ECONOMIC LOSS BY LANDSLIDES

DEVELOPMENT OF AN EMPIRICAL CALCULATION MODEL WITH REGIONAL APPLICATION TO GERMAN SUBDUED MOUNTAINS

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INTRODUCTION

Landslides cause significant threads to infrastructures and economic values in mountainous regions. The focus of the present study is the development of an empirical calculation model, which is composed of object-specific planning process models, various cost modules, former accountings and individual loss in value parameters. In contrast to prevalent cost estimations, this study highlights a systematic calculation framework regarding different landslide characteristics for the first time. By implementation of the calculation model in a database-driven ex-post cost calculation for Northern Hesse and Southern Lower Saxony, new important insights for cost awareness of direct economic landslide damages are generated.

METHODS

The basis for calculating direct economic damages are planning process models, which describe the object-specific governmental or corporate planning steps posterior to a landslide event. Information on planning processes is generated by means of expert interviews with competent persons in departments of highways and transportation, municipal planning departments and railroad infrastructure companies. Flow charts structure and compromise the initially unsystematic process information and allow for a simplified modeling of real and complex planning processes. Such flow charts are developed for all types of damaged object categories and regard the main natural and geotechnical characteristics of landslide events. Since they depict competencies and cost relevant planning steps, these flow charts form an essential calculation basis.

Arising costs or asset losses after a landslide event are measured with numerous cost modules and individual loss in value parameters. Cost modules are standardized and price-based reproduction or prevention works with well-defined accounting units. For cost modules construction cost databases, which contain market-based unit prices of nationwide announced construction works, and expert interviews with natural hazard engineering companies, are the monetary valuation basis. Cost modules are characterized by standard remedial actions basing on technical regulations or practical experiences. Combining price information with basic principles of geotechnical remedial actions, these cost modules allow a proper damage assessment. In contrast the different real estate appraisal methods (e.g. cost or income approach) are possibilities for the creation of individual loss in value parameters, which can be applied for calculating asset and income losses in particular cases. Initially, the best cost estimation can be generated by utilization of former accountings for realized reproduction or prevention works. To calculate the direct economic damages the discussed model components must be combined with landslide information, which can be provided in great detail by several regional landslide databases. Fig. 1 illustrates the general calculation model with its different model components.

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RESULTS

The general calculation model has many possibilities for application, especially for calculations basing on well-founded landslide databases. Besides testing of the calculation model, application to Northern Hesse and Southern Lower Saxony gives interesting insights in the regional economic damages of landslides. Since 1980 the study area faces a total direct and inflation-adjusted economic damage of approximately 1 Million Euro on average per year. Nearly 90 % of the costs are damages concerning road infrastructure. In road construction landslide damages are forcing unpredictable investments, which can be connected with immense regroupment in the regional budgets and thus result in high opportunity costs. Although the economic damages to building infrastructure is considerably lower, landslide damages pose significant financial threats to private house owners, since they bear the financial risks of landslides.

CONCLUSIONS

The development of this calculation model enables a systematic, comprehensible and empirical quantification of the economic loss by landslides for the first time. The calculation model offers manifold possibilities of application, especially in the fields of road and railroad construction, spatial planning and natural hazard management.

REFERENCES


Keywords: landslides, direct economic damages, empirical calculation model, regional application