Hatch and University of Toronto

Joint Research Program

Uniform Project Ontology
Risk Characteristics of Industrial Megaprojects

Prepared for W3C Linked Building Data Community

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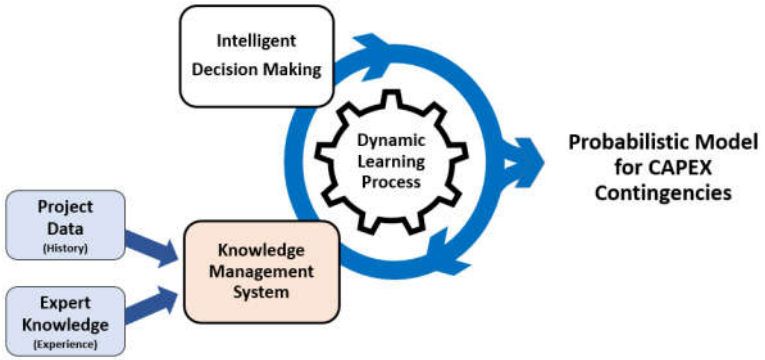
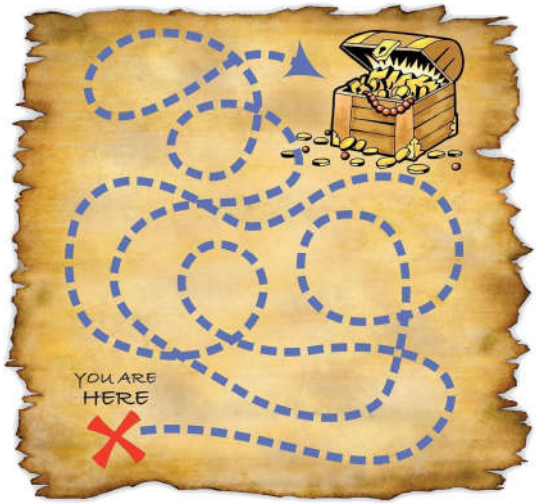
Who am I, & why I am here

- Pouya Zangeneh
- P.Eng. PhD Candidate in Risk Management of Industrial Projects at University of Toronto
- Affiliated with Hatch ltd. (https://www.hatch.com/)
- Research: Knowledge Representation and Artificial Intelligence in modeling financial behaviour of projects



- Focus is on industrial projects
- We are reaching out on our ontology to: LBD-W3C, Government of Ontario, Government of Australia, National Resource Canada, Ontario Securities Commission, and others…

Introduction



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Industrial Megaprojects

Industrial Megaproject

- CAPEX: ≥1 B$ USD
- Economic profit
- Operate complex production processes
- Special Financing Structures (Limited Recourse)
- Multi-agent processes:
  - Sponsors,
  - Engineers,
  - Financiers
  - Governments, etc

Typical Industrial Megaproject (US$5.3 Billion)

Project Risk Quantification

- Statistical risk quantification (Base rates)
- Uniform/universal project risk language

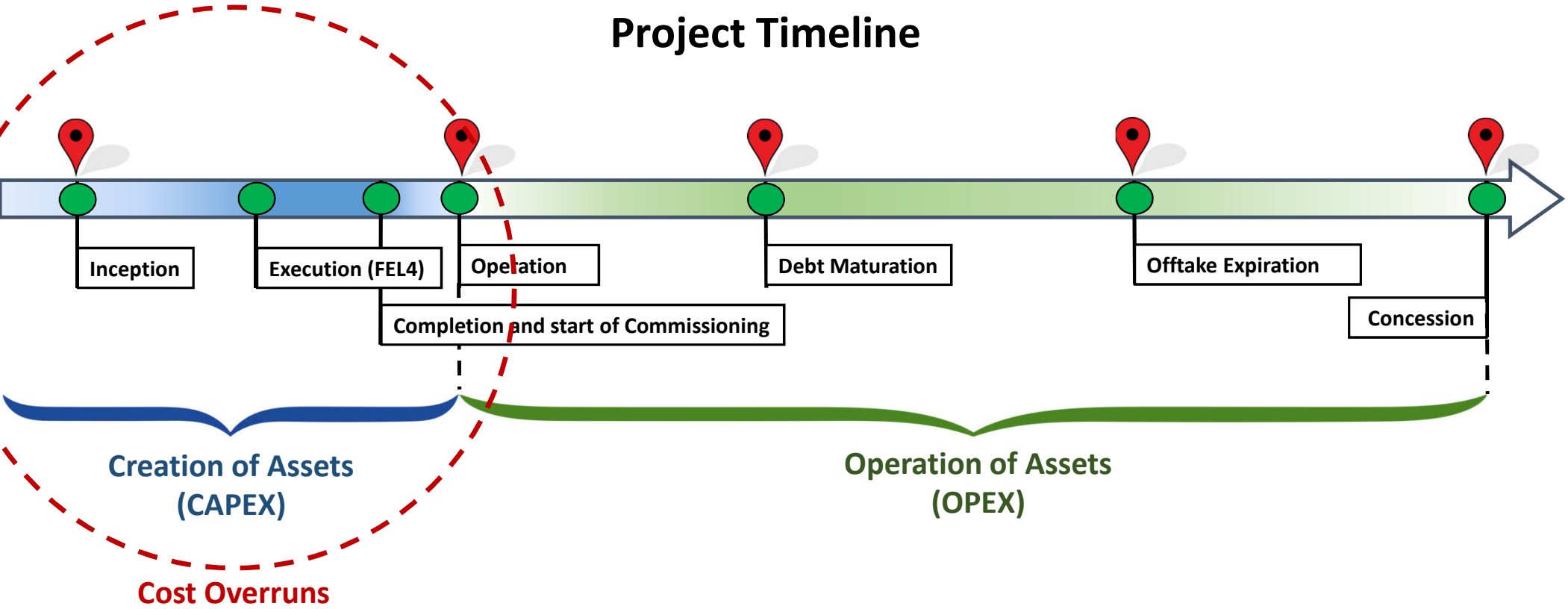
➢ Clearer scope of project risk:

- Classic Financial Model: New York Life Insurance Funds Investment Law (Art.14-05)

1. Completion Risks
2. Operation Risks
3. Technological Risks
4. Environmental Risks
5. Raw Material Supply Risks
6. Economic Risk (Demands)
7. Financial Risks (Rates)
8. Currency Risks
9. Political Risks
10. Force Major Risks

Probabilistically Dependent Variables

Project Risk Scope



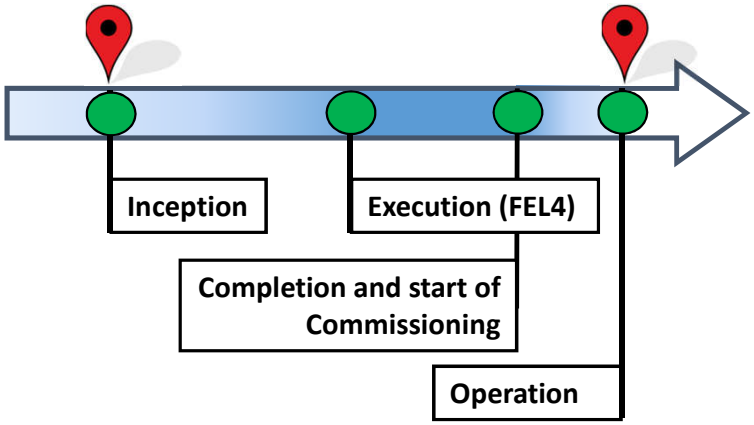
Project Risk Scope

1. Completion Risks
2. Operation Risks
3. Technological Risks
4. Environmental Risks

Engineering Consultants

5. R.M. Supply Risks
6. Economic Risks
7. Financial Risks
8. Currency Risks
9. Political Risks
10. Force Major Risks

Other Functions of Project Company



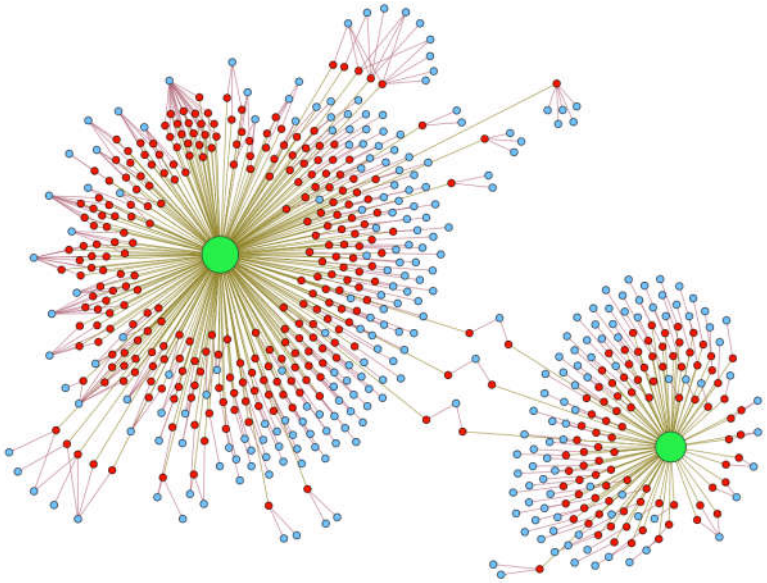
Creation of Assets (CAPEX)

Importance

- Open data initiatives
  - https://open.canada.ca
  - http://africaopendata.net
  - https://data.europa.eu

- Sustainable Development Goals (#SDG) call for public data in resource sector
- World Bank
  - Billion Dollar Map to Help Africa Turn Mining into Prosperity

Knowledge Base Design



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Knowledge Management System

Main issues

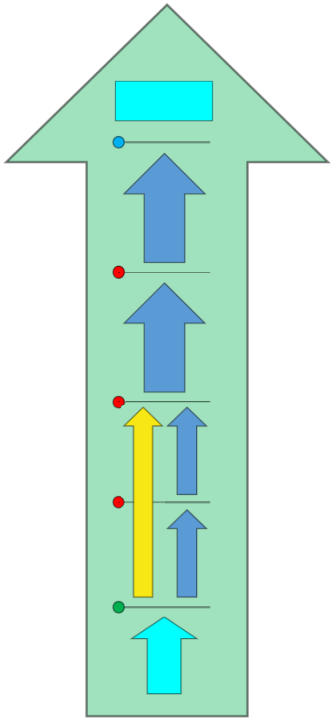
- **Uniform/universal project risk language**
- **Lack of efficient data, data structure (unorganized data)**

Main objectives

- **Collect project data**
- **Integrate available databases**
- **Efficient, and interoperable database "infrastructure"**
- **Communicate risk and project characteristics**
- **Serves as a "logical model" of projects for probabilistic inferences**

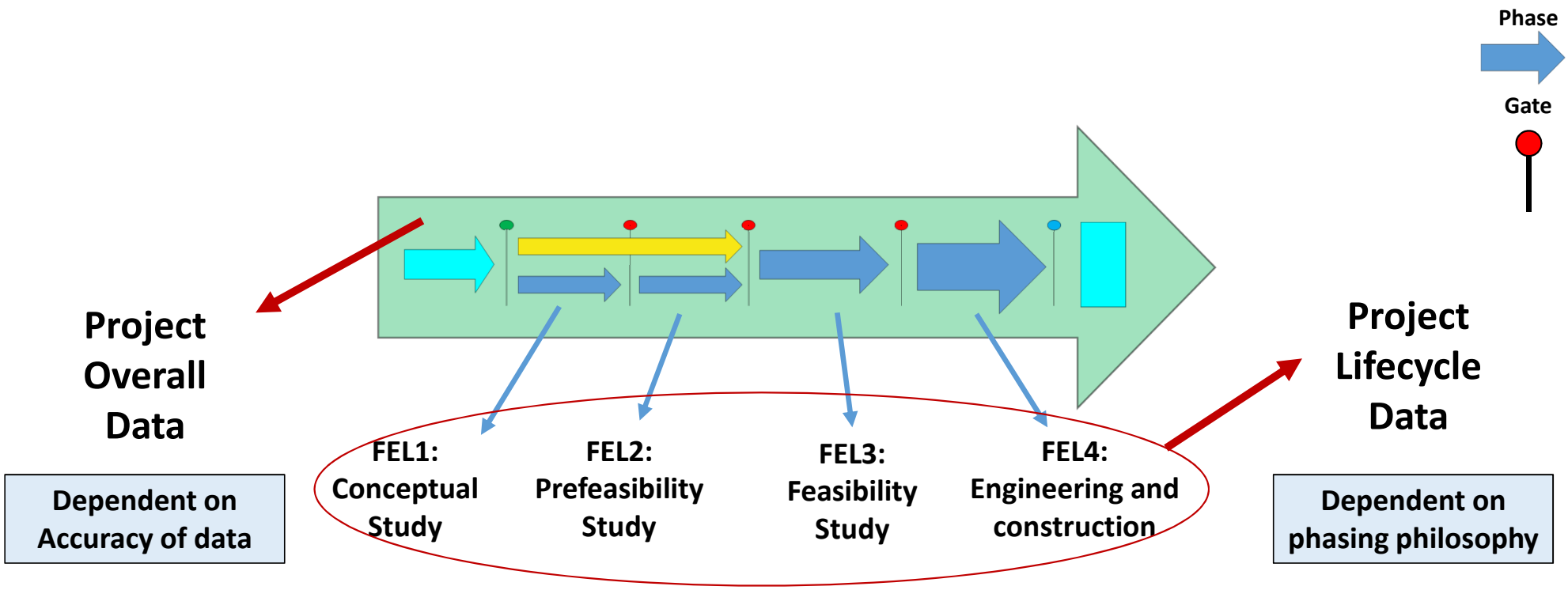
Approach

- **Assessment processes, KPIs, Best Practices, Lifecycle data management**
- **Took advice from experts**
- **Knowledge management systems**



UPonto
Uniform Project Ontology

Megaprojects Data



Review: Unified Project Ontology

Three Levels of Data Maturity / Inference

➢Project Properties

- General project information
- Can be obtained easily from databases sources (NRC, SNL, …)

Easily captured with Information Extraction algorithms

➢Project Info-Card Properties

- Detailed project information
- Overall project indices
- Requires better understanding of a project

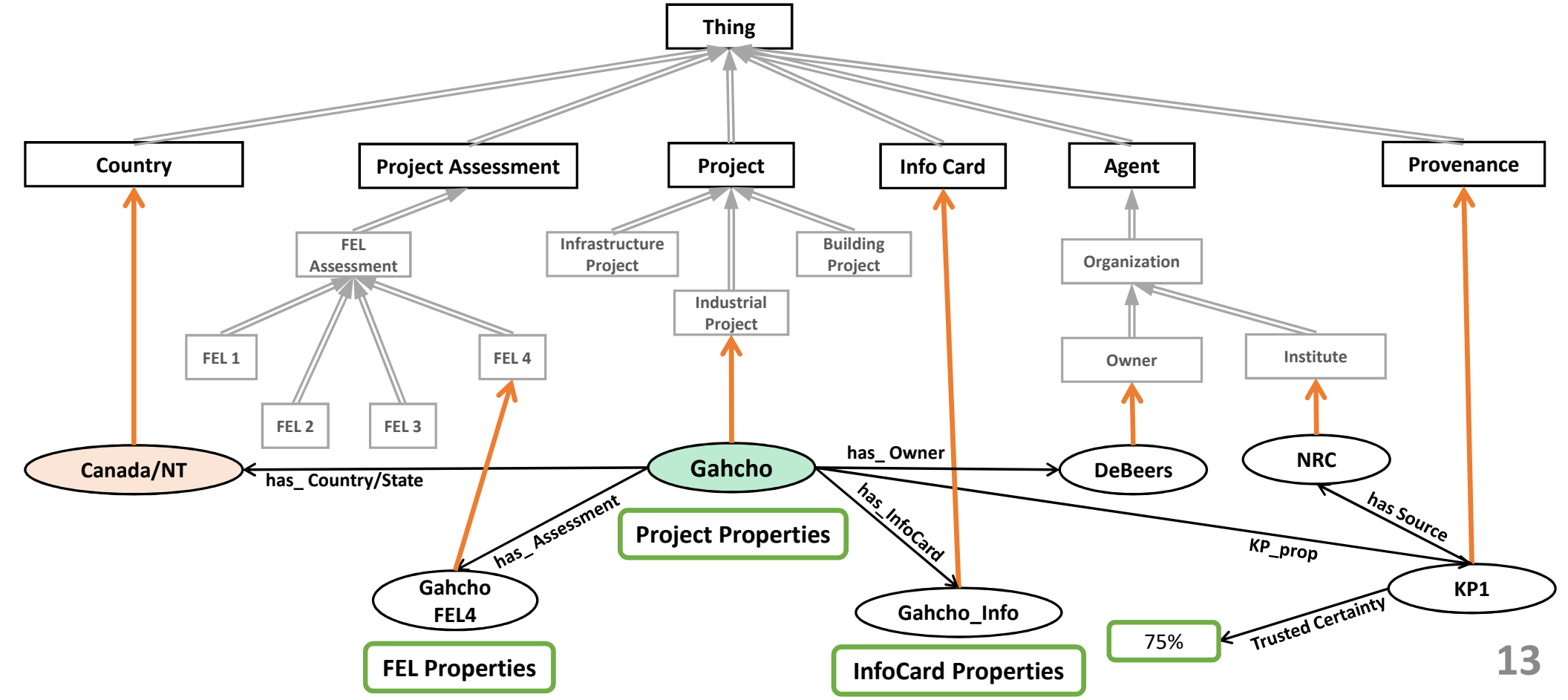
Supervised Information Extraction

➢FEL Properties (By phase)

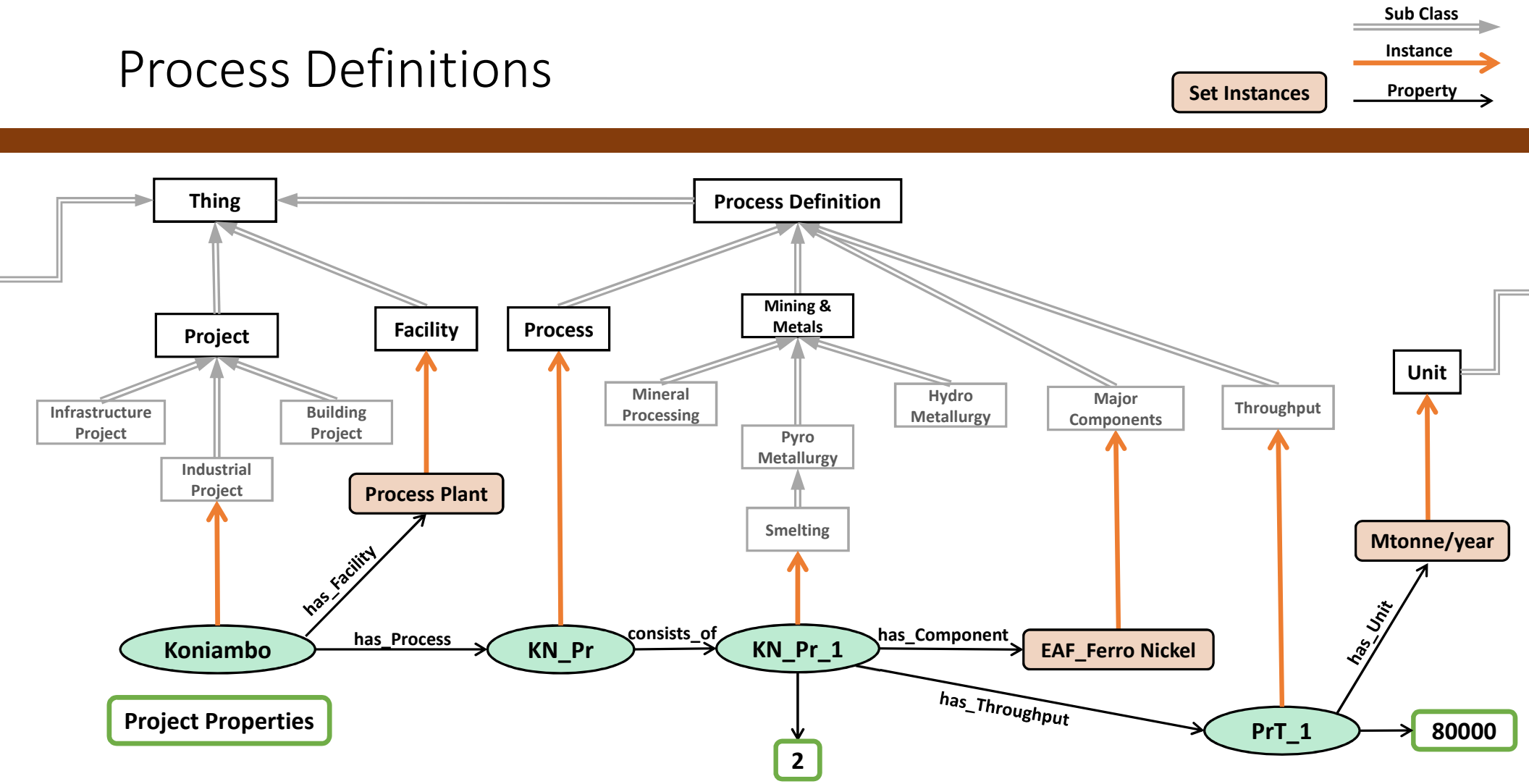
- Project data/outcomes by phase
- Phased breakdown of indices
- Requires full access to the project data

Hard to Capture – Requires Access to Native Documents

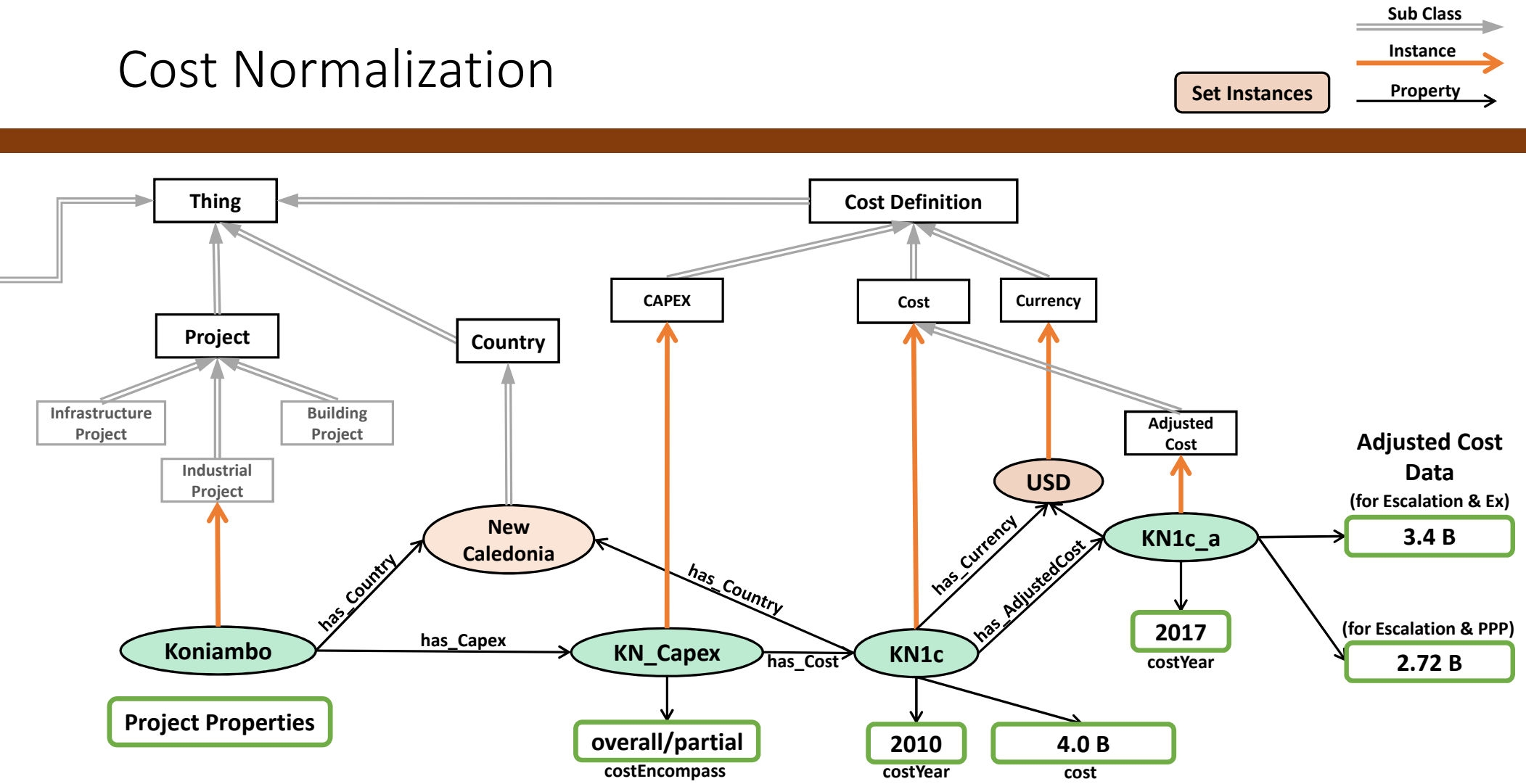
Uniform Project Ontology



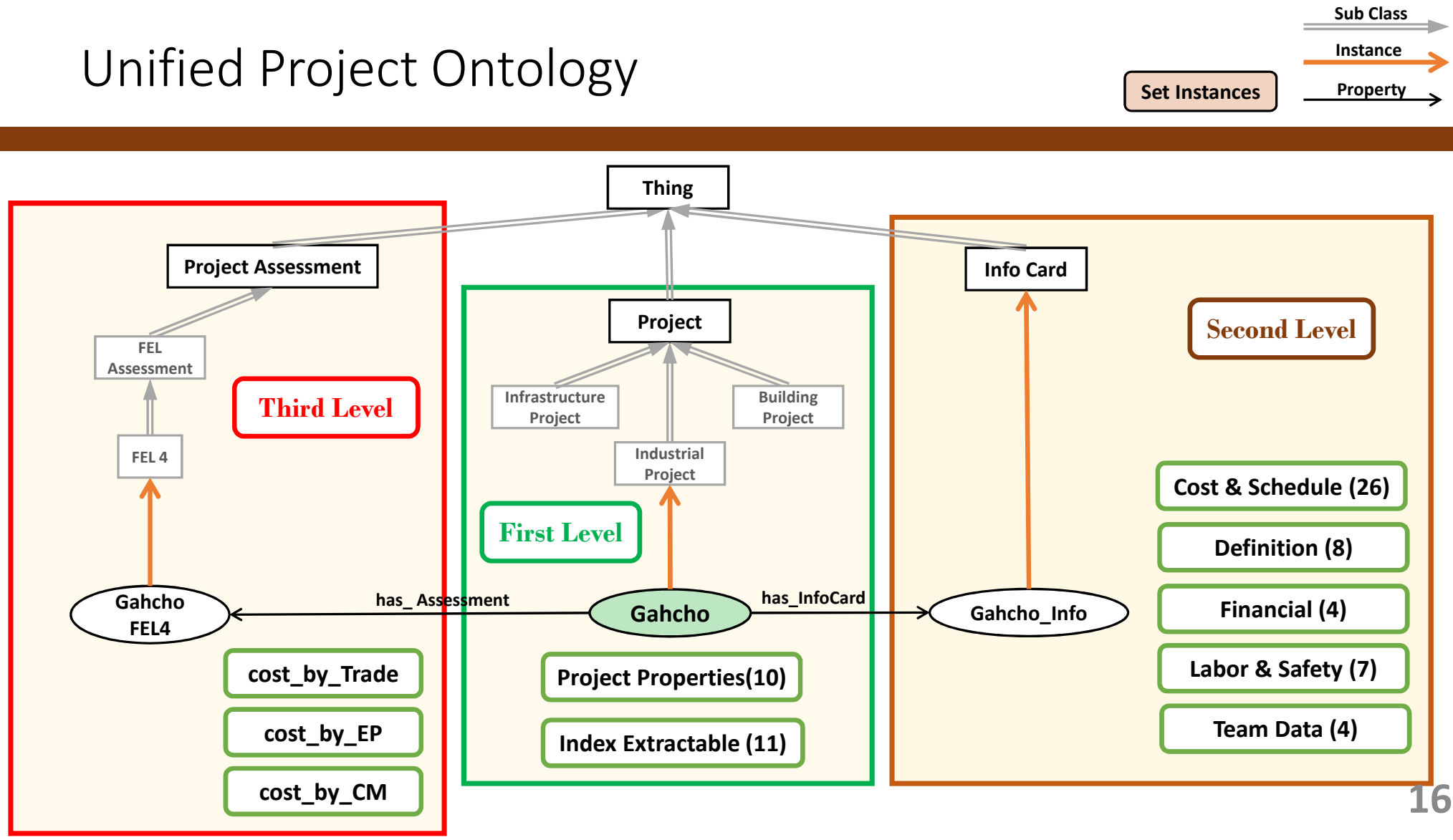
Process Definitions



Cost Normalization



Unified Project Ontology



Data Properties

Project Properties(10)

- Name
- Geolocations
- Minerals
- Time
- etc.

Cost & Schedule (26)

- Cost
- %Estimated Cost
- Manhours
- %Estimated Manhours
- etc.

Financial (4)

- NPV
- IRR
- WACC
- etc.

Team Data (4)

- Size
- Experience
- etc.

Index Extractable (11)

- Country indices
- Escalation
- Remoteness
- Climate
- etc.

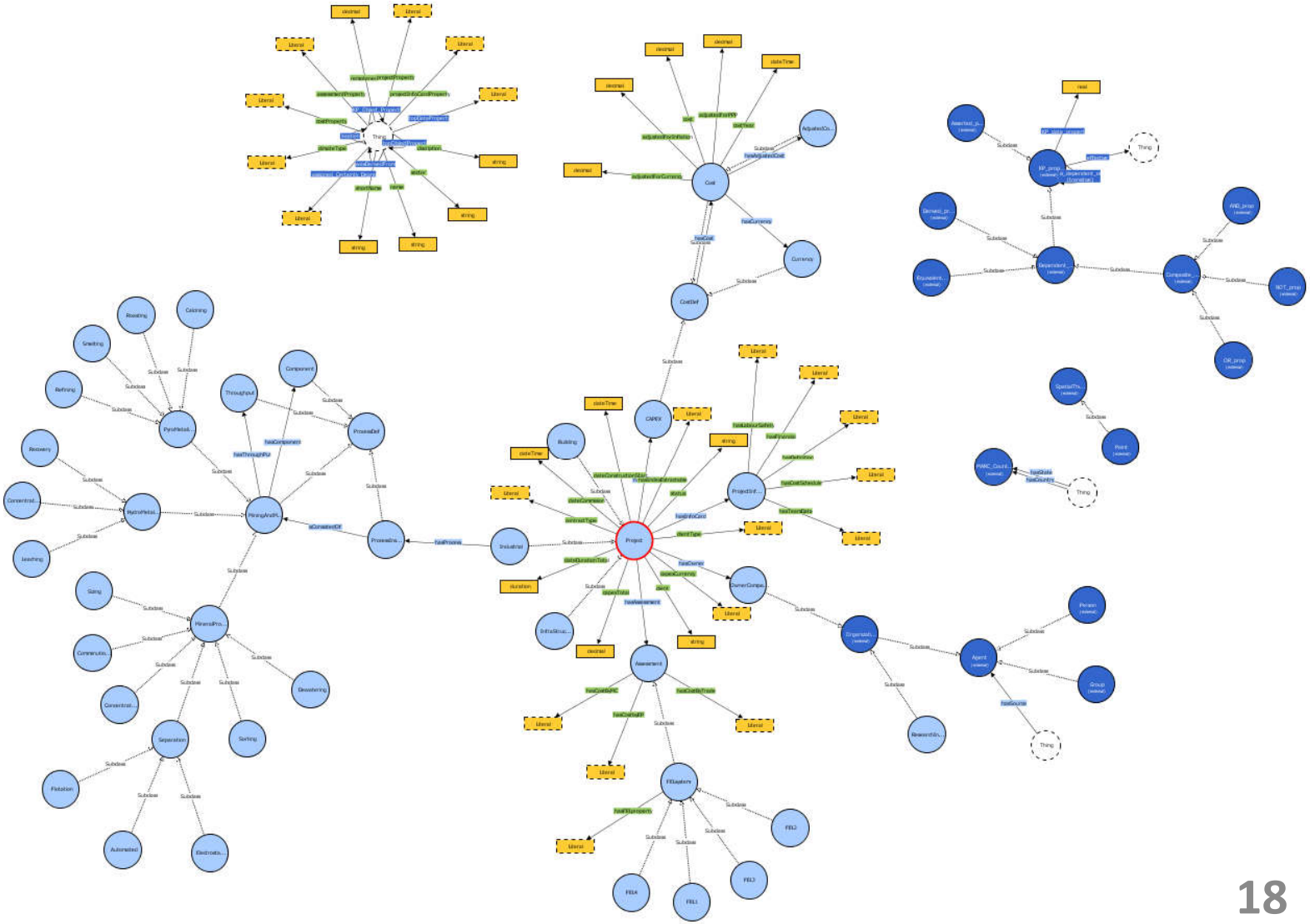
Definition (8)

- %Phases cost
- %Phases manhours
- Technology class
- etc.

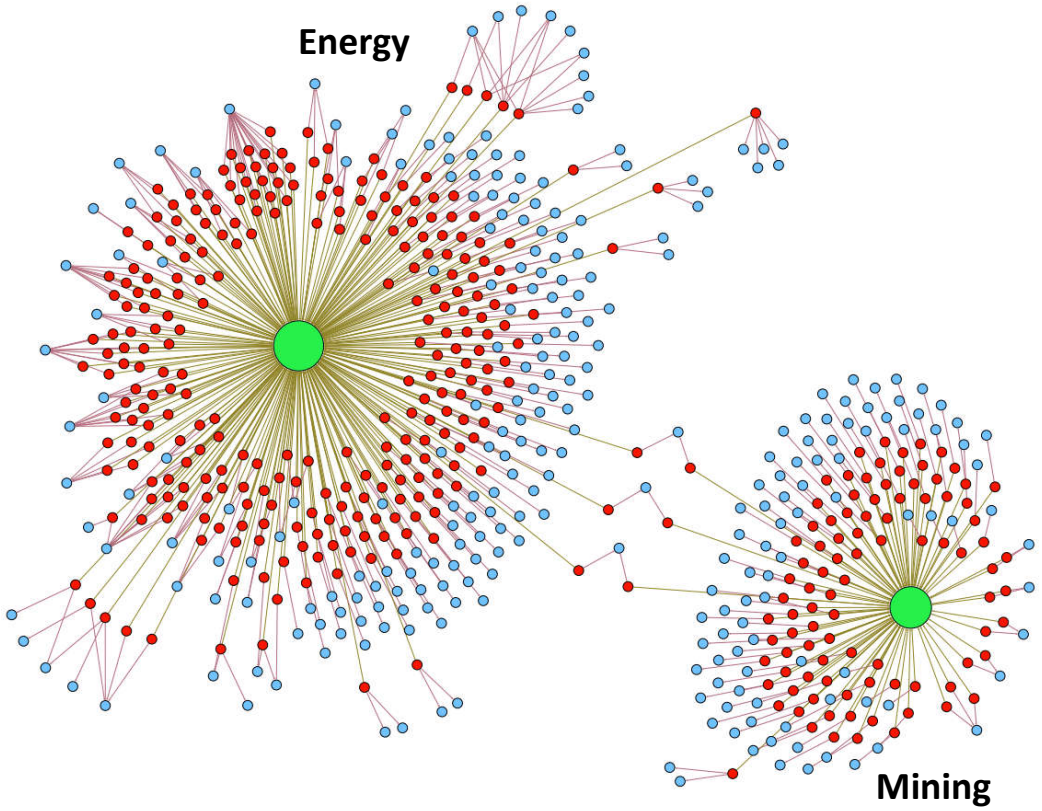
Labor & Safety (7)

- %Labor by origin
- Injury lost time
- etc.

State of the Knowledge Base



Natural Resources Canada - Major Projects



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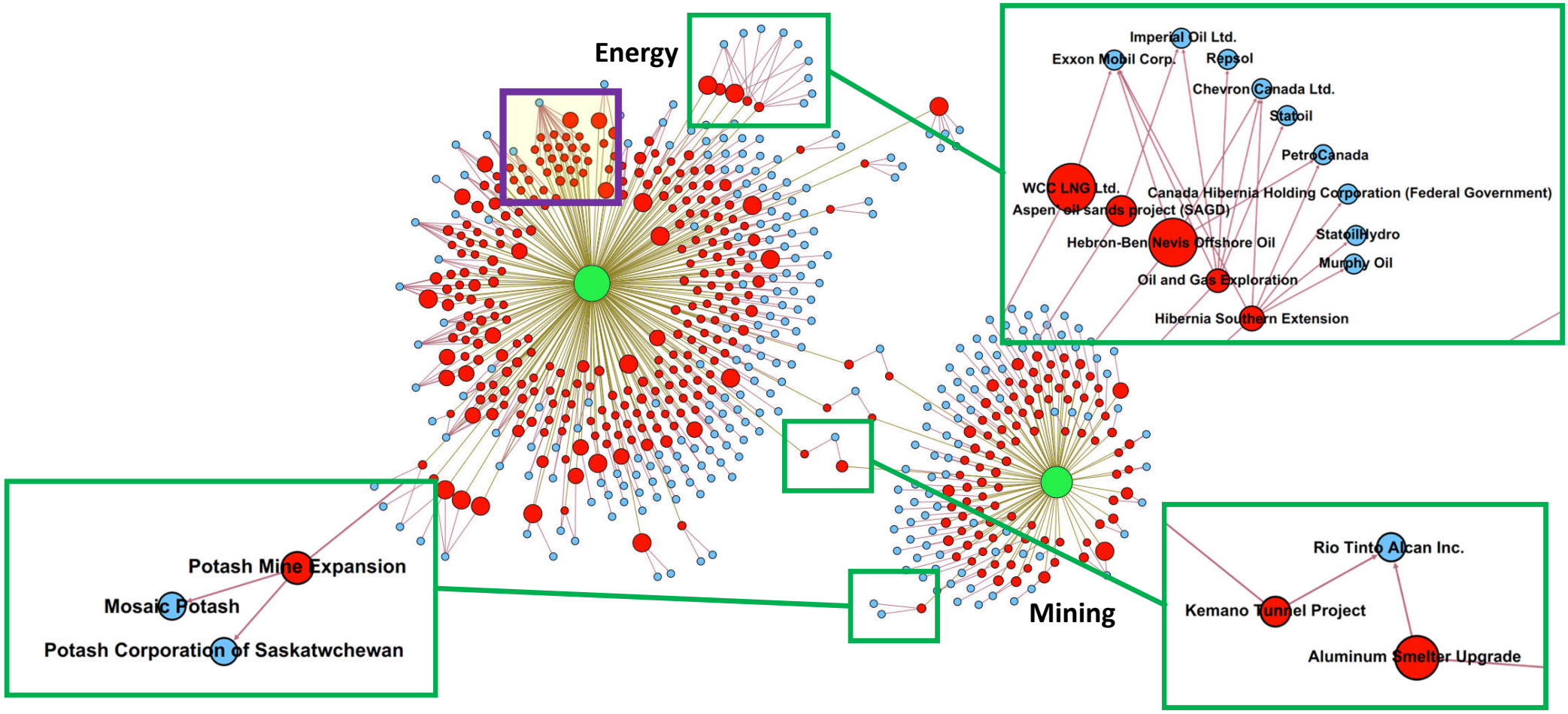

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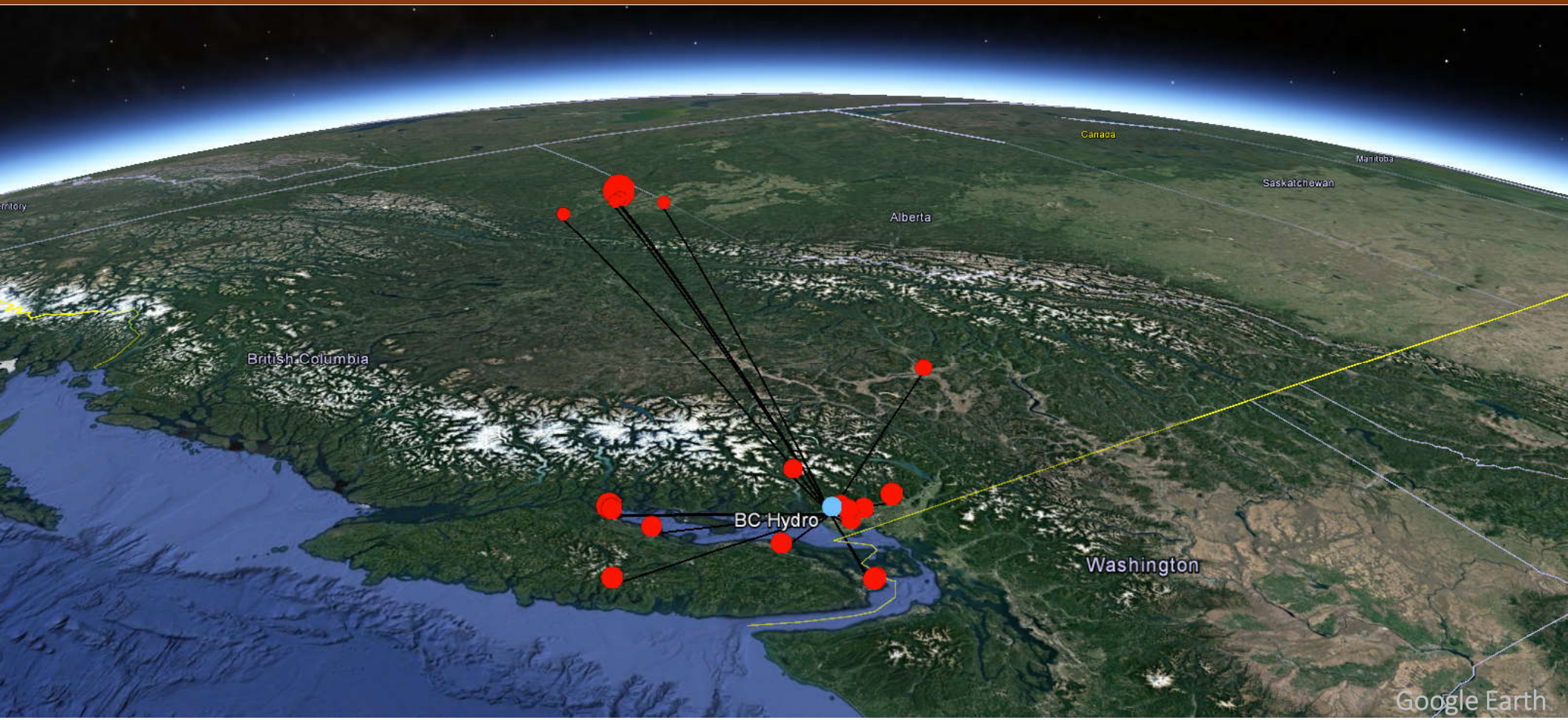

Thank you very much

Questions, comments & feedbacks are very appreciated

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