RISK ANALYSIS AND DECISION MAKING IN CONSTRUCTION CLAIMS

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Outline

- Paper Objectives
- Statement of Research
- Literature Review
- Proposed Method
- Conclusion
Research Objectives

- Risk Analysis of Construction claims from economic standpoint
- Defining causation and reasoning of claims with Bayesian Networks
- Refining models of bargaining process for construction claims
- Considerations and elements in analysis of Pretrial Negotiations and equilibrium concept for settlement
Statement of Research

- Best actions or strategies?
- Most desirable outcomes?
- Information and beliefs of each party?
- Thresholds for accepting or rejecting settlement offers?
- Why do cases fail to settle?
- Current claims and settlements in the industry
- Influence of Jury system, Board of appeals, attorneys, etc.
Contract Dispute predictors

Construction of Multi-Attribute Dispute Hierarchy

Construction Industry Institute (CII) to calculate Dispute Potential Index (Likelihood of contract dispute)

Main Characteristics

- **People**
  - organizations, relationships, roles, responsibilities, and expectations

- **Project**
  - technical nature of the work, type and complexity of a project, limitations of the environment

- **Process**
  - Planning, financial and scope definition, contractual obligations, risk allocation, administrative procedures

BNN model for main criteria leading to disputes
CII Contract Dispute predictors – BN Model

Remodeling interrelationship of claim causes in BN format

CII Branch of Hierarchy

Logistic Regression Model (Discrete Choice Modeling)

Linear Weighting Model

Sample Questionnaire
Game Theoretic Parameters for non-cooperative games

- **Players**
- **Actions & Strategies**
- **Outcomes & Payoffs**
- **Timing**
- **Information**
- **Prediction (Estimates)**

- **Timing for Actions**
  - Simultaneously -
    Mostly used in axiomatic and Symmetric Information Models
  - Sequentially
    Only if actions can be observed and can influence other player’s decision

- Timing also can be considered as factor of duration for negotiation
Game Theoretic Parameters

Information

- **Perfect Information**
  - Players know the exact Verdict if case goes to trial

- **Imperfect Information** - Players are not sure about Verdicts
  - **Symmetric** – (Shared Knowledge)
  - **Asymmetric** – (Private Knowledge)
    - **One-sided Asymmetric** – One party hold private info about the case
    - **Two-sided Asymmetric** – both parties hold private info about the case
Game Theoretic Parameters
Prediction (Estimates)

- **Cooperative Games**
  - Efficient (No money left on the table or wasted like zero-sum game)
  - Equilibrium
    - Nash Bargaining Solution
    - KS Solution

- **Non-cooperative**
  - Nash Equilibrium
    - No player can unilaterally improve his payoff by changing strategy
  - Bayesian-Nash
    - Conditional probability on expected payoffs
Decision Tree for Players’ Settlement

**Plaintiff**
- Claim
- Ignore
- Not

**Defendant**
- Claim
- Ignore
- Not

- Offer
  - Accept
  - Court
  - Drop
  - Ask
  - Accept
  - Court
Dual Agent Decision Tree for Players

\( \delta \): Contractor’s Damages
\( K_i \): Litigation Costs
\( S_C \): Contractor’s settlement Asking
\( S_O \): Owner’s settlement offer
\( V \): Court’s Verdict

<table>
<thead>
<tr>
<th></th>
<th>Contractor</th>
<th>Owner</th>
</tr>
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<tr>
<td>Offer Settlement</td>
<td>( S+O )</td>
<td>-</td>
</tr>
<tr>
<td>No Offer</td>
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<td>-</td>
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<tr>
<td>Accept</td>
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<td>0</td>
</tr>
<tr>
<td>Court</td>
<td>-</td>
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</tbody>
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\( S+O \): Sum of contractor’s settlement and offer
\( \delta \): Contractor’s Damages
\( 0 \): No payment or action
Conclusions

- Claim causes can define probability of being held liable by using Bayesian Networks.
- Parties acquire private information about claim cases or they may perceive the same information differently.
- The belief gap on the amount of damages between claim parties is the base of disputes.
- The interaction between parties and measuring the belief gap can be calculated using non-cooperative games for pretrial negotiations (Bayesian Games).
- It is concluded that using Bayesian Network in game theoretic models helps to update parties’ belief based on multiple parameters.
Questions and Suggestions