A tool for pre-selecting beneficial uses of dam fine sediment

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Introduction: Sediment dredging is needed to ensure good operation of ports, waterways and reservoirs where navigation or energy production is concerned.

The beneficial use of dredged fine sediment is a challenge (i) to keep a satisfactory level of functionality of the facilities and (ii) to conserve natural resources. In fact, these materials can be considered a valuable potential alternative resource and can be integrated into a circular economy.

Therefore, this paper proposes a global approach, adapted to dam fine sediments, to implement a decision-making tool in order to pre-screen sediments towards re-use options.

Methods: The decision tool was designed from the identification and interpretation of relevant technical criteria, and from minimal characterization of dam fine sediments [1].

The methodological framework has been established inspired by works on soil quality [2].

In this tool for evaluation of the technical suitability of fine sediments, the approach consists of three steps, as shown on fig. 1.

The indicator criteria are selected according to application specification and/or to allow comparison between sediment characteristics and traditional raw materials. Depending on the application, 3 to 7 criteria are selected.

In the tool, each indicator criterion is transformed into scores in the interval [0, 1] using scoring curves. Curve fitting software was used to develop algorithms describing the relationship between the indicator criterion values and normalized scores.

Then, the criteria were integrated into a Sediment Suitability Index (SSI) using a weighted average of scores and then multiplied by 10 (see fig. 1, step 3). Thereby, SSIs allow users to evaluate the technical potential of sediment to be reused.

For each considered use, indicator criterion (e.g. median diameter, organic matter content, Atterberg limits,...), there interpretation and there weighting was determined based on large bibliography *i.e. scientific papers, standards, technical guidelines*, experiments at the laboratory scale and consideration of expert opinions.

A full description of this tool for evaluating the technical suitability between sediment characteristics and beneficial use specifications is given in [3].
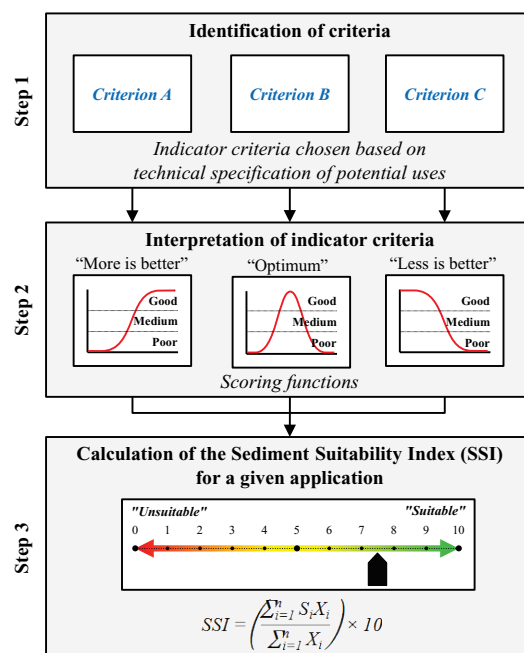

Fig. 1: Conceptual framework of the tool development.

Results: A relatively user-friendly version of the tool for pre-selecting beneficial use options according to technical criteria was developed.

By applying the described methodology, six SSIs have been developed for the following potential beneficial uses *i.e. clay products (e.g. bricks), alternative raw material to produce Portland cement clinker, filler aggregates for use in concrete and mortar, road sub layer materials, agricultural uses and manufactured soil.*

This tool was tested on 10 case studies with fine sediments from French hydroelectric reservoirs. Thus, the most technically suitable options could be highlighted according to the sediment characteristics.

References: [1] Anger et al. (2013) *8th SedNet Conference* 87; [2] Andrews et al. (2004) *SSSA Journal* **68**:1945‑1962; [3] Anger (2014) *PhD thesis*, University of Caen 309.