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Spatial aggregation of indicators in sustainability assessments: Descriptive and normative claims

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ABSTRACT

Indicators are widely used in sustainability assessments. They serve both a descriptive function (i.e., assessing a situation or effects of potential changes) and a normative function (i.e., allowing the expression of value judgments). These functions are usually considered when identifying and using indicators. However, processes such as formalization, estimation, and customization are needed to produce tangible indicators. These processes and their influence on sustainability assessments are studied less often. We focus on spatial aggregation, a specific type of customization commonly used for landscape-scale and regional assessments. Using a database with 146 indicator profiles for water management, we investigated reasons for spatial aggregation choices, i.e. whether indicators based on spatially-explicit data are aggregated while under development or are provided to users in a disaggregated form. Although the literature assigns a descriptive function to spatial aggregation, our database shows that reasons underlying aggregation choices are more diverse. These reasons include highlighting differences, fitting to the scale of a process, fitting to criteria, recognizing a lack of knowledge, expressing social rationality, contextualizing information, and allowing different interpretations of the same indicator. Some of these reasons reflect the choice to expand or reduce the range of potential uses of an indicator, and therefore the potential for different viewpoints to confront each other. Hence, normative claims combine with descriptive claims when aggregating indicators, and even more so when customizing them. In general, the form of indicators merits more attention in the practice and theory of sustainability assessments.

1. Introduction

Sustainable management of natural resources requires governance that considers long-term dynamics and the spatial scale of the resource managed and that allows different actors to participate in the decision-making process. Sustainability assessments combine tools that can assist decision-makers in this task (Ness et al., 2007). Most sustainability assessment tools require indicators, which can be used to assess a situation and measure progress towards sustainable development (Pires et al., 2017; Singh et al., 2012; Smeets et al., 1999) or areembedded in prospective methods to assess scenarios involving change or policy options (Leenhardt et al., 2012; Singh et al., 2012).

Several guidelines and methods exist to identify relevant sets of indicators for sustainability assessments (Alkan Olsson et al., 2009; Bockstaller et al., 2009; Kurka and Blackwood, 2013; Reed et al., 2006; Valentin and Spangenberg, 2000), and the variety of methods reflects the diversity of contexts in which indicators are used. For instance, within "governance contexts"(Hezri and Dovers, 2006), in which people outside of the political elite participate in the decision-making process, indicators cannot be produced according to a clearly identified audience (Hezri and Dovers, 2006). Considering this, several authors claim that identifying indicators should be a social learning process that involves multiple participants (Bell and Morse, 2004; Fraser et al., 2006; Valentin and Spangenberg, 2000).

The large number of studies on indicator identification could suggest that defining the indicator set is the only crucial step of information processing, from which comes results of the sustainability assessment. However, other processes occur between defining the relevant indicator set and evaluating a situation or option. For spatial decision support systems, Uran and Janssen (2003) noted that "output sometimes needs simplification, aggregation, structuring, or another form of processing in order for it to be used in a decision-making process. In some systems this is done automatically, or 'hidden', so the user is unaware of the fact that an evaluation step has been made". This highlights the need to clarify and question the entire chain of processes required to develop indicators (and not only to identify them); this is the core motivation for this article.

More specifically, we focus on spatial aggregation, a specific process

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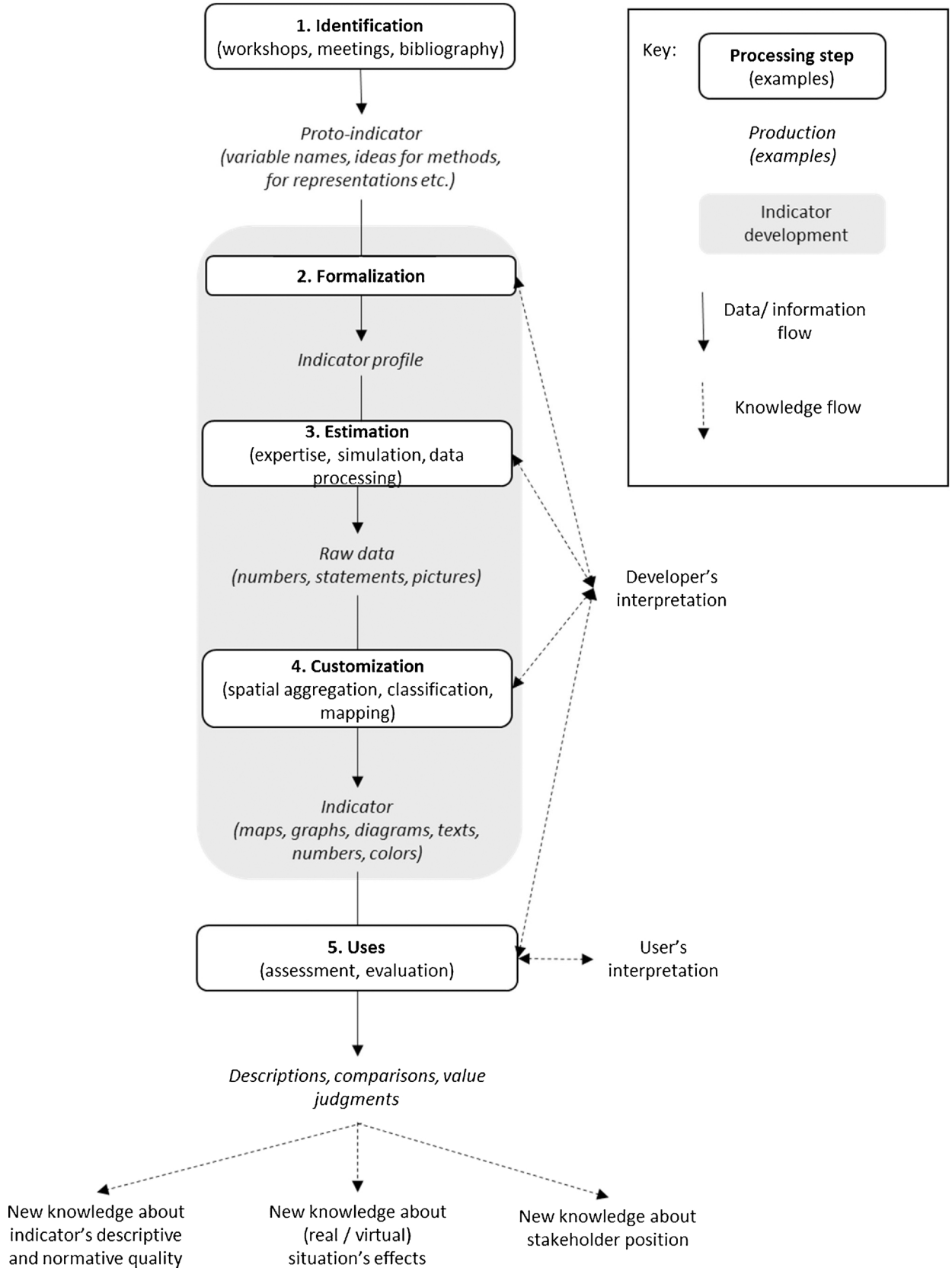

Fig. 1. Indicator identification, development and use as a chain of processes.