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Urban Districts

Cross-project working group

**„Indicators“**

# Handout

## on the typology of indicators and their application in planning processes and projects on sustainable district development

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**Introduction to the context and motivation for this handout**

As part of the flagship initiative "City of the Future" within the programme "Research for Sustainable Development (FONA)" coordinated by the Federal Ministry of Education and Research (BMBF), 12 inter- and transdisciplinary projects involving more than 20 model municipalities are carried out within the framework of the funding measure "Resource Efficient Urban Districts". The aim is to develop and test concepts for water management, land use and material flow management suitable for practical implementation as a basis for the sustainable development of urban districts. An accompanying project with cross-project working groups supports the networking of the projects to discuss certain topics, the communication with the outside world and the transfer into municipal practice.

Against the background of the BMBF flagship initiative "City of the Future", the projects of the funding measure "Resource-efficient urban districts for the future – RES:Z" are expected to make "...verifiable contributions, i.e. backed up by suitable indicators to be developed by the project consortia themselves..." [1]. A sub-task for the individual projects is therefore to use and/or develop suitable indicators, foundations and tools for the evaluation of sustainable district development measures. For this purpose, certain fields of action regarding the use of natural resources have been defined to achieve a thematical focus, i.e. water, land, materials and ecosystem services, to be embedded in an overarching sustainability assessment of the district development measures.

Within the framework of the accompanying project of the funding measure "Resource Efficient Urban Districts", a cross-project working group has been established for the cross-sectional topic (QT)"Indicators and Evaluation". The working group supports the projects with regard to the selection/application of suitable methods and indicators as well as synergies with other projects. In addition, the cross-working group is expected to create an added value for the funding measure by comparing and potentially aligning methods, performing quality assurance checks for the chosen methods and integrating the results regarding the contribution to the sustainable development indicators for a common "public image" of the RES:Z projects. After all, the intention is to develop approaches which can be used in municipalities beyond the projects’ durations and thereby support the processes of planning and realising a sustainable district development.

This handout was developed by the authors within the QT "Indicators and Evaluation". The typology of indicators presented here and their application in planning processes, as well as in the assessment of products and measures one of the results from the cross-project collaboration. This handout therefore builds on the experiences and contributions of the researchers from all individual projects of the funding measure "Resource Efficient Urban Districts". The authors of this handout would therefore like to thank the researchers for their contribution. Furthermore, we are thankful for the support by the accompanying project.

L. Schebek, T. Lützkendorf, M. Uhl, J. Hirschfeld

[1] BMBF announcement: Guideline "Resource-efficient urban districts for the future" on the topics of water management, land use and material flow management as a contribution to the implementation of the flagship initiative City of the Future. Federal Gazette of 14.03.2017

# Content of the Handout

# Summary

This handout provides support for a structured approach to the selection, application and interpretation of indicators in planning processes and projects in the context of resource-efficient district development. It is divided into two parts:

- **Part I** provides some background to the development of indicators and indicator systems. On this basis, a **typology of indicators** for use in planning processes and projects is developed.
- **Part II** outlines the procedure for the selection and application of indicators, using the typology introduced in Part I. A **flowchart outlining the procedure** is presented.

To provide some background to the topic, Part I outlines the fields of application and terminology of indicators and presents the global Sustainable Development Goals (SDG) of the United Nations as a target system for sustainable development. The chapter explains in general terms how individual goals and indicators can be derived from such overarching goal systems for specific levels of action, i.e. also for the district level. In the following, the so-called Driving Forces - Pressures - States - Impacts - Response model (DPSIR model) is presented, where the environmental issues and their (complex) interactions are described, and indicators are assigned to these issues. The cause-effect concept of this model can also be used to structure other indicators for topics which are not addressed here.

In this handout, a typology of indicators for the assessment of districts is defined. The typology is based on the DPSIR model and comprises three types of indicators: **Status indicators**, which describe the specific conditions of a district at a certain point in time; **impact indicators**, which describe the influences on the environment, economy and society and establish a reference to the sustainable development objectives; and **performance indicators**, which describe the characteristics and properties of (technical and organisational) measures to improve the resource efficiency of the districts as a contribution to sustainable development.

In Part II, the practical procedure for the selection and application of indicators is structured into two-phase process. In the first phase, indicators are selected. The first step is to define the object to be analysed for which indicators are to be selected. This can be the **district** itself, but also a **measure** or a **product** that is being developed for use in the districts. The types of indicators to be used are assigned to the objects to be analysed. Afterwards, concrete indicators are selected from existing indicator sets or indicator systems or by deriving indicators from different contexts (e.g. water, land). If necessary, indicators can also be developed conceptually or derived in participatory processes. The indicator selection phase is completed by comprehensive documentation with clear definitions of all selected indicators. The following phase of the (indicator) application follows the structure given by the **tasks of the planning and realisation cycle** of districts. These tasks are explained with regard to the respective objects of consideration to be evaluated and the assigned types of indicators. The result of Phase 2 is the evaluation of the respective objects of consideration by means of the selected indicators. As a transparent basis for decision-making by actors in district planning, the result of the evaluation is documented in a comprehensible and task-related manner by means of indicators.

# I. Background

## I.1 Fields of application and terminology

When developing a district, it is necessary to record, analyse and evaluate situations in different contexts and at different times in order to ensure a problem analysis as the basis for a goal orientation with regard to aspects of sustainable development. In all these contexts, indicators are used to support the evaluation of initial- and target states. Often, planning and measures to support sustainable district development are initiated with concrete subject areas such as land or water management in mind. Here, one first deals with technical indicators and indicators concerning certain (environmental) issues. Using just a few suitable indicators, it is often possible to conclude that there is a direct need for action and to develop a basis for proposals for concrete measures. However, the effects of these measures often go beyond the specific subject area and/or the district boundaries. Their contribution to the objectives of sustainable development requires a more extensive evaluation, which must include facts and information from outside the district. For this purpose, complex evaluation methods such as life cycle assessment or life cycle costing have to be used, whose application requires further expertise for the calculation and interpretation of indicators (Kaltschmitt und Schebek 2015).

Even this brief outline makes it clear that the field of indicators and associated evaluation methods is very broad. A review of the relevant regulations and literature sources shows that even the details of existing definitions of the central term "indicator" differ from one another, since the respective documents usually originated in or are bound to a specific context. For this reason, a generic interpretation of the term “indicator” has been adopted for use in the present handout, which can be applied to different contexts: an indicator is defined in the most general form as a proxy value that serves to describe a (complex) situation.

Accordingly, there are a large number of concrete definitions and characteristics of indicators, some of which are (1) topic-specific, (2) cross-cutting, (3) based on standards or guidelines, or (4) proposed in the scientific literature. In order to structure this wide range, a typology is very helpful. On the one hand, it will be helpful to those working on research projects to achieve a common understanding of the terms, and for those working in real planning and implementation processes. On the other hand, it highlights the connectivity of individual planning or project systems to higher-level target systems, especially to the overall social sustainability targets. This is especially advantageous because in individual planning processes or projects, individual target systems can emerge from the compilation of a wide variety of indicators, which reflect the specific framework conditions and contents of the planning process or project. By means of a typology, these can be classified into general target systems of a sustainable development. This (1) increases the transparency of decision-making processes based on indicators and (2) facilitates the exchange and communication with different groups outside a planning process or project.

## I.2 Sustainable development target systems and indicators for districts

The definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[2] was coined by the The Brundtland Commission (World Commission on Environment and Development) in 1987. The very name of this commission shows that the objectives of sustainable development are defined from a global perspective. Today, on a global level, the target system for sustainable development is described by the 17 Sustainable Development Goals (SDGs), which were adopted by the United Nations in 2017 and are underpinned by a system of 169 individual targets. The SDGs were implemented by the German government in the German sustainability strategy with a total of 63 goals (Bundesregierung 2021; Blumers und Kaumanns 2017).

Based on these objectives for society as a whole, these sustainable development goals have been and are being concretised for various fields of action. For urban development, the New Leipzig Charter (BMI 2020) postulates the basic features of an urban development policy in which sustainability and orientation towards the common good are the fundamental premises of transformation for the benefit of quality of life under rapidly changing boundary conditions. A high quality of life in cities serves the common good for the benefit of all people and should not be limited to certain aspects only. Strategies of sustainable land policy and use, polycentric settlement structures with appropriate density and compactness as well as multifunctional land uses are recommended as an urban space framework. Neighbourhoods with mixed uses, high-quality public spaces, green and blue infrastructures which are interconnected as well as a vital architectural heritage are highlighted as significant determinants for a vibrant city. The provision of sufficient healthy and affordable housing, good social and technical infrastructure, the efficient and equitable use of resources and climate protection are considered key tasks of municipal services of general interest. This transformation of cities requires, among other things, resource management that has clear indicators, comprehensible methods and participatory planning.

Sustainable development encompasses goals in the ecological as well as in the economic and social spheres. The topic of resource efficiency is primarily placed in the ecological dimension, since the concept of resources is usually interpreted as natural resources in sustainability policy (cf. Glossary) (UBA 2012). While resources are often colloquially equated with primary raw materials, this definition of natural resources also includes nature's sink function for emissions and, in particular, the topic of ecosystem services.

The term ecosystem services was established by the 2005 United Nations Millennium Ecosystem Assessment report (Kaltschmitt und Schebek 2015). This report defined 24 services, 15 of which were already in a state of advanced or ongoing degradation in 2005. Since then, different classifications have been developed for ecosystem services. In general, they include both direct provisioning services (e.g. provision of food and drinking water, extraction of raw materials) and a wide range of so-called regulating services (e.g. with regard to climate effects and water and material flows), and also cultural or aesthetic services (e.g. landscape or recreational benefits). The value of ecosystem services for society can be translated into monetary values in a multicriterial way with a variety of individual indicators or with the help of different economic valuation methods, for example in the context of extended cost-benefit analyses for the comparative evaluation of different management options.

[2] Citation according to BMU: https://www.bmu.de/themen/europa-internationales-nachhaltigkeit-digitalisierung/nachhaltige-entwicklung/strategie-und-umsetzung/nachhaltigkeit-als-handlungsauftrag/

If indicators are to be selected or developed for a specific application case based on sustainable development goals, SDGs that (a) feature an object to be analysed in the sense of a level of action, (b) show a need for action, (c) define a target system and (d) name possible solutions should be selected. Figure I-1 provides a suggestion for the case of neighbourhood development.

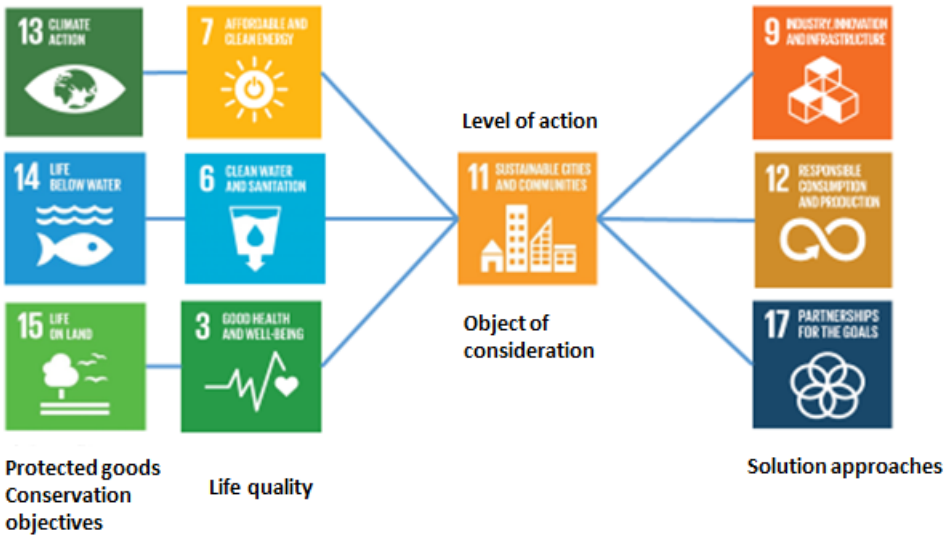


*Figure I-1: Sustainability goals with reference to district development [Lützkendorf / 2020]*

Further points of reference include the management rules for sustainable development, where the use of resources is addressed, the protected assets and objectives of sustainable development in the areas of environment, economy and society, which provide a basis for criteria and indicators for the sustainability assessment of buildings, and the basic requirements for the sustainable use of natural resources, which are specified in the Construction Products Ordinance. The Guide to Sustainable Construction (BMI 2019) provides an overview of the protected goods and protective goals of sustainable development which are suitable for the derivation of indicators for construction measures and neighbourhood development, among other things.

## I.3 The DPSIR Model

As a result of the political agreement on sustainability goals, which forms the basis for the SDGs, quantitative targets have to be defined and monitored. International policy makers achieve this through a system of statistics implemented at the national level. Data that are either directly used as indicators for specific issues or combined with other information to form such indicators are collected for these statistics. In order to structure the wide range of indicators for sustainable development, the OECD developed the Pressure-State-Response Model for the environment as early as 2003, which was subsequently developed further into the Driving Forces - Pressures - States - Impacts - Response Model by the EEA for national and international environmental statistics (OECD 2003). It links "Driving Forces", "Pressures", "States", "Impacts" and "Responses" in a causal relationship. As shown in Figure I-2, cause-effect relationships in the environment are structured in the DPSIR scheme as follows:

D = Driving Forces: **Driving indicators** show which human activities cause the relevant pressures on the natural environment (e.g. increasing population, changing lifestyles or demand for products to fulfill people’s needs).

P = Pressures: **Pressure indicators** express the concrete pressures on the natural environment (e.g. emissions from the production of materials, products, energy, etc.).

S = States: **State indicators** describe the state of selected components of the natural environment (e.g. immission concentrations in air or water, soil sealing).

I = Impacts: **Impact indicators** highlight changes in the natural environment that are attributed to certain influencing factors (e.g. greenhouse effect, decrease in biodiversity).

R = Responses: **Action indicators** measure the means by which and the extent to which politics and society respond to changes in the natural environment in the defined fields of action (e.g. legislative or technological measures).

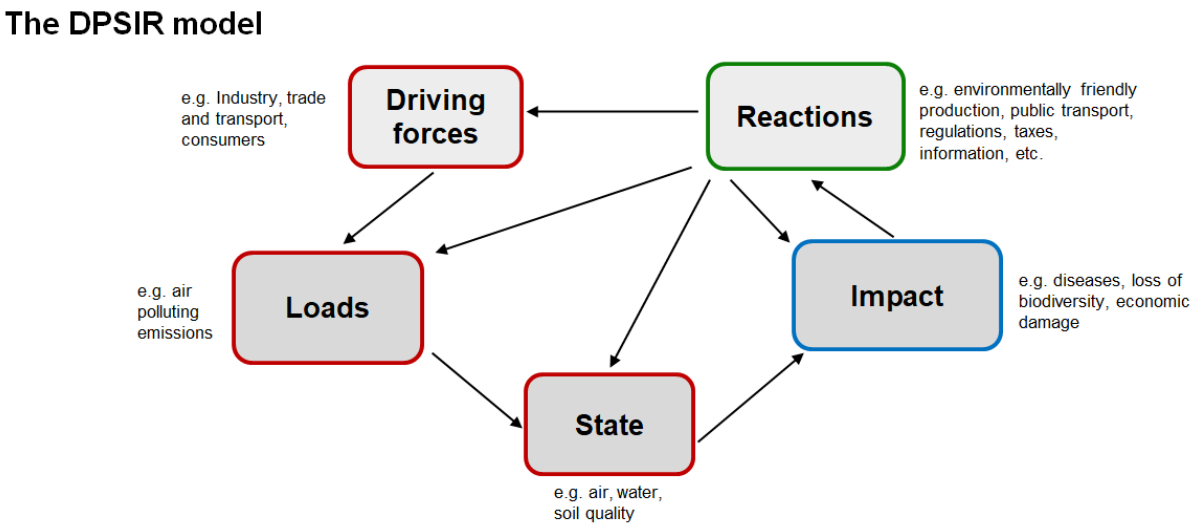


*Figure I-2:DPSIR-scheme [Source: own representation according to (EEA 1999)]*

The comprehensive causal-analytical representation of relevant processes around the natural environment and their anthropogenic influence, which is the basis of the DPSIR model, is a conceptual foundation generally used in politics as well as in science today. It is therefore also a suitable basis for fields of application below the level of national statistics, including the topic of sustainable district development.

## I.4 Typology of indicators for sustainable district development

The analogous transfer of the DPSIR scheme to a field of application makes it possible to classify different indicators according to their content-related character. The DPSIR's basic structure is therefore translated into a **typology of indicators for application in sustainable district development** by means of the definitions below. Three types of indicators are distinguished:

> **Status indicators:** Indicators that describe the concrete **status of a district** at a specific point in time, both with regard to structural and other aspects and including the (technical) systems directly connected to the district (e.g. sewage system). **Status indicators can be determined from measurements, surveys or interviews directly on or in the district.**
>
> The definition of status indicators is made here in a wider sense. It also includes driving forces and pressures of a district. Status indicators can (but do not have to) be divided into the following sub-types:
>
> - Indicators for driving forces that originate directly from the district (e.g. number of residents[3]) **("driving indicators")**.
> - Indicators for pressures in the form of substance inputs from the district (e.g. into water bodies) or for land use or land use changes in the district **("pressure indicators")**.
> - State indicators in the narrower sense, i.e. the state of the environment within the district or its direct surroundings (e.g. substance concentrations in air or water, state of surfaces (sealed; hemeroby levels) in the district) **("state indicators")**.
>
> **Performance indicators (response)**: Performance indicators **measure** the characteristics and properties of interventions. This type of indicator is used to assess the suitability of a measure for its intended purpose. Accordingly, performance indicators can only be defined in connection with concrete measures (cf. also Part II). (e.g. efficiency of a plant, evapotranspiration performance of a green space).
>
> **Impact indicators**: Indicators that describe the effects of district activities and/or measures on the economy, society and the environment. They therefore also refer to ecological, economic and social circumstances outside the district. **Their determination therefore requires the inclusion of further information outside the district and, if necessary, the application of complex methodological approaches/models.** Impact indicators are used for a sustainability assessment with reference to the objectives of sustainable development. (e.g. greenhouse gas emissions, consumption of abiotic raw materials).

**The general application of the defined types of indicators is shown in Figure I-3.** The condition of a district can be recorded and evaluated as an initial, intermediate and (preliminary) final condition. In

[3] Alternatively, it is possible to consider population composition and development as a separate district characteristic and to integrate it into a corresponding presentation of initial information and boundary conditions.

this respect, its recording and evaluation is possible and useful before, during and after district development processes. The assessment of both the actual state (initial state, status quo) and the target state (hypothetical or real target state) is carried out by means of state and impact indicators. In contrast, measures that effect the transition between the actual and target state within the framework of district development processes are evaluated by means of performance indicators.

The term “benchmarking” is also often used to describe indicator-based evaluations. Benchmarking refers to the comparison of the determined value of an indicator with the corresponding target value (referred to as the “benchmark”). Benchmarking is basically possible with all types of indicators and does not make any statement about the character of the respective indicator. The target value (benchmark) represents the or an evaluation standard. A distinction can be made here between relative benchmarking, in which the best variant is determined from different variants, and absolute benchmarking, which indicates the distance to a target value defined by external specifications or internal self-commitment, e.g. to obligatory standards of energy efficiency or to politically set sustainability targets.

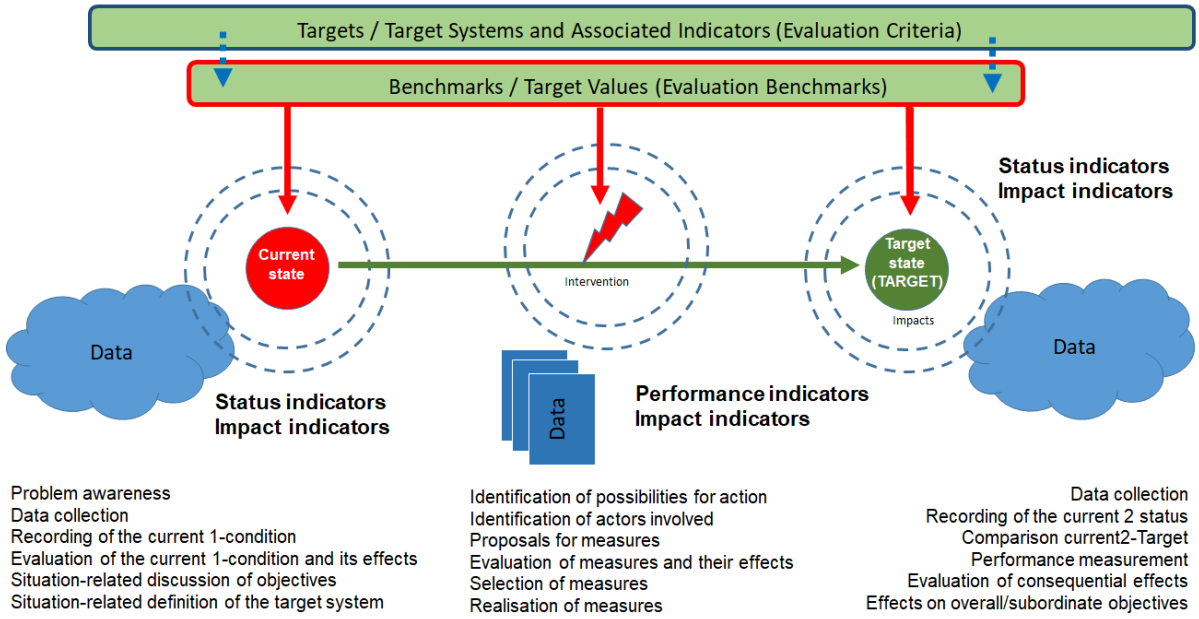


*Figure I-3: Localisation of the indicator types in their respective application environment [Source: Lützkendorf]*

The general presentation in Figure I-3 marks the transition to the following practical part, in which the concrete application of indicators in real district development processes is explained in the sense of a step-by-step procedure intended for practical application.

# II. Practical approach

Using the typology developed in the previous section, the practical application of the indicators is shown in the process diagram in Figure II-1. The process is divided into two phases:

**Phase A:** Selection process for indicators

**Phase B:** Application of indicators in concrete planning processes/projects

Phase A ensures the transparent and comprehensible justification of the choice of indicators, both for the direct process/project participants and for communication with external parties. Accordingly, the result of phase A is the complete documentation with a clear definition of the selected indicators.

The application of the selected indicators in phase B leads to the concrete results of the assessment with the need for action derived from them. The result of phase B is the presentation of the assessment results for the purpose of decision support, assigned to the individual tasks of the analysis, planning- or realisation process.

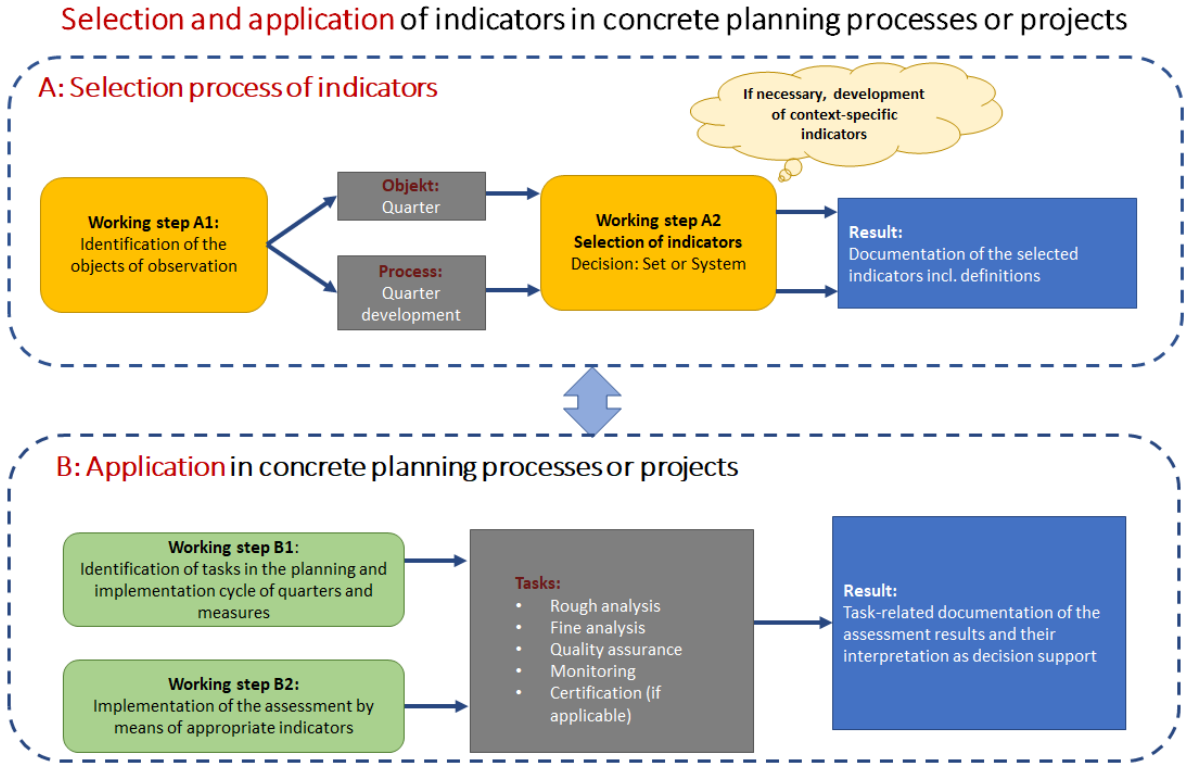


*Figure II-1: Process diagram for the selection and application of indicators in concrete planning processes or projects [Source: Schebek]*

## Phase A

In step A.1, the selection of indicators begins with the identification of the objects of observation. This is followed by the selection of indicators from indicator sets or indicator systems in step A.2.

### A.1 Identification of the objects to be analysed

Indicators can be used in the context of districts for different objects to be analysed and for different tasks; conversely, the selection and application of indicators depends on the object to be analysed and task within district development. While the tasks arise dynamically from the planning and realisation cycle of districts (cf. step B1), objects to be analysed can be assigned to types of indicators in general form. The first step is therefore to identify the object(s) to be analysed, to which the indicators are then to be applied.

The object to be analysed is naturally first and foremost the **district** as a whole. The part or aspect of the district to be analysed is defined via system boundaries and described via the specification of essential characteristics. The choice of the system boundaries can differ for individual indicators, since districts can be defined differently under specific (e.g. structural or social) aspects and are also connected to infrastructure systems (e.g. water supply, sewage disposal).

For the application of indicators (Phase B), a distinction is made between two cases of observation of the districts: on the one hand, the **assessment of a district as an "object" at a defined point in time**. In this case, **status and impact indicators** are used. On the other hand, the application can refer to the support of sustainable neighbourhood development as a **"process"**. In this process, it is necessary to evaluate not only the district itself, but also the options for action and activities to change it.

Accordingly, the term **"measure"** can be identified as a further object of consideration (as a collective term for all options for action and activities, regardless of whether they are only conceptualized or also realised). The aspect of the measure to be assessed is described by the type, intensity and direction of the effect of the activities to improve an actual state in the direction of a target- or desired state. There are organisational, technical, structural and other types of measures. **Measures are assessed based on the effectiveness and efficiency of the selected performance indicators**. In addition, measures are assessed with regard to their effects on society, the environment and the economy using **impact indicators**, and are thus subjected to a sustainability assessment.

A measure may include the use of **products**, or products may be developed specifically for districts as part of a project. If the main interest is in evaluating the product, then this can also be defined as an object of consideration. This object to be analysed includes products that are developed and used to improve certain areas or conditions in the district (e.g. green facade systems). Such a product is first described in terms of technical/functional characteristics and properties. **Its effectiveness and efficiency can be assessed with the selected performance indicators**. In addition, products are assessed using **impact indicators** with regard to their effects on society, the environment and the economy and thus subjected to a sustainability assessment. The system boundary usually comprises their complete life cycle. The evaluation by means of indicators can take place both in the case of the selection and evaluation of products for use in the context of measures and to support the development of a product, including the evaluation of variants of the product to be developed.

## A.2 Selection of indicators

In step A2, concrete indicators for the objects to be analysed are derived or selected. In exceptional cases, new indicators may also be developed. With regard to the compilation of different indicators for a planning process or a project, the terms "sets" and "systems" can be distinguished:

> **Open indicator sets** are collections of indicators from which actors can choose depending on the question and situation or which are individually compiled depending on the specific situation. These sets can contain indicators that assess a situation from different perspectives. Double counting does not play a role here; however, it follows directly that these indicator sets are not suitable for aggregation. Such sets in the form of collections of indicators can be compiled by the participants themselves or taken from other projects/preliminary work.
>
> **Closed indicator systems** are usually used in connection with evaluation tasks or in the context of evaluation systems. Such systems are based on a homogeneous conceptual or model-theoretical approach. They often contain procedures for partial or full aggregation on the basis of weighting factors. Therefore, double counting must be avoided here, which must be ensured by the underlying conceptual approach. An example of such closed indicator systems are impact models of life cycle assessment. In these, material flows are assigned to individual impact categories that stand for different environmental problems, for example, the indicator Global Warming Potential for the environmental problem of climate change. The indicators of the individual impact categories can then be aggregated into indicators for protected goods in the sense of "endpoints", i.e. human health, ecosystems or non-renewable raw materials.

The starting point for deriving or selecting indicators is the existence of open indicator sets or closed indicator systems that are developed and made available by third parties. From these, indicators for districts or district development can be selected in different ways:

- Adoption of technical parameters for certain thematic areas;
- Implementation of participatory opinion-forming and goal-setting processes in the district (bottom up);
- Justification from overriding social, political or scientifically based goals in the context of sustainable development (especially Sustainable Development Goals/SDGs) (top down);
- Adoption of existing standards and regulations (with or without adjustment to the context).

The selection of indicators must always include an examination of the availability of data and the appropriateness of the effort required for data collection. A clear definition must be provided for each indicator selected. Such a definition includes (1) a textual description of the conceptual idea of the indicator, (2) the procedure for its derivation, (3) the specification of a measurement rule and (4) the assignment to the types of indicators mentioned. In case of existing indicators are used, this requirement regarding the definition can be met by citing the source. When using indicator systems (usually sustainability assessment and certification systems), a reference to the system is sufficient. When selecting indicators from indicator sets, a reference must be made for each individual indicator.

The selection of indicators **from open indicator sets** offers the following possibilities:

- Adaptation to specific questions
- Adaptation to the information needs of specific actors
- Adaptation to the specific data situation

In special cases, a situation may arise where no suitable indicator can be identified for a concrete issue or a specific sub-objective. In this case, a project-specific additional indicator can and shall be developed and tested. In the case of self-developed additional indicators, a corresponding definition must be developed and filed in the project documentation. In the documentation, it is noted to which category the indicator belongs, i.e. status, performance or impact indicator.

**Closed indicator systems** are mainly used for the selection of impact indicators with the aim of connecting them to the overall societal objectives of sustainability. Such indicators often go hand in hand with complex model-based evaluation approaches. Therefore, existing validated methods and their indicators must be used in this case, and the corresponding know-how for their use in planning processes or projects must be available.

**Result of phase A:**

- Documentation of the selected indicators, classified into the categories "open indicator set" or "closed indicator system" and by the types of indicators.
- Definitions of all selected indicators.

## Phase B

The identification of the concrete task in connection with its respective object to be analysed form the basis for the application of the indicators. This takes place within the planning and realisation cycle of the districts and measures (work step B1). As a decision support for this task, the evaluation is then carried out by means of suitable indicators; and the result and interpretation of the evaluation are documented (work step B2).

### B.1 Identification of tasks in the planning and realisation cycle of districts and measures

In connection with the development of new districts or the further development of existing districts (mainly considered here), certain tasks have to be dealt with in the context of planning and decision-making that make the use of indicators necessary, or that can be supported by the use of indicators. These tasks are shown in Figure II-2 in the planning and realisation cycle of districts and measures: Rough analysis, detailed analysis, quality assurance, monitoring (if necessary, also certification, cf. section B2). The selection, application and interpretation of the indicators is carried out in connection with the concrete object to be analysed and the questions to be dealt with.

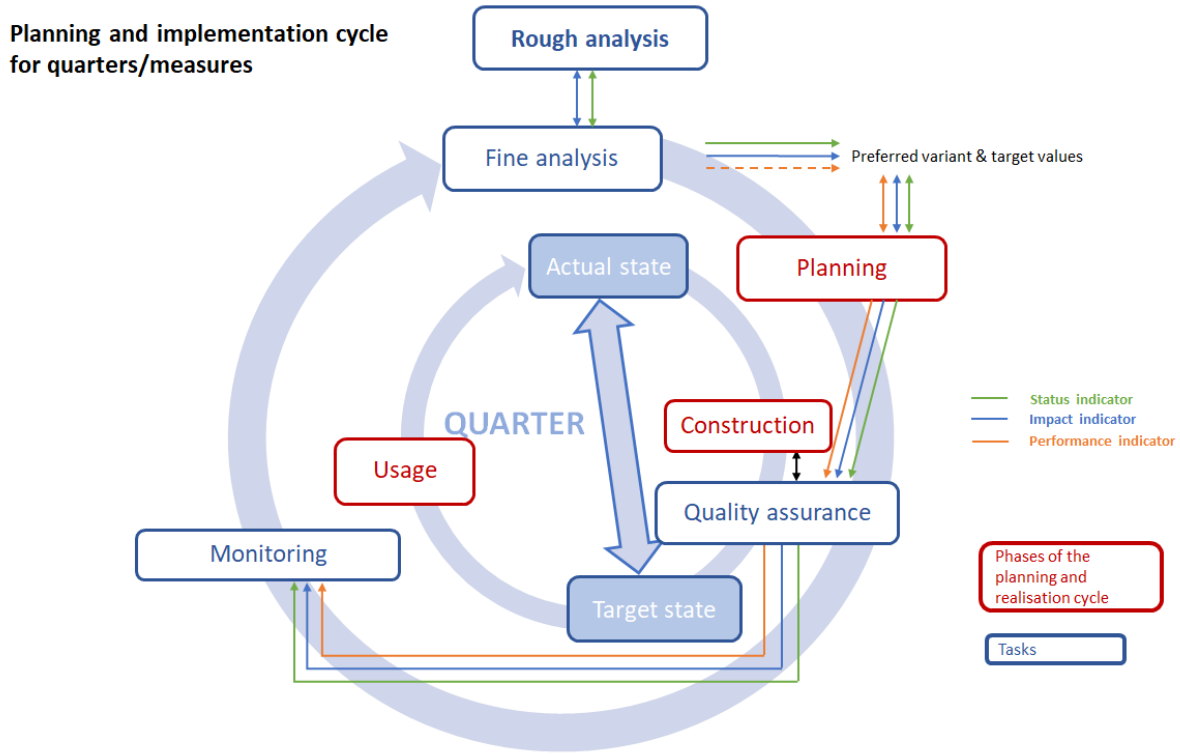


*Figure II-2: Planning and realisation cycle of districts/measures. [Source: Uhl/Schebek]*

The activities in the planning and realisation cycle at neighbourhood level are preceded by a process of analysing and evaluating the status quo, setting goals and determining the need for action. This process is referred to here as a **"rough analysis"**. For the rough analysis, status and impact indicators are used for the object to be analysed, i.e. the district. In the subsequent evaluation, these are compared with target values (benchmarks) and evaluated both individually and synoptically. One example is the assessment of a district with regard to its sustainability using sustainability assessment systems

(not dealt with in detail here), another is the development of strategies and solutions for improving the situation in existing districts in the direction of sustainability, through which the need for action to support sustainable district development is identified. As a result of the rough analysis, a need for action is identified, which subsequently triggers planning measures in the area of neighbourhood development and concrete individual measures (projects).

The other tasks result from accompanying and supporting the process of sustainable neighbourhood development, i.e. the planning and realisation cycle which initially takes place at the district level. They can either be permanently implemented in (municipal) structures or exist for a defined period of time in the sense of a project. This results in the overhang to the object of consideration of individual measures/projects.

The active design and transformation of (existing) districts to increase resource efficiency is thus usually carried out through concrete projects (including organisational and technical construction measures) - see Figure II-2.

The planning and realisation cycle [4] shown in Figure II-2 is basically structured in three phases: Planning phase (shown in the outer circle of Figure II-2), construction/realisation phase and utilisation phase (in the inner circle of Figure II-2).

The **planning phase** includes, for example, urban land-use planning at district level or object-, operational and redevelopment planning for individual projects. In this phase, decisive decisions are made on the use of resources such as land, water and raw materials in the future construction and utilisation phase. The **construction/realisation phase** consists of all activities for the new construction, conversion, maintenance and renovation of structural or technical measures. Among other things, the resource types ‘materials’ and ‘space’ are used in accordance with the underlying plans. In the medium to long term, the **utilisation phase** requires the resources land, water, materials including energy carriers, as well as system services of the ecological, infrastructure and social and economic systems which are directly or indirectly affected. In the case of technical or construction measures, the end of use or life cycle as well as the associated treatment/disposal processes are included.

[4] The phases of planning, realisation and utilisation of measures are classified into the cycles of a dynamic district development (Figure I-2). The district development itself is interpreted as a process; the measures are the subject of a life cycle analysis.

## B.2 Implementation of the assessment by means of appropriate indicators

The implementation of the assessment makes use of the indicators identified as suitable in section A.2.

Building on the rough analysis, the concrete need for action is specified and detailed in the form of a **detailed analysis** according to type, extent and time as well as possible measures in the planning phase. Here, **status and impact indicators** are used and, with regard to already foreseeable possible measures, also corresponding **performance indicators are applied**. With these, planning variants can be compared on the basis of their predicted solution contributions and a preferred variant can be selected. The preferred variant is specified in the design planning and finally evaluated on the basis of the planning forecast values of its indicators and their specified target values.

In the subsequent construction/realisation phase, the focus is on **quality assurance**, both during and after completion. Here, **performance indicators** of the selected measures or products are used, but if necessary, the expected overall condition of the district can already be evaluated by means of the corresponding **status and impact indicators** in the sense of an interim evaluation (if necessary, at milestones of the project process). With the completion of the construction/realisation phase, the new status is achieved and is assessed with updated status and impact indicators. As a result, the degree of improvement can be shown.

This is followed by the utilisation phase. It is accompanied by continuous or temporary **monitoring** and the measures implemented to maintain a certain condition, usually by systematic maintenance. Within the monitoring framework, the same indicators are used that were already used in quality assurance. For these, data from the actual operation is now available, which is used both for success control and for a condition analysis as the start of the next planning cycle in the sense of the management principle of continuous improvement. If monitoring shows that target values (benchmarks) are not being met, corrective measures can be designed in a new planning cycle. If, either during implementation or through monitoring, it becomes clear that target values are fundamentally not achievable, alternative or compensatory measures can be considered.

As a further task, **certification** can take place as required. This can be interpreted as a special form of a status quo analysis, as the primary goal is not to identify the need for action or measures, but to check compliance with the specified criteria of a certification system.

**Result of phase B:**

Task-related documentation of

- the assessment results for the selected indicators
- the interpretation of the assessment results for decision support purposes and the derivation of recommendations for action.

# III. Glossary

**Benchmark**: Generic term for target values and evaluation standards. In the narrower sense/used here in the sense of a target value that reflects the numerical expression of an indicator for representing the goals of a development or a measure.

Benchmarks can be obtained empirically, taken from laws and standards, developed under consideration of technical and/or economic feasibility, or derived top-down from planetary boundaries. It is possible to define them in terms of a voluntary commitment. Benchmarks can be used as single values or in evaluation scales. Here, a distinction is usually made between limits and reference values, and between short- and medium-term target values. The development, definition and updating of target values forms part of the provision of benchmarks.

**Benchmarking**: Benchmarking means comparing the determined value of an indicator with the corresponding target value (benchmark). Benchmarking is basically possible with all types of indicators and does not make any statement about the character of the respective indicator.

Depending on the character of the target value set for benchmarking, a distinction can be made between relative benchmarking, in which the best variant is determined from different variants, and absolute benchmarking, which indicates the distance to a target value defined by external specifications or internal self-commitment, e.g. to mandatory standards of energy efficiency or to politically set sustainability targets.

**Data**: Units of information obtained directly from measurements, surveys or interviews. They can be represented by a numerical value and a unit. The term is used synonymously with the term measurement data.

**Indicator**: A proxy value that serves to describe a (complex) situation. An indicator is described by the (calculation) rule for its determination from data and its unit.

**(open) indicator set**: collection of indicators which may contain double counts and is therefore not suitable for aggregation. From this collection, it is possible to select - on a case-by-case basis -those indicators that are suitable for assessing individual issues from the perspective of specific groups of actors. The inclusion of further indicators to record and assess impacts is recommended.

**(Closed) indicator system**: Compilation of indicators based on a homogeneous conceptual or model-theoretical approach. All indicators need to be used in an assessment, (i.e. it is not possible to select only individual indicators from the system). Due to the avoidance of double counting, aggregation is possible.

**Measures**: all technical, design, organisational, social and financial activities/installations/actions that have a targeted effect on the district and lead to changes inside or outside the district.

**Resources**: defined as natural resources in the context of resource efficiency

**Natural resources**: “A resource that is part of nature. These include renewable and non-renewable primary raw materials, physical space (area), environmental media (water, soil, air), flowing resources (e.g. geothermal, wind, tidal and solar energy) and biodiversity. It is immaterial here whether the resources serve as sources for the production of products or as sinks for the absorption of emissions (water, soil, air)" (UBA 2012).

**Status**: in the narrower sense, the state of the natural environment as defined by the "State" definition of the DPSIR scheme. In a broader sense, any state of a system at a given point in time; often used in the contexts of "status quo state" and "target state".

# IV. List of references

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