Monte Carlo Simulation in Hong Kong Construction

A balanced view for Planning Professionals from the desk of an HK planning practitioner

Where We Stand Today

After years of hearing about Monte Carlo simulation[1] in academic circles and international best practices, it's time for an honest conversation about where this technique actually fits in our Hong Kong construction reality. The truth? Monte Carlo isn't widespread here – *yet*. Most of us still rely on good old CPM[2] with deterministic schedules, and there's nothing wrong with that for many projects. But for those complex jobs where uncertainty keeps you up at night, Monte Carlo offers something our traditional methods simply can't: *probabilistic confidence levels backed by data.*

In practice, Monte Carlo simulation remains a specialist tool rather than a standard industry requirement in Hong Kong. Its strongest presence is found in academic research, large infrastructure programmes, and projects supported by international consultants or sophisticated client organisations. Deterministic Critical Path Method (CPM) scheduling remains dominant for baseline planning, progress monitoring, and most delay analysis exercises.

That said, Monte Carlo is well understood among senior planners and forensic consultants, particularly as part of Quantitative Schedule Risk Analysis (QSRA). Tools such as Primavera Risk Analysis, often linked with Primavera P6, are commonly used to assign optimistic, most-likely, and pessimistic durations to key activities and run thousands of iterations to generate probabilistic completion dates (P50, P80, P90).

The Real-World Applications

Quantitative Schedule Risk Analysis (QSRA) using tools like Primavera Risk Analysis is where Hong Kong practitioners are seeing genuine value. Instead of presenting a single completion date that everyone knows is optimistic, you can now say: "We have 30% confidence in 24 months, but 80% confidence in 26 months." That conversation changes strategic planning.

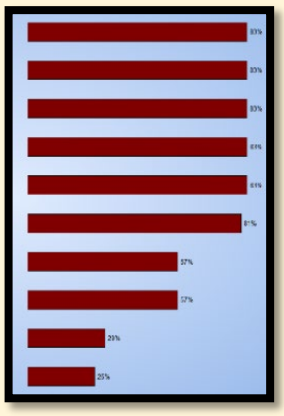
Cost-schedule integration is the next frontier. When delays happen, Monte Carlo helps *quantify* the ripple effects on preliminaries, escalation, and prolongation costs – critical for extension of time claims and contractual negotiations.

[1] The Monte Carlo simulation is a computer method that uses random guesses over and over to predict results in tricky, unpredictable situations; it started in the 1940s on the Manhattan Project, when mathematician Stanislaw Ulam - stuck in bed sick at Los Alamos Lab - got the idea from playing solitaire and thinking about gambling, came up with it in 1946 to solve neutron movement issues, worked with John von Neumann to tweak it for early computers, and got its name from Nicholas Metropolis after Monaco's casino as a fun reference to luck, before spreading from bomb physics to areas like finance, engineering, and stats.

[2] CPM is Critical Path Method

Large infrastructure projects – Railway extensions, major bridges, and complex design-build contract are where we're seeing adoption among international JVs and sophisticated main contractors. The technique shines when multiple uncertainties interact, such as ground conditions affecting both excavation duration and support costs, weather impacting multiple concurrent activities, or supply chain disruptions cascading through the schedule

Why It Hasn't Gone Mainstream (and that's OK)



Let's be practical. Hong Kong moves fast. We have tight tender periods, established workflows, and a culture built on experience and relationships. Implementing Monte Carlo analysis necessitates reliable historical data which may be unavailable to many organizations as well as specialized expertise and adequate time for proper setup. For simple projects with obvious critical paths, the effort may not be worthwhile.

The tool is only as good as the inputs – garbage in, garbage out still applies. And yes, there's sometimes pressure to manipulate models to show favourable results for tenders. We need to acknowledge these realities.

Three Practical Recommendations

1. Start Selective, Not Universal

Don't try to apply Monte Carlo to every project. Focus on complex jobs with high uncertainty, multiple parallel paths, or significant financial exposure. Build your capability gradually through pilot projects where the value proposition is clearest.

2. Invest in Your Team's Skills

The software Primavera Risk Analysis is accessible. The real barrier is analytical thinking about probability distributions and correlations. Consider targeted training for your senior planners and QS teams. Partner with specialists on your first few implementations rather than going it alone.

3. *Leverage It* for Delay Analysis and Claims

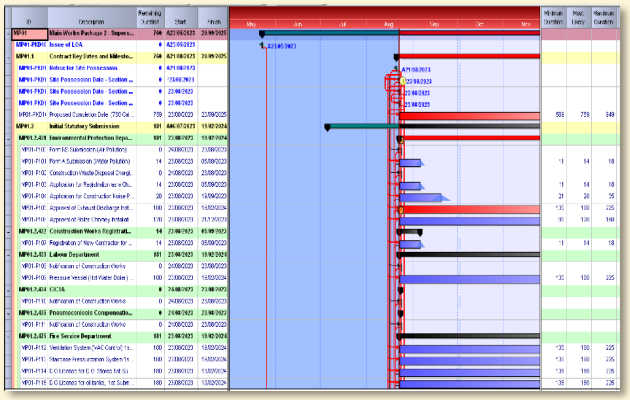
This is where Monte Carlo can truly differentiate your practice. In disputes, demonstrating how a delay event shifted the probability distribution – using AACE RP 64R-11 methodology[3] – provides compelling expert evidence. It moves the conversation from subjective opinion to quantitative analysis. As adjudicators become more sophisticated, this capability will become increasingly valuable. Let me elaborate on this more.

When disputes arise over significant delays, Monte Carlo can add weight to your analysis. Instead of arguing "this delay caused X months," you can demonstrate "before this event, we had 80% confidence of finishing by Month 26; after it, only 50% confidence." This

[3] AACE International Recommended Practice (RP) 64R-11, titled *"CPM Schedule Risk Modeling and Analysis: Special Considerations,"* provides a framework for conducting quantitative schedule risk analysis using Critical Path Method (CPM) networks and Monte Carlo simulations

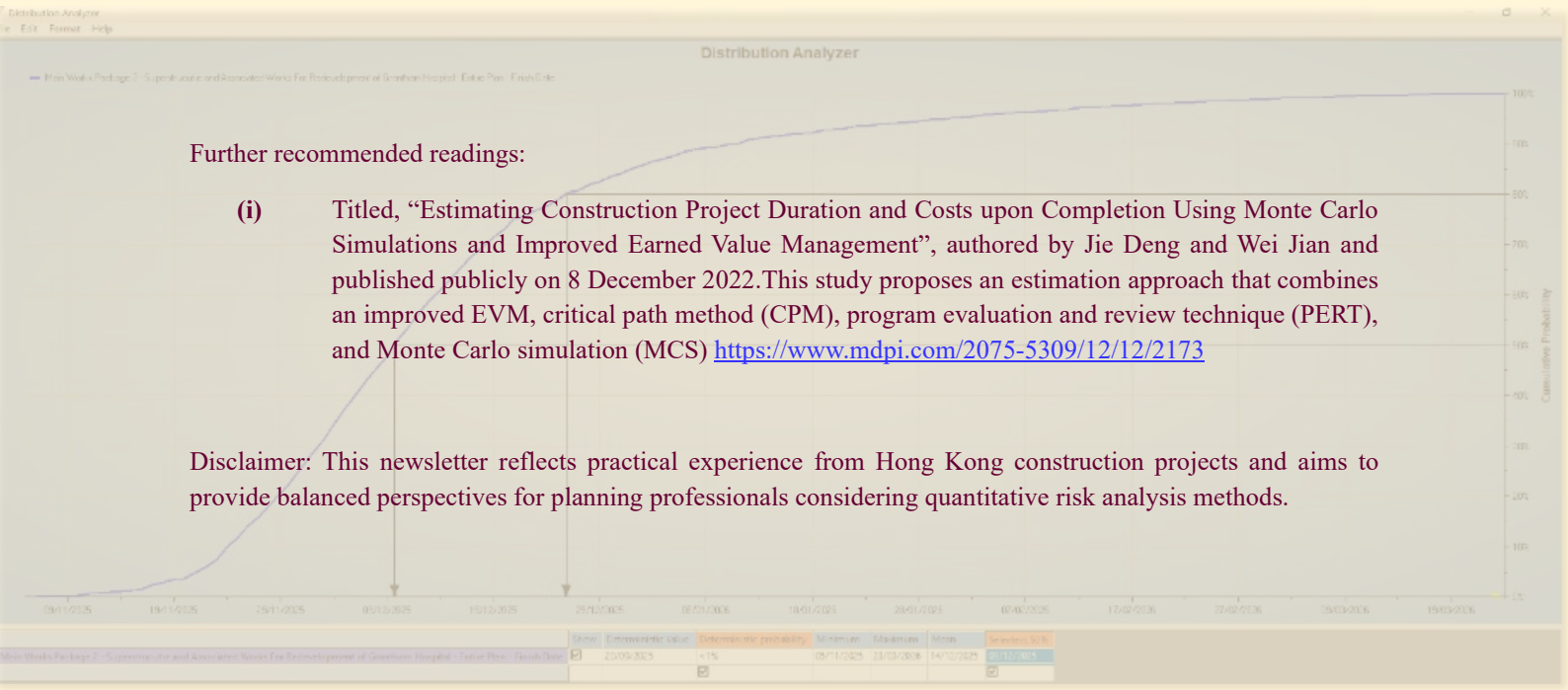
probabilistic approach provides an additional layer of evidence alongside traditional delay analysis methods. While it's not yet standard practice in Hong Kong adjudication, it's worth exploring for high-value disputes where sophisticated quantitative analysis could strengthen your position – particularly when paired with solid contemporaneous records and traditional CPM logic.

The Bottom Line



Monte Carlo simulation isn't replacing traditional CPM, it's complementing it for situations where understanding uncertainty matters. It won't solve all our project control challenges, but that's why we have a toolkit: CPM for logic and sequencing, Earned Value Management for progress tracking, PERT for three-point estimates, risk registers for qualitative assessment, and line-of-balance for repetitive work. Each tool has its place.

The question isn't whether to adopt Monte Carlo everywhere tomorrow. It's whether you're building the capability to deploy it when your projects genuinely need it. For those of us managing complex, high-stakes work where uncertainty significantly impacts outcomes, understanding probabilistic analysis is becoming a valuable skill – even if it's not something you use daily.



Further recommended readings:

(i) Titled, "Estimating Construction Project Duration and Costs upon Completion Using Monte Carlo Simulations and Improved Earned Value Management", authored by Jie Deng and Wei Jian and published publicly on 8 December 2022.This study proposes an estimation approach that combines an improved EVM, critical path method (CPM), program evaluation and review technique (PERT), and Monte Carlo simulation (MCS) https://www.mdpi.com/2075-5309/12/12/2173

Disclaimer: This newsletter reflects practical experience from Hong Kong construction projects and aims to provide balanced perspectives for planning professionals considering quantitative risk analysis methods.