

# MULTI CRITERIA DECISION MAKING MODELS FOR REPAIR AND REPLACEMENT DECISIONS OF CONDITION BASED BUILDING MAINTENANCE

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NOVEMBER 2017

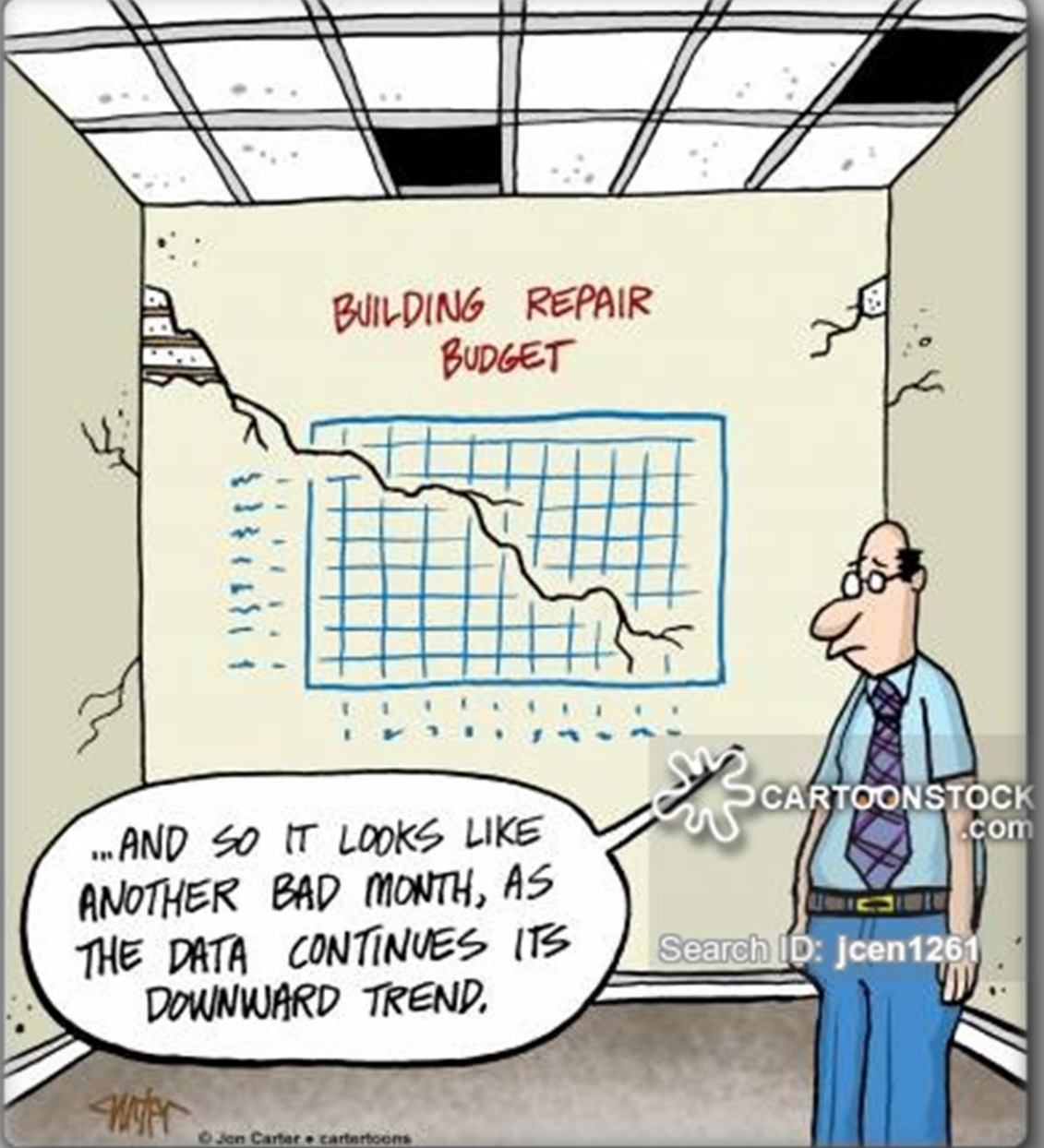
## 4 METHODOLOGY

CONDITION ASSESSMENT	TYPE OF FAILURE	CRITERIA	CASE STUDY	COMPARISON OF DECISIONS
LITERATURE REVIEW	LITERATURE REVIEW	LITERATURE REVIEW	CONDITION ASSESSMENT FRAMEWORK	DECISIONS WITH MCDM MODELS
SURVEY (INDUSTRY PRACTICE)	CSU DATA	SURVEY (INDUSTRY PRACTICE)	MCDM's	DECISIONS WITHOUT MODEL
SUPPORT FRAMEWORK	CU BOULDER DATA			
OCCUPANT FEEDBACKS	AURARIA HEC DATA			
PREVENTIVE MAINTENANCE RECORDS				
WORK ORDER RECORDS				

## 5 EXPECTED IMPACTS

- To analyze the benefits of repair vs replacement decisions with the proposed condition assessment support framework and MCDM's compared to decisions given without model.
- To present a resource efficient method of condition assessment process for building maintenance in the lack of allocated personnel and resources.
- To state the effect of various criteria on decisions and to show the importance of other criteria beyond cost and budget.
- To present the effects of models on final decision with the help of comparing decisions without using model
- To help decision makers for maximizing the benefits of their decisions according to their expected outcome

## 1 PROBLEM STATEMENT



...AND SO IT LOOKS LIKE ANOTHER BAD MONTH, AS THE DATA CONTINUES ITS DOWNWARD TREND.


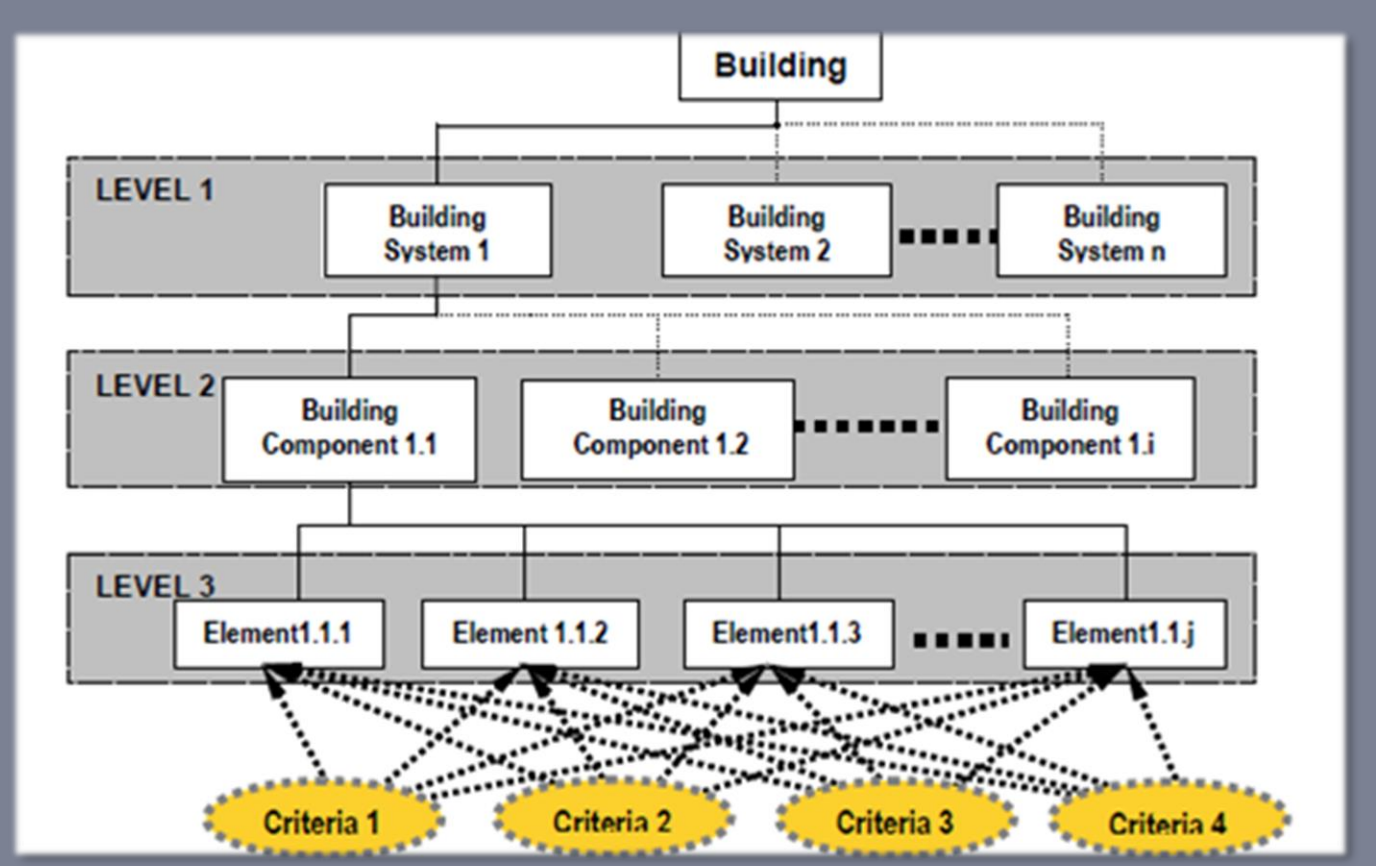
- Aging and rising building stock
- Economic challenges and budget cuts
- Limited professional condition assessment and preventive maintenance
- Issues beyond cost (safety, loss of use, energy consumption)
- Need for maximizing facility performance, budget allocation and minimizing the negative impacts of failures
- Complexity of the problem and need for Multi Criteria Decision Making (MCDM)

The **MAIN PURPOSE** of this study is to generate a decision making model for the efficient repair and replacement decisions of building maintenance with a condition assessment support framework and MCDM.

## 2 BACKGROUND

**Building maintenance** is defined as "a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition." in British Standard 3811 (British Standard, 1993) According to Zavadskas and Vilutiene, (2006) the efficiency of maintenance depends on planning, design and commissioning processes which require qualified and experienced personnel, proper equipment, and expertise.

**Decision-making** process is a significant part of operations research which applies statistical analysis and mathematical modeling to solve organizational problems. **Multi Criteria Decision Making (MCDM) Models** is a branch of operational research dealing with finding optimal results in complex scenarios including various indicators, conflicting objectives and criteria. Kumar et al., 2017)

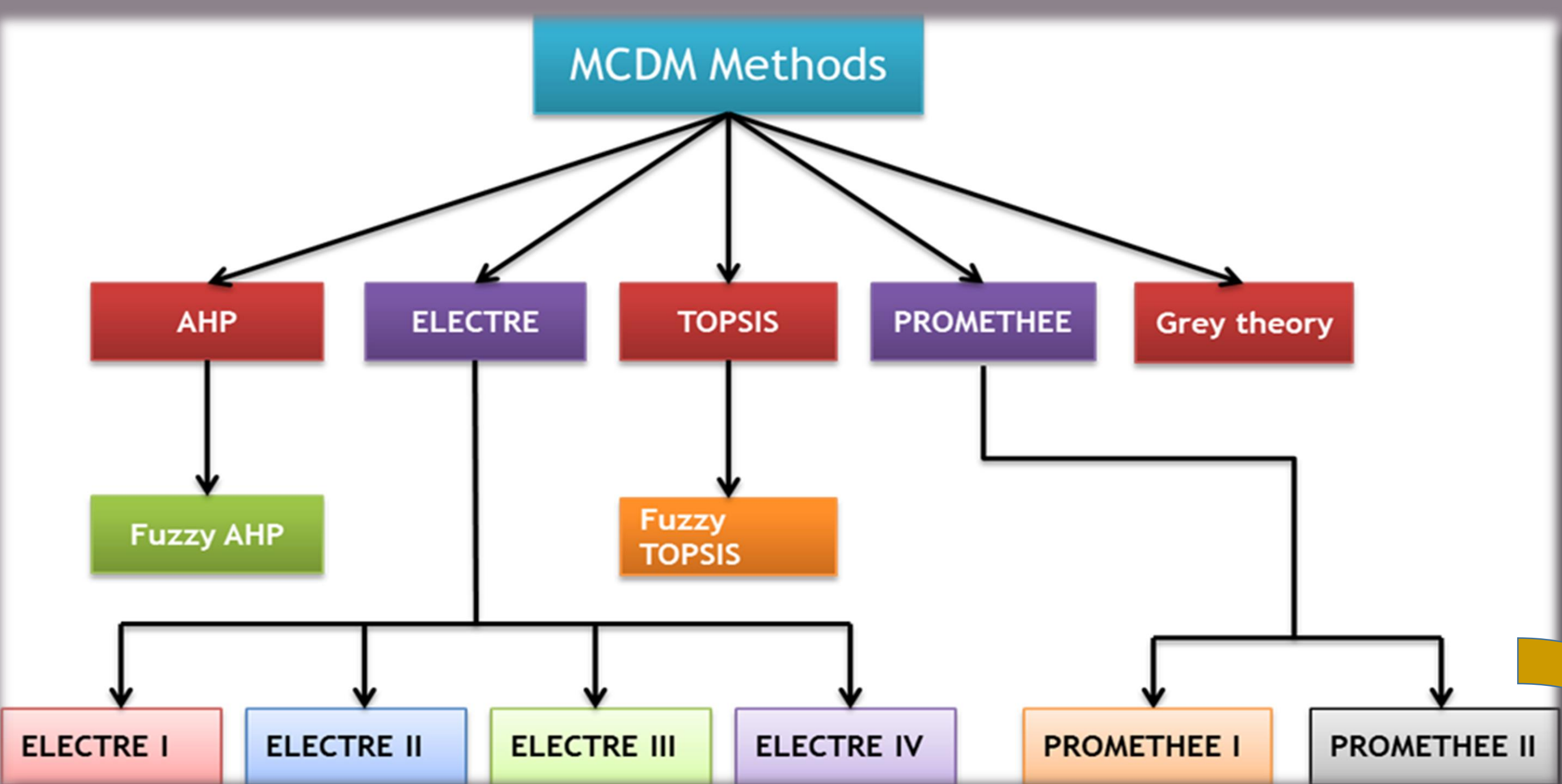
## 3 DECISION MAKING FRAMEWORK

Multi Criteria Decision Making (MCDM)

**CRITERIA**

Performance  
Cost  
Priority  
Energy Consumption

**MODELS**



**DECISIONS**

REPAIR  
DEFER  
REPLACE  
DO NOTHING

## 6 REFERENCES

- Standard, British. (1993). *Glossary of terms used in terotechnology*. BS, 3811, 1993
- Zavadskas, E. K., & Vilutiene, T. (2006). *A multiple criteria evaluation of multi-family apartment block's maintenance contractors: I - Model for maintenance contractor evaluation and the determination of its selection criteria*. Building and Environment, 41(5), 621-632. doi:10.1016/j.buildenv.2005.02.019
- Kumar, A. et al., (2017). *A review of multi criteria decision making (MCDM) towards sustainable renewable energy development*. Renewable and Sustainable Energy Reviews 69, 596-609. http://dx.doi.org/10.1016/j.rser.2016.11.191