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Editorial

Editorial: Special Issue "Resource Management in Urban Districts—A Contribution to Sustainable Urban Development"

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1. Introduction

The built environment is responsible for large shares of energy consumption as well as use of water and natural resources—contributing to resource depletion, water pollution, land use and land use change, greenhouse gas and other emissions as well as waste generation. New ideas, concepts and research are needed to foster a truly sustainable development.

This Special Issue focuses on the efficient and effective management of natural resources in the built environment to enhance a more sustainable development of urban districts or neighborhoods. Here, natural resources include energy carriers and raw materials, water, land, and soil as well as urban green (biodiversity). Target groups of this Special Issue include decision-makers from politics, municipal development, district and urban planning, as well as national and international scientists who deal with issues of resource management as part of sustainable district and urban development.

A sustainable development of urban districts can be interpreted as a complex management task where different stakeholders in specific constellations are involved. However, a sustainable urban development should not only include an improved resource efficiency via planning and assessment but also via influencing the use of resources and the flows of materials. Original research on resource management in the built environment, on sharing economy, urban development, quantification, monitoring and optimization of resource usage and its impacts, disruptive technologies, new management and business models, and related topics were invited and included in this Special Issue. Additionally, the monitoring of air quality, water consumption, emissions into ambient air, water and soil, dust, noise, debris, and waste production and treatment as well as the assessment of improvement measures are part of a process to support sustainably managed urban resources.

In the literature, there is still a prevailing gap between scientific findings and their consequent transfer into the management and decision-making of stakeholders in the built environment. In particular, urban data are not as utilized as they could be for converting districts and cities to more sustainable ones (Punter 2007 [1], Mostafavi et al. 2014 [2], Jain and Espey 2022 [3]). Moreover, monitoring and performance assessment of concepts and measures is crucial to measuring and managing urban transition (Jain & Espey 2022 [3]).

2. This Special Issue

Thus, this Special Issue aimed at bringing together natural science, social science, engineering, and management approaches to increase the impact of research on resource usage, management, and investment decision-making towards more sustainable urban development. In this Special Issue, the editors could invite and publish nine papers describing current state-of-the-art and new/innovative approaches that were developed in Germany recently. All contributions were developed within the funding scheme RES:Z "Ressourceneffiziente Stadtquartiere für die Zukunft" ("Resource-Efficient Urban Districts for the Future") funded by the Federal Ministry of Education and Research (BMBF), Germany. The aim of this funding measure was to generate knowledge on urban resources and their management processes so that decision-makers and those involved in action can better carry out the tasks of conservation and provision, taking into account ecological, economic, and social concerns. The funding measure promotes interdisciplinary and transdisciplinary research approaches that develop and test implementation-oriented concepts at an urban district level.

To cover a broad range of aspects of urban resource management, the presented papers cover different aspects (see Figure 1). The first three papers (Koller et al. 2022 [4], Schinkel et al. 2022 [5], and Schebek and Lützkendorf 2022 [6]) deal with the definition and principles of indicators, indicator sets, and indicator systems to support resource management on a district level (blue).

Koller et al. (2022) [4] learn from 12 publicly funded research projects of the Federal Ministry of Education and Research, Germany, that the optimisation of resource use in urban districts cannot take place independently of each other. Potential conflicting goals and interests should be recognised at an early stage so that measures can be tailored to the specific neighbourhood context when applying an integrated approach. Particularly, multifunctional and multi-beneficial implementation measures are seen as promising to enable/foster a sustainable transformation of urban districts.

Schinkel et al. (2022) [5] developed a set of indicators for sustainable urban infrastructures that include the ecological, economic, and social dimensions of sustainability. The indicator development is based on the results of literature and policy review but was further developed and tailored to urban infrastructures and technologies. Moreover, they demonstrate and test the applicability of the indicator set on a vertical air conditioning and wastewater treatment system.

Schebek and Lützkendorf (2022) [6] present general principles for the development and application of indicators that are suitable for supporting sustainable neighborhood development. The differences between the assessment of a condition and the monitoring of development processes as well as between closed systems and open sets of indicators are discussed. A conceptual outline of a framework is shown, which includes a typology of indicators. It's embedding in urban planning processes is discussed. The framework combines a theoretically concise unifying structure with a flexible practical approach for application in diverse areas of resource efficiency assessment.

The next five papers (Naber et al. 2022 [7], Hörnschemeyer et al. 2022 [8], Beier et al. 2022 [9], Boehnke et al. 2022 [10], and Kugler et al. 2022 [11]) show different assessment methods and tools that can be used for resource assessment purposes on a district level (green). In most of the papers, case studies of real urban districts show the application of the developed tools and methods.

Naber et al. (2022) [7] present an innovative and integrated tool (software) "Namares" to assess urban resources that can moreover propose improvement measures and assess their expected environmental and economic impact. Nine intervention measures are implemented to identify potentials, estimate investments and annual costs, and assess the appeal of existing subsidies. The approach was applied to a case study redevelopment area in a large city in Germany. Moreover, a five-level hierarchy for a land-sensitive urban development strategy was derived.

Hörnschemeyer et al. (2022) [8] developed the integrated planning tool (framework) "ResourcePlan", that covers water (storm- and wastewater) management, construction and maintenance of buildings and infrastructure, urban energy system planning, and land-use planning. It helps to assess inter-disciplinary resource efficiency, supports the spatial identification of synergies and conflicting goals, and contributes to transparent, resource-optimized planning decisions.

Beier et al. (2022) [9] investigated the effects of blue-green infrastructure elements (BGI) on air and surface temperature in courtyards. The effects are examined based on on-site measurements and simulations. Recognizable effects on the temperature were observed. Model simulations with the software PALM-4U were performed and proved to be useful to analyze the effects of BGI on the microclimate.

Boehnke et al. (2022) [10] developed and described a method to quantify and map private urban green on urban district scale. Based on this, they link local biotope and tree mapping methods to the concept of ecosystem services and use it for comparative analyses. The methodology was tested in an inner-city district in Germany, comparing publicly accessible areas and non-accessible courtyards. In the case study results, the private urban green spaces and trees were very important for the overall urban ecology.

Kugler et al. (2022) [11] developed a technical system to extract low-temperature heat from the underground wastewater network and distribute energy in the urban district. Therefore, they developed new pipes and propose an integrated energy concept (energy master plan) on a district level. In their analyses, they show that the dual use of the pre-existing infrastructure, such as the wastewater system, significantly reduces CO_2 equivalents and that the sustainability of the system depends significantly on the used energy mix for electricity.

Finally, Volk et al. (2022) [12] provides an overview on state-of-the-art assessment aids and tools in urban resource management that can help stakeholders and decision makers to identify most suitable tools for developing strategies and implementing actions (orange). In this contribution, 51 urban resource assessment, management, and planning tools were reviewed and analysed. It shows that simple informational aids, such as visualizations or GIS viewers, are widely available. However, databases and tools for explicit and data-based urban resource management are sparse. Only a few focus on integrated assessment with decision and planning support for impact and cost assessments. Real-time dashboards, forecasts, scenario analyses, and comparisons of alternative options are rare.

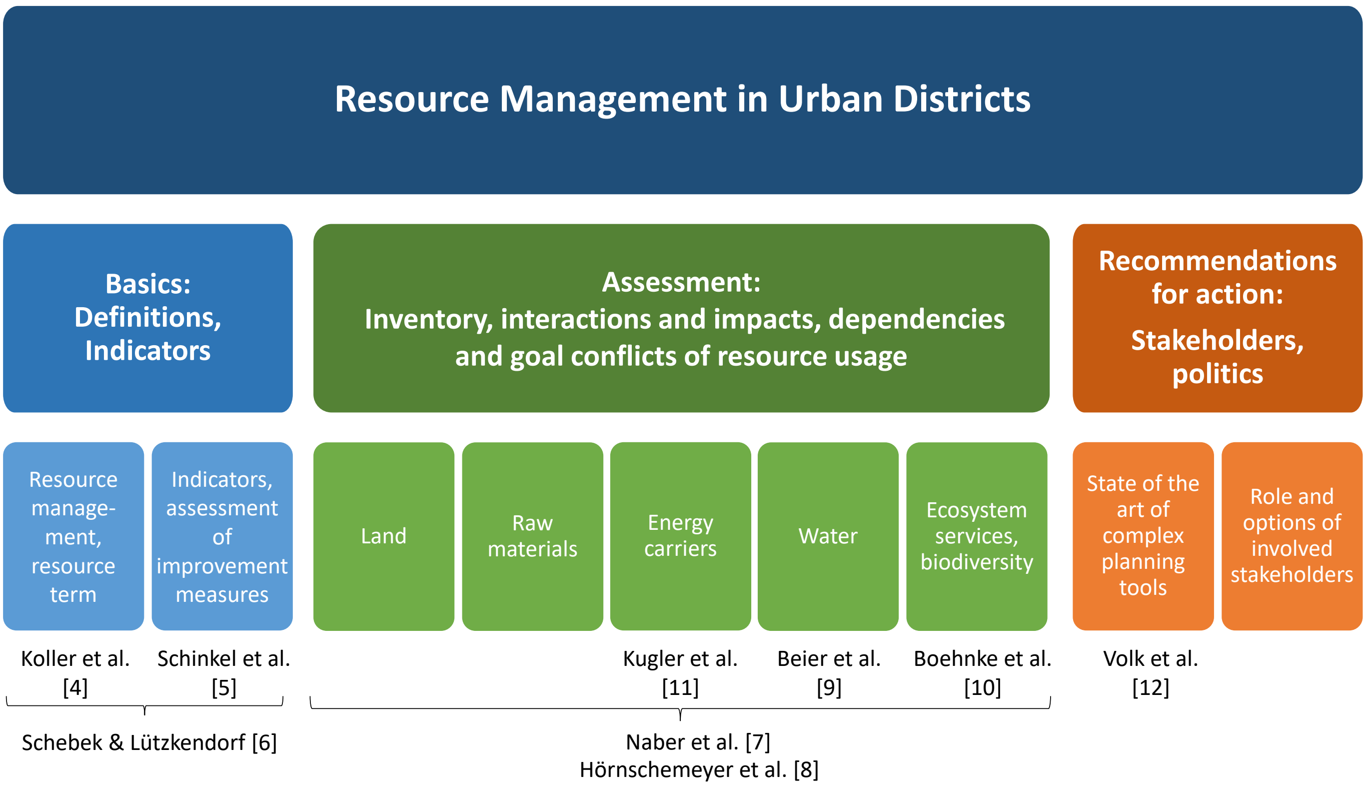

Figure 1. Overview on covered fields in Resource Management in Urban Districts.

3. Conclusions

Taking into account the contributions of this Special Issue, the editors come to the following conclusions of this research field:

- A combination of urban district research and development of resource management approaches is a new field of research that opens up with a particular urgency and societal relevance.
- Urban districts form an important level of action that allow local stakeholders to be involved and activated. Moreover, this level allows for a valid connection of (inter-) national and local goals, action requirements, and implementation options.
- Indicators and assessment approaches should accompany planning, development, and implementation. For this, open indicator sets should be preferred over closed, non-recurring indicator systems to enable time series and extensions.
- Roles and options of involved stakeholders in sustainable development at an urban district level have not been systematically analysed so far. Especially, the role of public administration in the provision and conservation of urban resources as public goods and the problems with public goods, e.g., market failure due to free riders and unwillingness of private stakeholders to provide the services ("Tragik der Allmende"/"Tragedy of the Commons") and the legal regulation on treating urban resources requires consideration. Moreover, the role of civil society in sustainable neighborhood development should be analysed. Additionally, research on goal conflicts or use conflicts could be extended—particularly with analyses and solutions to solve the goal conflicts and interest/dispute settlements. Research in all these fields should be escalated.
- Research on implementation (e.g., real-world labs) is sparse—barriers and how to overcome the barriers are under-researched.
- Despite some existing and further/newly developed tools, data-based urban resource management remains difficult due to unstandardized urban data, e.g., regarding availability, data structure, quality, and timeliness of data. This makes quantitative analyses very time-consuming.
- The use of integrated analyses and tools are indispensable, since the considered resources are interlinked and competing with each other on land/surface coverage and investment/budget.

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