

# Information flows in decision making: application to the torrential risk management

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## CONTEXT

Risk management relies on multi-actors decisions based on relevant data and information that can be numerous, heterogeneous, dispersed, more or less useful and available. Our work aims at proposing an approach to identify, and formalize data and information necessary for the different stakeholders and risk management phases. The application presented here concerns torrential floods but the approach can be extended to other types of natural hazards: avalanches, rock falls...

## METHODS

The proposed methodology consists of four distinct phases organized according to a hierarchic principle (Figure 1): (i) modeling of the different information flows between stakeholders according to the main decisions they take concerning risk management and highlighting of information communication problems; (ii) determination of data needed by each actor (mayor, expert, inhabitants...) relative to their decision-making; (iii) development of ontologies to structure relevant data in each field study; (iv) formalization of such data by indicators robustly defined. Phases i and ii rely on a literature review and interviews with actors. The whole steps highly involve domain experts, either to identify necessary knowledge, or to validate formalization.

Those works are both carried out on a conceptual and an applied way. A study was conducted on a town, subjected to the torrential floods risk. It had a twofold goal: identify potential information management and propose suitable solutions in agreement with concerned stakeholders.

## RESULTS

Phase 1 - The proposed generic methodology is applied to the prevention phase of torrential risk management. A generic modeling of information flows is given for a mayor whose municipality is subjected to torrential floods. Actors, interacting

with each other during the prevention phase (Prefecture department, residents, engineering offices...), are represented along with decisions formalized in regulatory documents (Natural risk prevention plan, Municipal Level Backup...). In parallel, interviews were conducted on a French town to meet different torrential risk stakeholders. Those interviews lead to observe real effectiveness of their exchanges and their uses of regulatory documents. Interviews permitted to identify dissonances towards available but little useful or useable data in this way. There are also requests for necessary data but not available or supposed unavailable. For example, the Mayor and the elected people have a hydrologic study for torrential civil works management but they do not use some of the information inside whereas they need it. Maybe it is because this information is not readable for them: the report is probably too long (50 pages), not enough synthetic or written in a too technical language.

Phases 2-4 - This real scale test also allowed highlighting of bias that can spread in the decision making process. It can depend on actors, perception of the used data. So it seems crucial to propose well-represented necessary data to stakeholders according to their decision-making. From interviews and literature results, necessary data are listed and structured, for each stakeholder, in the form of ontology. Each ontology corresponds to a decision made by the concerned stakeholder. For instance, we made two ontologies dedicated to protecting civil works: one for municipal councilors and the other for experts in civil structures. Then data are formalized, also according to stakeholders who will use it, for data to be effectively perceived. For instance, for experts, data are formalized in the form of robust indicators which use is reproducible in time.

The actors met were receptive to our approach and found the developed tools relevant.

## CONCLUSION

These results allowed us to propose a conceptual representation of information flows and decisions helping to highlight communication problems between stakeholders. We then proposed an identification methodology of stakeholders' necessary information. Application to torrential floods showed the interest of this approach. It highlighted imperfections that may exist in information transfer, such as lack of data or difficulty to understand information. It also permitted representations at different granularities (from data to decision) and spatial scales (from civil works to watershed). Torrential flood consequences may exceed, by indirect effects, the scale of a watershed (e.g. road network interruptions). Territorial risk management is a perspective to this work.

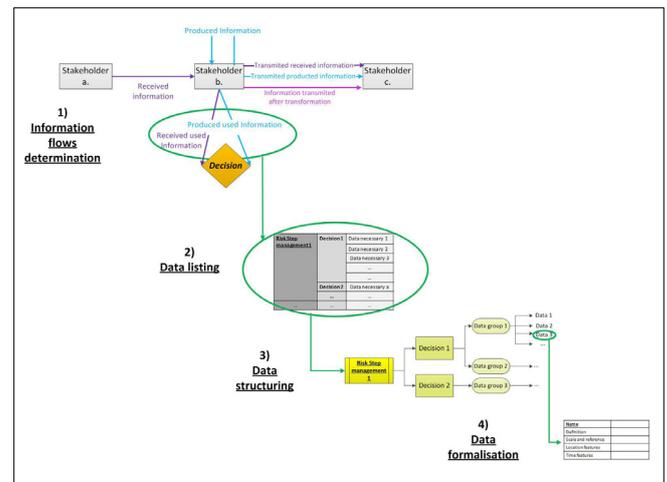


Figure 1. Proposed methodology to identify and formalize data needed by risk's stakeholders

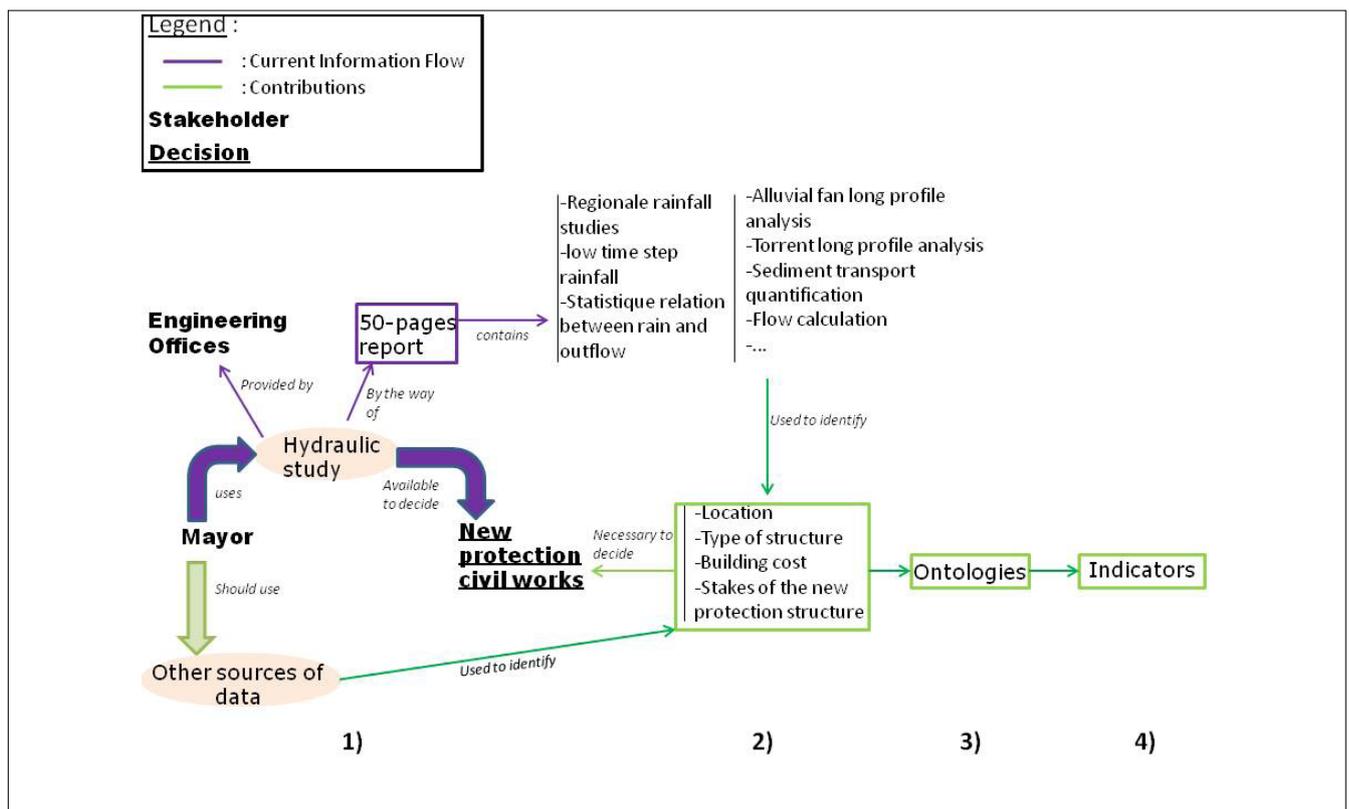


Figure 2. Identification methodology of stakeholders' necessary information applied to the case study

## KEYWORDS

Information flows; Decision-Making; natural hazards; risk management.

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