

# CARLVIN JERRY MWANGE

## Head of Data & Financial Engineering

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### EXECUTIVE SUMMARY

Financial Data & Quantitative Engineering leader with 7+ years of progressive expertise at the intersection of capital markets, advanced quantitative modelling, and scalable analytics platform architecture. As Head of Quantitative Research & Financial Engineering at Innova Limited — a FinTech/CapTech firm serving 50+ regulated financial institutions across 16 Sub-Saharan African countries — I lead a specialist quant team delivering mission-critical analytics infrastructure for Central Banks, Investment Banks, Fund Managers, Wealth Managers, Pension Administrators, and Capital Market Regulators. Notable engagements include architecting the quantitative engine of the Innova Integrated Analytics Platform (piloted by 11 Kenyan fund managers and independently verified by two actuarial firms), building the Internal Credit Risk Analysis Tool (ICRAT) for MEFMI (deployed to 10+ Central Banks across Eastern & Southern Africa), and contributing to Kenya's CMA Regulatory Sandbox. I hold a BSc and MSc in Financial Engineering, with applied specialisation in derivatives pricing, portfolio optimisation, time-series modelling, copula theory, distributional analysis, and sovereign credit risk. I bring both the technical depth to architect complex quantitative systems and the leadership capability to build, mentor, and scale high-performance quant engineering teams.

### PROFESSIONAL EXPERIENCE

#### Head of Quantitative Research & Financial Engineering · Innova Limited 2022 – Present | Nairobi, KE

Leading the Financial & Data Engineering department of a pan-African CapTech firm whose analytics platforms serve regulated financial institutions — including Central Banks, Investment Banks, Fund Managers, Pension Administrators, and Capital Market Regulators — across 16 countries in Sub-Saharan Africa.

- Architect and own the end-to-end quantitative design of Innova's Integrated Analytics Platform (IIAP) — a multi-tenant financial data and analytics engine piloted by 11 Kenyan fund management companies, independently verified by two actuarial firms, and deployed to 50+ institutional clients across 16 African markets, processing portfolio valuations, performance attribution, risk metrics, statistical analytics, and regulatory reporting workloads.
- Led client engagement and training for the IIAP pilot cohort — translating complex quantitative models (copula, distributional analysis, time-series, VaR, attribution) into practical working knowledge for fund managers and investment analysts.
- Lead and mentor a team of 4–7 quantitative analysts and researchers, establishing research methodology standards, code review protocols, model validation frameworks, and career development pathways.
- Spearhead quantitative model development for Innova's RegTech & SupTech Platform — used by Central Banks and Capital Market Regulators — delivering automated regulatory data ingestion, stress-testing analytics, and systemic-risk reporting pipelines.
- Design and implement financial risk models covering market risk (VaR, CVaR, stress testing), credit risk (PD/LGD modelling, ICRAT), liquidity risk, and bond risk analytics (convexity, modified/Macaulay duration, portfolio drift) for institutional clients managing fixed income, equity, and alternative asset portfolios.
- Drive integration of machine learning and advanced statistical techniques into financial analytics: time-series forecasting, copula-based dependency modelling, distributional analysis, regression and correlation analytics, and portfolio optimisation deployed within the Investment Management Platform.
- Act as primary technical authority and client-facing engineering lead for quantitative modules, engaging directly with C-suite and technical stakeholders at Fund Management Companies, Custodian Banks, and Regulatory bodies to scope, validate, and deliver analytical solutions.
- Established department data engineering standards: ETL/ELT pipeline architecture, data modelling conventions, and API design patterns for financial data ingestion across heterogeneous African market data sources.
- Played a key role in Innova's CMA Regulatory Sandbox initiative — a cloud-based financial markets data analysis and reporting platform developed in partnership with the Capital Markets Authority of Kenya.

#### Senior Quantitative Analyst · Innova Limited 2019 – 2022 | Nairobi, KE

Promoted from Quantitative Analyst role; led quantitative R&D and took ownership of model development and financial data analytics across Innova's investment management and analytics product suite.

- Developed and deployed quantitative models for securities pricing (equities, fixed income, unit trusts), portfolio performance measurement, and attribution analysis — adapting global methodologies to African capital market structures, settlement cycles, and pricing conventions.

- Built predictive modelling pipelines in Python and R for financial time-series analysis, including NAV forecasting, yield curve modelling, distributional analysis, and portfolio return attribution.
- Engineered data processing and analytics workflows integrating market data feeds from multiple African exchanges and OTC markets into Innova's Investment Management and Wealth Management platforms.
- Implemented machine learning classification and regression models for financial pattern recognition and risk flagging, with workloads executed on Microsoft Azure ML infrastructure.
- Authored quantitative model documentation, validation reports, and technical specifications to support client onboarding, regulatory compliance, and internal quality assurance processes.
- Collaborated cross-functionally with Software Engineering, Project Management, and Business Development teams to translate client quantitative requirements into production-grade platform features.

#### Quantitative Analyst · Innova Limited 2018 – 2019 | Nairobi, KE

- Conducted research and implementation of financial markets analysis models, performing quantitative analysis across African equity, fixed income, and alternative investment markets.
- Built, developed, and tested financial models for investment data analysis spanning multiple African markets using Python, R, Julia, and F# for .NET framework integration.
- Contributed to machine learning research in the financial domain, delivering early-stage predictive modelling capabilities that formed the foundation of Innova's AI-powered analytics layer.

#### Mathematical Engineering Intern · Innova Limited 2016 – 2017 | Nairobi, KE

- Performed analytical research in data manipulation and visualisation; developed financial risk management and analysis models in R.
- Built an internal analytics tool to store, analyse, and visualise employee transaction data — demonstrating early data engineering and product delivery capability.

### KEY PROJECTS & INITIATIVES

#### Innova Integrated Analytics Platform (IIAP) (Quantitative Architecture Lead · Piloted by 11 Fund Managers · Independently Verified by 2 Actuarial Firms)

IIAP is Innova's flagship cross-asset quantitative analytics product, deployed to Fund Managers, Wealth Managers, Custodian Banks, Pension Administrators, and Capital Market Regulators across 16 Sub-Saharan African countries. The platform was formally piloted by 11 Kenyan fund management companies and independently validated by two separate actuarial firms, confirming the accuracy and robustness of its quantitative models, calculations, and analytics outputs — a level of third-party verification rare in African FinTech. The platform delivers a comprehensive suite of technical and fundamental analytics across all asset classes, enabling institutions to perform statistical inference, risk measurement, performance attribution, and investment decision support — all within a single integrated environment.

##### Technical Analytics Engine — Quantitative Modules Built & Maintained:

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| <ul style="list-style-type: none"> <li>▪ Portfolio &amp; Security Risk: VaR, CVaR, Stress Testing</li> <li>▪ Return Attribution: Brinson, Cascading, Risk-Adjusted</li> <li>▪ Performance Ratios: Sharpe, Treynor, Jensen's Alpha, Information Ratio, Modigliani-Modigliani</li> <li>▪ Statistical Analysis: Standard Deviation, Variance, Tracking Error, Semi-Deviation, Kurtosis, Skewness</li> <li>▪ Distributional Modelling: Parametric &amp; Non-Parametric Distribution Fitting, Tail Risk Estimation</li> <li>▪ Copula Modelling: Dependency Structures for Multi-Asset Portfolio Risk</li> </ul> | <ul style="list-style-type: none"> <li>▪ Time-Series Analysis: Trend Decomposition, Autocorrelation, Forecasting, Regime Detection</li> <li>▪ Regression &amp; Correlation Analysis: Multi-Factor Models, Factor Attribution</li> <li>▪ Bond Risk Analytics: Convexity, Modified Duration, Macaulay Duration, Portfolio Drift</li> <li>▪ Excess Return &amp; Volatility Metrics</li> <li>▪ Predictive Modelling: ML-driven return and risk forecasting</li> <li>▪ Fundamental Analysis: Liquidity, Profitability, Solvency, Asset Quality, Efficiency, Coverage &amp; Market Value Ratios</li> </ul> |
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**Role:** Quantitative architecture lead for the IIAP analytics engine — responsible for the mathematical design, implementation, validation, and ongoing enhancement of all quantitative modules. Led client engagement and delivered hands-on training to fund management teams across the pilot cohort, translating complex quantitative methodology into practical operational knowledge for investment analysts and portfolio managers. Served as the primary internal authority on statistical methodology, model governance, and cross-asset analytical consistency throughout the actuarial verification process and subsequent full deployment.

#### ICRAT — Internal Credit Risk Analysis Tool (Client: MEFMI · Deployed to 10+ Central Banks · Eastern & Southern Africa)

The Macroeconomic and Financial Management Institute of Eastern and Southern Africa (MEFMI) is a regionally owned capacity-building organisation mandated to strengthen macroeconomic and financial management across 14 member countries, including Angola, Botswana, Kenya, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. MEFMI's primary clients are Central Banks and Ministries of Finance.

Innova partnered with MEFMI to design, build, and deploy ICRAT — a quantitative tool enabling sovereign reserve managers at Central Banks to conduct internal credit risk assessments independent of external rating agencies (required under FSB and IMF guidance post-2008). The tool evaluates counterparty creditworthiness using three integrated credit risk modules:

- **Market Implied Ratings** — inferring credit ratings from market signals ahead of Credit Rating Agency updates (Breger-Goldberg-Cheyette model)
- **Default Probability Modelling** — estimating probability of default using bond pricing mechanics and recovery rate assumptions (Vrugt, 2011)
- **Financial Ratio Analysis** — fundamental-based issuer classification across Commercial Banks, Corporates, Sovereigns, Government Agencies, and Supranationals

Each module classifies counterparties through a traffic-light system (green/yellow/red), with an integrated signal supporting Central Bank foreign exchange reserve investment decisions. The tool was migrated from Excel/VBA to Python to handle larger datasets, improve computational performance and security, and add multi-currency support (USD, GBP, EUR, CNY, JPY — aligned with IMF SDR basket). Deployed to 10+ Central Banks across Sub-Saharan Africa.

**Role:** Quantitative engineering lead for ICRAT model development, Python migration, and deployment — working directly with Central Bank reserve management teams across Eastern and Southern Africa.

### **CMA Regulatory Sandbox — Capital Markets Analytics Platform** (Client: Capital Markets Authority of Kenya)

Contributed to the design and delivery of a cloud-based financial markets data analysis and reporting platform developed in partnership with the Capital Markets Authority of Kenya. This initiative positioned Innova as a RegTech leader in East Africa and directly shaped Kenya's regulatory technology framework for capital markets oversight.

### **ESG & FDI Research — Panel Data Analysis, East African Markets**

Independent quantitative research examining the impact of ESG factors on Foreign Direct Investment inflows across East African developing markets, using pooled and fixed-effects regression panel data models to identify key ESG drivers of FDI growth across the region.

### **Digital Nudging Research — Safaricom Alpha Hackathon Finalist**

Ranked among top finalists at a Safaricom PLC-hosted data science competition at Strathmore University; applied nudge theory and NLP techniques to live Twitter data streams using R and Python to extract geolocation signals without economic incentives.

## **EDUCATION**

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### **MSc, Financial Engineering**

2020 – 2024

**WorldQuant University** (Accredited · Tuition-Free · Merit-Based · Global Cohort)

A globally recognised, fully accredited postgraduate programme drawing top quantitative talent worldwide. Curriculum spans advanced mathematics, statistical inference, data science, and machine learning — all applied to real-world financial challenges.

**Core Areas:** Securities Pricing (Black-Scholes, Binomial Trees, Monte Carlo) · Algorithmic Trading Strategies · Portfolio Optimisation (Markowitz, Black-Litterman) · Derivatives & Structured Products · Financial Risk Management · Stochastic Calculus · Machine Learning in Finance · Python for Quantitative Finance · Financial Time-Series Econometrics

### **BSc, Financial Engineering**

2013 – 2017

**Jomo Kenyatta University of Agriculture & Technology (JKUAT)** · Nairobi, Kenya

An interdisciplinary programme equipping graduates with the mathematical, statistical, computational, and financial tools to model, price, and manage financial risk. One of the few dedicated Financial Engineering programmes in Sub-Saharan Africa.

**Core Areas:** Foundations of Financial Mathematics · Probability & Statistics (I, II, III) · Calculus & Linear Algebra · Ordinary Differential Equations · Fixed Income Securities Analysis · Theory of Insurance & Actuarial Practice · Financial Institutions & Markets · Economics (Micro & Macro) · Database Management Systems · Statistical Programming in R · Investment Mathematics · Risk Management · Financial Engineering & Derivatives · Quantitative Methods · Business Law & Financial Accounting

**Final Year Project:** *Comparative Analysis of Options Hedging Strategies vs. Futures-Based Hedging in African Capital Markets.*

## **TECHNICAL SKILLS**

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**Quantitative Finance:** Derivatives Pricing (Black-Scholes, Monte Carlo, Binomial), Portfolio Optimisation (Markowitz, Black-Litterman), Risk Analytics (VaR/CVaR/Stress Testing), Sovereign Credit Risk (ICRAT/PD/LGD), Fixed Income & Bond Analytics (Duration, Convexity), Copula Modelling, Distributional Analysis, Performance Attribution (Brinson, Cascading), Time-Series Econometrics, Algorithmic Trading, Yield Curve Modelling

**Data & Analytics Engineering:** ETL/ELT Pipeline Design, Financial Data Modelling, Multi-Tenant Analytics Architectures, API Design & Integration, Time-Series Data Engineering, Regulatory Reporting Pipelines, Bloomberg Data Integration, Cross-Asset Data Normalisation

**Programming Languages:** Python (primary: pandas, NumPy, SciPy, scikit-learn, statsmodels), R (statistical modelling, R Shiny), F# (.NET / functional & statistical programming), Julia, SQL, JavaScript

**Machine Learning & AI:** Supervised & Unsupervised Learning, Time-Series Forecasting, Anomaly Detection (AML), Classification & Regression Models, Feature Engineering for Financial Data

**Cloud & Infrastructure:** Microsoft Azure (ML Studio, Data Factory), Cloud-Based Analytics Platforms, REST API Architecture, Git / Version Control

**Financial Systems & Platforms:** Investment Management Systems, RegTech & SupTech Platforms, Wealth Management Platforms, Custodian & Safekeeping Systems, AML Platforms, Pension Administration Systems, Sovereign Reserves Management Tools

**Analytics & Visualisation:** Power BI, R Shiny, D3.js, Financial Dashboard Design, Statistical Reporting

**Leadership & Delivery:** Team Leadership (4–7 quant specialists), Quantitative Model Governance, Technical Roadmap Ownership, Cross-Functional Stakeholder Engagement, Central Bank & Regulator Engagement, Client-Facing Technical Advisory

## CERTIFICATIONS & PROFESSIONAL DEVELOPMENT

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- MSc Financial Engineering — WorldQuant University (Accredited, Merit-Based, 2024)
- author on quantitative finance, data engineering, and functional programming ([carlvinjerry.com](http://carlvinjerry.com)).