



PROJECT MANAGEMENT CENTER FOR EXCELLENCE

A.J. CLARK SCHOOL OF ENGINEERING
Civil & Environmental Engineering Department



RISK ANALYSIS AND DECISION MAKING IN CONSTRUCTION CLAIMS

Arian Lessani, PMP

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

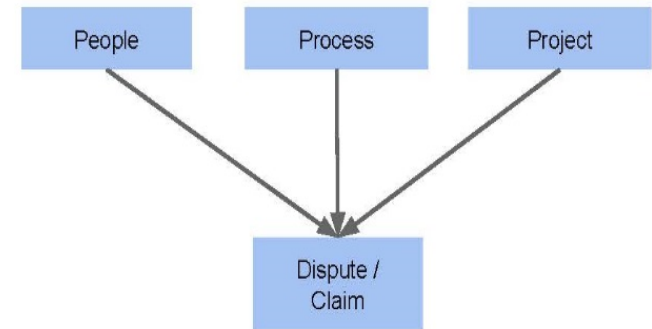
organizations, relationships, roles, responsibilities, and expectations

Project

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

Process

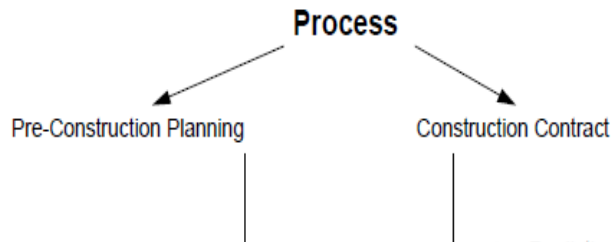
Planning, financial and scope definition, contractual obligations, risk allocation, administrative procedures



BNN model for main criteria leading to disputes

CII Contract Dispute predictors – BN Model

Remodeling interrelationship of claim causes in BN



**Logistic Regression Model
(Discrete Choice Modeling)
&
Linear Weighting Model**

CII Branch of Hierarchy

Permits and Regulations

Involve stakehold

PROJECT

12) Environmental Issues: This category considers the natural or physical environment in which the project was constructed.

Q) Was the project considered to be environmentally sensitive?

Yes					No
1	2	3	4	5	6

13) Public Interference: Problems can arise when construction projects conflict with the public's prerogative for comfort and safety. Traffic interference may occur on a high profile project, such as a hazardous waste incinerator, may cause local discontent.

Q) What was the probability and intensity of public interference for this project?

High					Low
1	2	3	4	5	6

14) Site Limitations: Project site limitations including limited to, storage and access for staging

Q) How did the project rate in space?

Poor					Good
1	2	3	4	5	6

15) Remoteness:

Q) Was the project located in areas with local materials and technical expertise were locally available?

No					Yes
1	2	3	4	5	6

16) Availability of Capable Craftsmen/Subs:

Q) What was the availability of skilled workers and subcontractors for successful completion of this project?

Low					High
1	2	3	4	5	6

17) Pioneer Project: A "pioneer" project includes aspects, such as new technology, which have never been constructed or used before.

Q) To what extent was this a "pioneer" project?

High					Low
1	2	3	4	5	6

18) Design Complexity: This entails the complexity of the design, not innovation, of the project. A nuclear power plant is not a "pioneer" project, but does have a complex design.

Q) What was the level of design complexity for this project?

High					Low
1	2	3	4	5	6

19) Construction Complexity:

Q) What was the level of construction complexity and innovation needed for this project?

High					Low
1	2	3	4	5	6

Sample Questionnaire

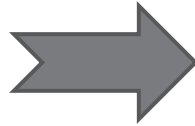
Game Theoretic Parameters

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

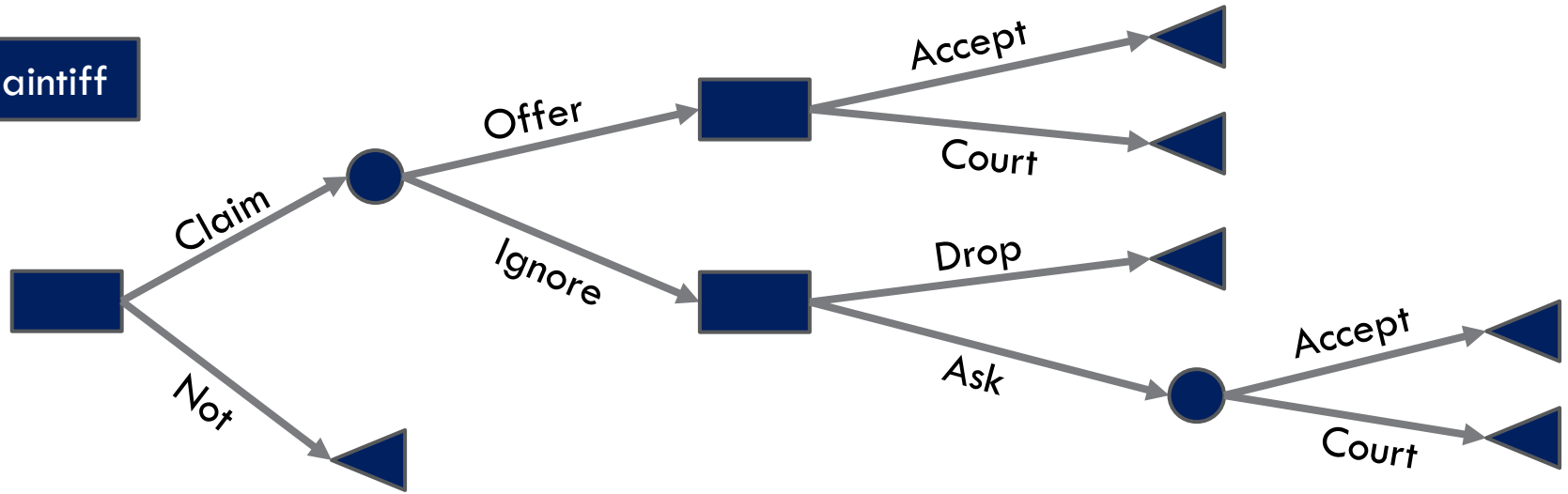
- Nash Equilibrium
- Bayesian-Nash

No player can unilaterally improve his payoff by changing strategy

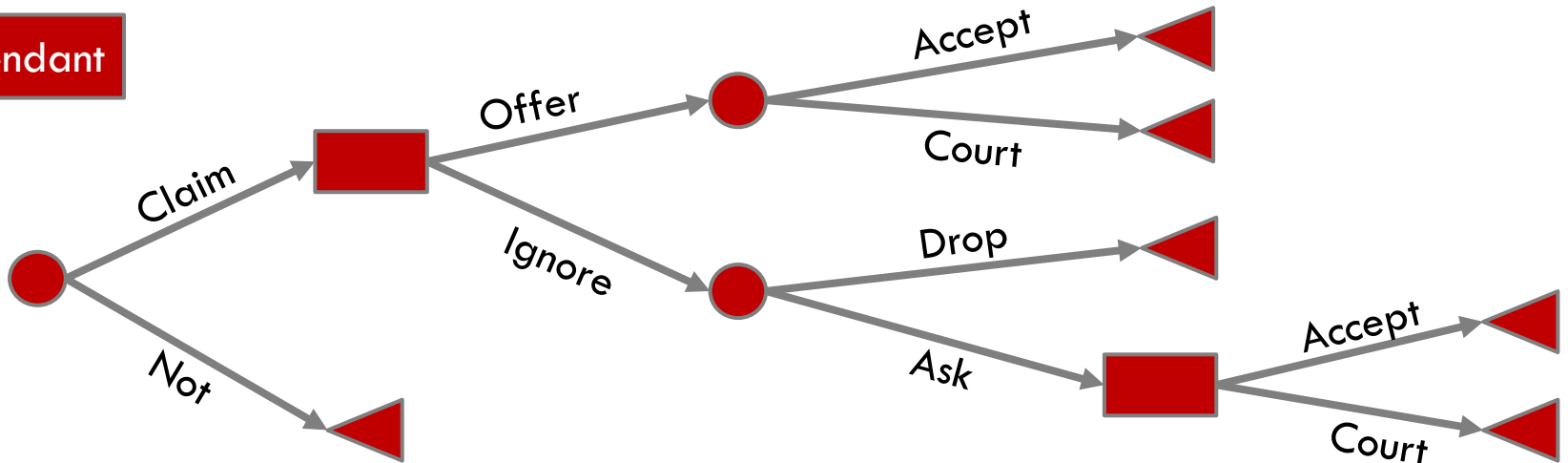
Conditional probability on expected payoffs

Decision Tree for Players' Settlement

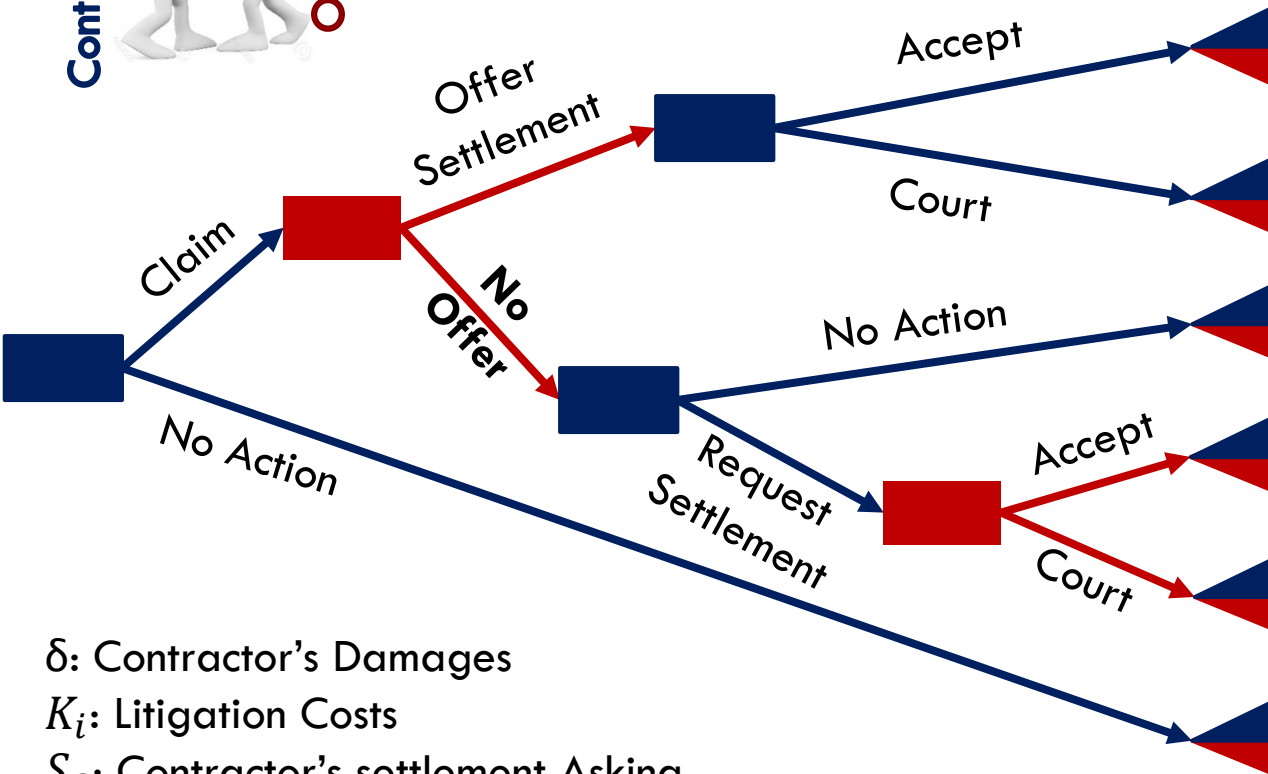
Plaintiff



Defendant



Dual Agent Decision Tree for Players



Contractor	Owner
$S+O$	-
	$-V$
$-\delta$	0
	-
	0

δ : Contractor's Damages

K_i : Litigation Costs

S_C : Contractor's settlement Asking

S_O : Owner's settlement offer

V : Court's Verdict

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

