

Effectiveness assessment of protection works in mountains: from knowledge management tools to operational survey

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INTRODUCTION

In mountains, natural phenomena put people and buildings at risk. Protection systems have been implemented throughout Europe since the 19th century, but human activity has generally increased in alpine regions and risk acceptance has globally been reducing since the second part of the 20th century. Consequently, effectiveness assessment of protection systems has become a key point for good management in a context of reduced public budgets.

In spite of a common need and national initiatives for standardization, no transnational and transdisciplinary agreement exists in this field. On the one hand, field experts help decision-makers manage their protection systems through specific operational management tools (new designs or maintenance of existing systems). On the other hand, definitions and recommendations from research are insufficiently applied. The main objective of this paper is to highlight possible gaps, divergences, and convergences between practices and research in European countries. It is based on extensive bibliographic and bibliometric analyses.

METHODS

We first detail the risk management context and the concept of protection system effectiveness. In European alpine regions, this topic mainly concerns five countries: Austria, France, Italy, Slovenia, and Switzerland. After a brief review of their global organizations of risk management, we specify the risk concept (combination of hazards and potential damage, generally monetary valued). Mitigation measures aim at reducing the initial risk to a residual risk, which require resources to be implemented. Effectiveness is the level of objective achievement. Efficiency refers to the rate between the level of effectiveness achieved and the resources

used. Global system effectiveness is a technical concept based on its real capacity compared with a fixed objective. For its design, the nominal capacity is defined through functional and structural design with expected structural and functional effectiveness. An existing system's real capacity depends on its real condition with real structural and functional effectiveness. System efficiency, also called economic effectiveness, integrates economic aspects such as system cost and capacity to protect exposed elements.

We then introduce the methodology used to establish the survey. First, a method has been developed to conduct a relevant literature review detailing the state of the art. It is based on the four main effectiveness concepts (structural and functional effectiveness, capacity, and efficiency) and on four main steps: definition of research bounds, data gathering, data sorting, and data processing. The data are gathered from several types of references, sources, and languages. After defining key words and requests for use, references are manually presorted and two databases are created. The bibliographical database makes it possible to conduct an automated textual analysis (correspondence and similarity analysis) on reference titles, abstracts, and keywords. An automated bibliometric analysis through co-occurrence analysis on keywords, locations, and affiliations is also performed. The Excel® database is the basis of semi-automatic processing. It statistically analyses the distribution and temporal evolution of references according to several criteria.

Second, a survey is conducted on several databases (in France, Austria, Italy). We divide this survey into three steps: i) development of a questionnaire related to the assessment of effectiveness and efficiency concepts, ii) analysis of existing databases, and iii) formulation of recommendations.

