Thivya THEVATHAS - M2 MCI EUR GER
My L1 : **Maëlle BOZO BERRIOS**

Paper 2 : Data-Driven Process Mining Framework for Risk Management in Construction Projects

Google scholar : https://iopscience.iop.org/article/10.1088/1755-1315/1101/3/032023/meta

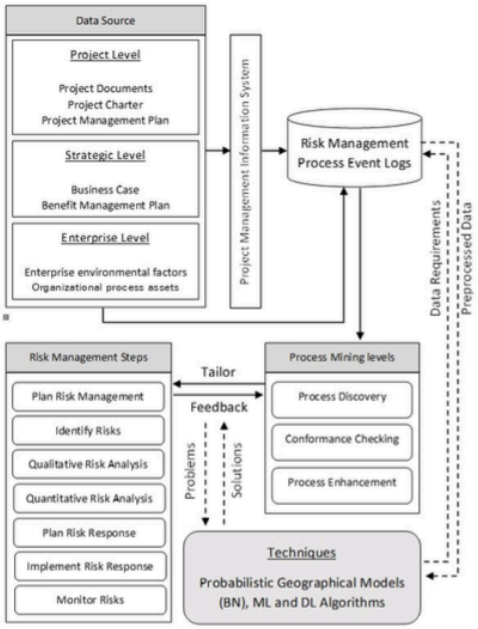
Major construction projects, both in terms of investment and construction time, have an impact on the likelihood of risks. These types of projects often face certain risks that cannot be predicted. That's why this research is based on exploring processes for improving these risks in the construction industry. And this can be tackled and solved by artificial intelligence, based on automation and learning with a graphical presentation model based on a Bayesian network.

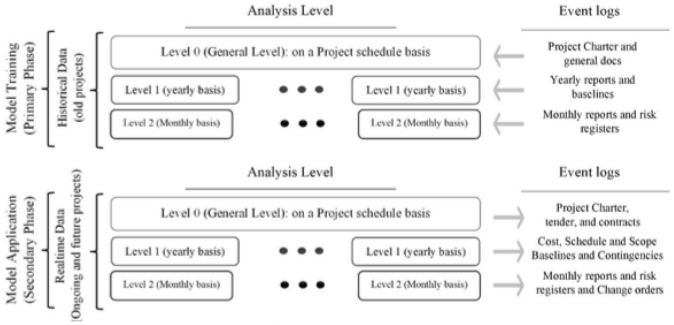
Let's remind ourselves what process mining is, before we begin our analysis. It's a method of analysis based on current and historical evidence and data, used to improve business or project processes. This process can be tracked in the form of event logs to identify necessary modifications.
PM is highly effective in uncertain, constantly changing environments, such as those found in construction projects, and can bring new technologies to bear on the industry's digital transformation.
Project management comprises several phases based on the objectives to be met in companies and projects with different levels of maturity. This analysis is carried out by Kulakli and Birgun for various business applications using techniques (e.g. transaction verification, emergency rescue in case of accident, fraud detection...).

A. AI for risk management
AI depends on the context used to identify the best maturity level for the model. It's important to be aware of all problems throughout the process using PM. That's what the event log is for.
Graphical probability models are techniques for modeling stochastic systems for risk and probability analysis.
Liu et al. have developed a risk assessment method for the Bayesian network most commonly used in the construction of an urban rail PPP project. These are known as directed acyclic graphs (DAGs) and comprise a BN structure, with variable or random nodes and directed arcs as indicators of causal relationships between variables, and a conditional probability distribution table, showing the influence of a parent node on a child node.
Mittnik and Starobinskaya presented an operational risk system based on a hybrid Bayesian network to model current shocks and map causal dependencies between frequencies and severity of risky events.
Regarding the integration of AI and Process Mining, Ou-Yang and Winarjo proposed a Petri net integration approach to support multi-agent process management using the alpha algorithm.

B. Research methodology
As mentioned earlier, we need to analyze the steps involved in implementing risk management. There are seven of them:
1) risk management planning, 2) risk identification, 3) qualitative risk analysis during the tender and contract award phase, 4) quantitative risk analysis, 5) risk response planning, 6) risk response implementation, 7) risk monitoring.
All this would be the basis for process knowledge, compliance verification or improvement. One of the main difficulties would be the variability of the process: ad hoc, temporary and one-off.
This methodology enables us to automate and improve current manual processes and techniques, with AI in particular, to make it easier to identify, assess and mitigate risks.

The diagram alongside mentions data sources, event logs, levels and levels and objectives of process exploration, risk management steps and techniques. Data sources consist of project, strategy and corporate level data. This raw data must be systematically collected and stored in project management information systems for analysis and decision-making.





This data between the event logs and the model proposes the model's input data in the training phase, and the reverse occurs in the application phase, enabling the model to automatically identify and analyze project risks.

C. Framework for process discovery

The main objective is to propose a real process model and establish real-time links with key data sources and event logs.

D. Framework for compliance testing

Compliance testing is carried out when statistical methods are used on data to understand each variation. The main objective is to improve key performance indicators and process control.

E. Results and discussion

The Bayesian network has 16 different states, each representing one of the identified risks of a new project. The model has an accuracy of 40%: 4 correct predictions out of 5.
According to the results, it can be applied in practice for a variety of purposes with a minimum of conflict and disruption, thanks to the high degree of conformity between PM and RM disciplines, implementation steps and data requirements.
One of the advantages of the Bayesian network-based risk tree is its ability to update itself immediately in line with new a priori, beliefs and knowledge.

Conclusion

Although artificial intelligence is widely adopted in various sectors its use in risk management remains nil, often reactive and lacking an established framework.
This article therefore proposes a framework for risk management in construction, based on a processual approach and exploiting the capabilities of Bayesian networks and probabilistic graphical models in a systematic way.

By merging the principles of risk management, probabilistic modeling and artificial intelligence, this framework aims to provide a data-driven decision-making tool, contributing to the digital transformation of the construction industry and improving project control.