DEVELOPMENT OF FLOOD RISK ASSESMENT MODEL

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OBJECTIVE

The main objective of the paper is to show a novel approach to flood risk assessment, combining three different analyses – Event Tree Analysis (ETA), Fault Tree Analysis (FTA), and Dempster-Shafer evidence theory (D-S evidence theory). Risk assessment presents a key stage in the risk management process. It begins with the identification of risks and directly depends on how detailed the potential disasters have been identified (Makajić-Nikolić, 2020). Unfortunately, climate change and floods are a very current problem, both in the whole world and in the Republic of Serbia.

Complex topics and phenomena such as natural disasters are the subject of study by many researchers in various scientific fields, and there are numerous studies that deal with the origin and modes of natural disasters, their forecasts and elements exposed directly and indirectly to these hazards, population perceptions and others. Risk assessment research is mainly conducted with an emphasis on prevention and all activities that need to be done before disasters occur.

The model presented in this paper creates a "flood life cycle" mapping all possible causes of a flood, all possible outcomes, and lastly the measurement of belief that these events will happen as stated by field experts.

METHODOLOGY

The model presented uses three previously stated analyses:

- Fault Tree Analysis is a systematic method used for analysis of the cause of risk using qualitative and quantitative deductive methods (Huang et al., 2016; Hyun et al., 2015).The analysis is based on a graph called the Fault Tree, which models the logical relationships between the observed adverse event and its cause, i.e., provides a graphical representation of the occurrence of an adverse event (Huang et al., 2016).
- In Event Tree Analysis, a tree constructed is a visual presentation which will identify and quantify consequences of an adverse event. This analysis provides an inductive approach to consequences probabilities, as it is constructed using advanced logic (Rahman et al., 2018; Clifton & Ericson II, 2005).
- Dempster-Shafer evidence theory deals with the epistemic (cognitive) uncertainty of a proposition. The theory is based on two measures: the measure of belief (belief measures) in a particular proposition and the measure of its plausibility (plausibility measures) (Salicone & Prioli, 2018).
- Interviews with field experts.

The model proposed encompasses these three analyses into one model showing the "lifecycle of a flood".

RESULTS

From the review of the literature and comparison of scientific papers on flood risk management, it is noticeable that they were used only from one angle - ranking the risk of cause or effect, and that D-S theory of evidence was used in forms other than those used in this proposed model. In this way, the entire "life cycle of a flood" from all possible causes to all possible consequences is examined. The result of this model

is a proposal of measures that simultaneously affect both elements of risk: reducing the probability of primary events (FTA) and mitigating the consequences (ETA).

CONCLUSION

It is evident that floods pose a major threat to people, material goods, infrastructure, the economy and the environment, despite significant developments in event forecasting, disaster management, defense and rescue activities in emergencies. Predicted climate change and urbanization of floodplains will increase the lethality of floods, and precisely because of this, efficient and effective flood management is becoming more and more necessary and urgent. It should be added that an adequate flood risk assessment model, which covers a flood's entire life cycle, results in opportunities for timely future response to irregular climate events.

Keywords: *flood risk, risk assessment, flood life cycle*

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