. Journal of Cleaner Production, 50, 111 – 122. doi:10.1016/j.jclepro.2012.12.001
23	Newton, P., & Glackin, S. (2013). Using geo-spatial technologies as stakeholder engagement tools in urban planning and development. Built Environment, 39(4), 473 – 501. doi:10.2148/benv.39.4.473
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