|  |  | **Paper No** | **Model/System** | **Method** | **Application** | **Description** | **Software** |
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| ***Decision & Risk Analysis*** | | 1 | Fuzzy-based DANP (FDANP) | **Decision Making Trial and Evaluation Laboratory (DEMATEL), Analytic Network Process (ANP), and fuzzy logic theory** | Evaluation of decision-making that is associated with CI governance, including protection planning, and managing the vulnerability of CI, as well as to increase the resilience of both CI systems and the communities that rely on them | FDANP effectively captures the dynamics of various expert perceptions within the assessment processes, yielding a more robust analysis result | MATLAB |
| 2 | Multi-expert multi-criteria decision aid (ME-MCDA) | **Monte** **Carlo** **simulation (MCS) + individual preference analysis + robust stochastic superiority and inferiority ranking (RS-SIR) + analytical hierarchy process (AHP)** | Develop a decision aid for selecting on-site ready-mix concrete (RMC) unloading type in decision making situations involving multiple stakeholders and evaluation criteria | Application of the decision aiding model in actual RMC case confirms that the method provides a robust and effective tool for facilitating decision making under uncertainty | MATLAB |
| 3 | Multi-criteria decision making (MCDM) | **MCDM + Monte Carlo simulation (MCS)** | Analyzing group decision-making regarding renewable energy (RE) policy selection | Improvements to sustainability are generally measurable based on their environmental, economic, and socio-cultural effects This study applied this concept by developing and empirically testing a risk-based method for assessing renewable energy policy | MATLAB |
| 4 | Fuzzy analytical hierarchy process (FAHP) | **Analytical hierarchy process (AHP) + fuzzy set theory+** **Monte Carlo simulation** | Propose a new bidding strategy to support decision-making | The proposed approach is used to analyze data on bridge construction projects that are taken from a database of the Taiwan Public Construction Commission The systematic bid assessment model and the cost-probability curve can be used as strategic tools for quantifying project risks and calculating bids for construction projects | Microsoft Excel, MATLAB, and @Risk50 |
| 5 | Multi-objective particle swarm optimization (MOPSO) | **MOPSO + Monte Carlo simulation (MCS)** | Evaluate the cost-reliability tradeoff in a flexible maintenance strategy based on non-dominant solutions | A numerical example of a highway pavement project is illustrated to demonstrate the efficacy of the proposed MOPSO algorithms The analytical results show that the proposed approach can help decision makers to optimize roadway maintenance plans | MATLAB |
| 6 | Monte Carlo simulation | **MCS + multivariate normal random simulation (MNRS) + multivariate lognormal random simulation (MLNRS) + NORmal To Anything (NORTA)** | This investigation uses historical construction projects as case study data to create an early-stage cost distribution for budget allocation | The cost simulation approach offers a simplified decision tool for fairly assessing construction cost and uncertainties based on the experienced judgment of project managers | MATLAB |
| 7 | **MCS + Cumulative distribution functions (CDF)** | Develop an alternative approach that aids decision makers in terms of probability and confidence level | This study focuses on assisting estimators who are attempting to enhance the accuracy and reliability of engineering project cost in the pre-conceptual stage | MATLAB |
| 8 | Case-based reasoning (CBR) | **Equal weights (EW-CBR) + ei-genvector method (EM-CBR)** | Estimate Pavement Maintenance Cost | The CBR model was found to be more effective in considering the experience-based weights of these attributes compared to the situation when it treated them as equally important | MATLAB |
| ***Engineering Failure Analysis & Disaster Management*** | **Wind Turbine Failure Analysis** | 9 | Collapse mechanism and risk management of wind turbine tower in strong wind | **Forensic engineering + Disaster-causing factors + Risk management** | Investigates domestic and international wind turbine tower collapses | This study identify the mechanisms that trigger strong wind-induced wind turbine collapses, analyze the activation mechanisms of tower collapse and the forces that are exerted on the wind turbines at these times, and to generalize the factors that govern wind turbine collapse | SPSS |
| 10 | Structural failure simulation | **Structural and mechanical analysis + Finite element analysis** | Investigates the causes of this incident and the mechanical mechanisms of turbine tower collapse and blade fracture to support risk prevention and hazard-resistant design of future wind turbines | This study gives the recommendations on weaker blades being a safety mechanism for the wind turbine tower, torque capacity of the pitch system as well as the required strength of joint bolts to be installed in steel structural connections, so as to withstand severe storms |  |
| 11 | Structural failure analysis | **Risk management + structural mechanics simulation+ wind frequency simulation + mechanical analysis + Finite element analysis** | Failure analysis of wind turbine blade under critical wind loads | On September 28, 2008, five large wind turbines (WTs) located in the Changhua Coastal Industrial Park in Taichung sustained blade damage from fierce winds and heavy rainfall brought by Typhoon Jangmi To examine the causes of this damage, specifically, delamination and cracking in the WT blades, this study first reviewed and analyzed data in related engineering documents | ANSYS & Solid Works |
| 12 | Failure analysis and risk management of a collapsed large wind turbine tower |
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| **Managing Hazards** | 15 | BIM-based intelligent fire prevention and disaster relief system | **BIM + mobile app** | Provide 3D visualization to support the assessment and planning of fire safety, to provide early detection and alarm responses, to direct efficient evacuation, and to facilitate fire rescue and control efforts in order to increase overall building safety and disaster-response capabilities | The present study uses BIM to construct a BIM-based Intelligent Fire Prevention and Disaster Relief System This system integrates information on personal localization, on evacuation/rescue route optimization with Bluetooth-based technology, and on a mobile guidance device to create an intelligent and two-way fire disaster prevention system framework that displays the real-time and dynamic fire information in three dimensions (3D) | NET Framework 45, C# programming, SQL SERVER 2010, Cloud service, and Revit |
| 16 | Structural Equation Modeling (SEM) | **SEM + Exploratory Factor Analysis (EFA )+ Importance–Performance Analysis (IPA)** | Investigate ex-post performance in past and current disaster prevention in Taipei | The results of this study can serve as a reference for governments to improve disaster management outcomes and resource allocation efficiency | SPSS & AMOS |
| 17 | **SEM + Learning Satisfaction Index (LSI) + Importance–Performance Analysis (IPA)** | Ex-post evaluation of preparedness education in disaster prevention, mitigation and response | This study empirically assessed the impacts of various factors on learning effectiveness for disaster prevention and response training performed in Taipei | SPSS & AMOS |
| 18 | Qualitative research | **Qualitative case-based research** | Complete specific disaster preparedness and reinforce local resources for disaster prevention and response | This qualitative case study used the participant observation method to collect relevant empirical data by performing action research with self-reflection | SPSS |
| 19 | Biological-based Genetic Algorithms (BGAs) | **BGAs + Immune Algorithms (IAs) + GAs** | Allocating disaster refuge site staff and for planning relief supply distribution | The simulation results show that, compared to other methods, BGAs can compute optimal solutions faster | MATLAB |
| 20 | Geographic information system and predictive data mining techniques integration | **GIS + TELES + Bayes Net + C50 + Logistic + CHAID + QUEST + CART + Neural Net + Discriminant** | Create a pre-disaster static potential diagram and a refuge or shelter capacity assessment table | Conclusions and recommendations are provided for making disaster prevention and relief decisions simultaneously concerning earthquakes and flooding | TELES simulation, IBM SPSS Clementine |
| 21 | Risk analyses | **Deterministic and probabilistic risk analyses** | Identify and assess heavy rainfall–induced potential risks on flood, debris flow, and landslide | This study found the annual exceedance probability is very sensitive to the assumed coefficients of variation of the affected population | MATLAB |
| 22 | Earthquake disaster potential analysis | **Taiwan earthquake loss estimation system (TELES)** | Analyze seismic events and to predict building damage and displacement of citizens in each Taipei administrative district | Taiwan Earthquake Loss Estimation System (TELES) software for analyzing potential earthquakes was used to simulate earthquake events at potential faults in the Taipei area | TELES + SPSS |
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