A CFO's Guidebook to Enhancing Cash Flow Using Machine Learning

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INTRODUCTION

In an era in which financial agility and accuracy are paramount, the role of a Chief Financial Officer (CFO) has evolved to own and deploy innovative technologies like machine learning (ML) that enhance organizational cash flow. This guidebook dives into the transformative potential of ML, answering questions that CFOs might have about integrating this technology into their financial capabilities. This guide also delineates the specific benefits of using ML in cash flow forecasting, highlighting its ability to improve prediction accuracy and operational efficiency.

Additionally, we highlight the theoretical underpinnings that make ML an essential tool for modern finance departments. Both emphasizing its role in data-driven insights and decision-making and integrating ML with ongoing forecasting processes offer ways to seamlessly blend traditional methods with advanced approaches. This integration fosters a more dynamic and resilient forecasting framework, enabling CFOs to anticipate financial challenges and opportunities more effectively.
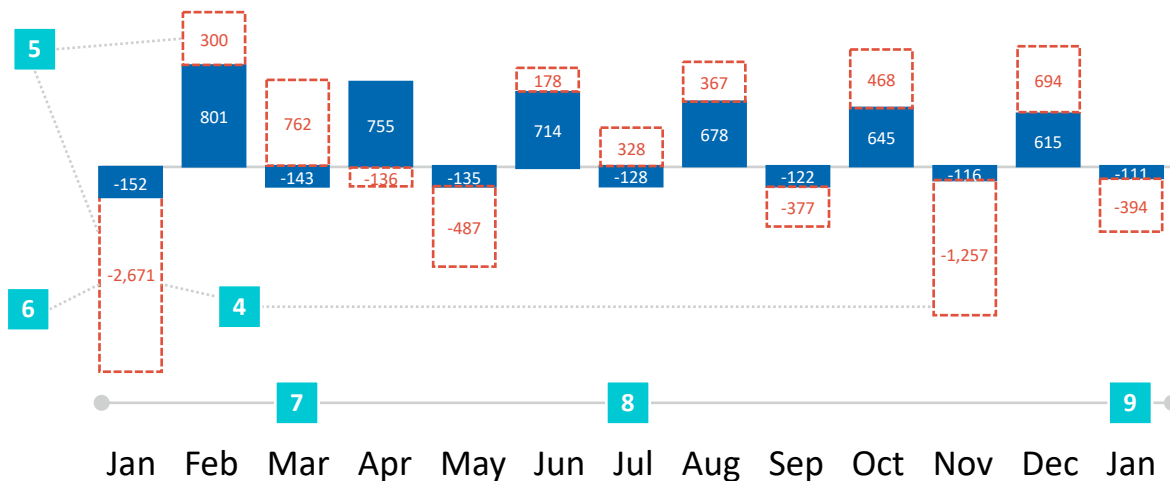
The pages that follow address potential hurdles in adopting ML technologies, and practical advice for overcoming these challenges and ensuring a smooth transition. Furthermore, we present a conceptual blueprint for CFOs to implement these technologies, from initial assessment to full-scale deployment. Ultimately, this guidebook serves as an indispensable resource for CFOs aiming to harness the power of machine learning to enhance their organization's financial health and strategic foresight.
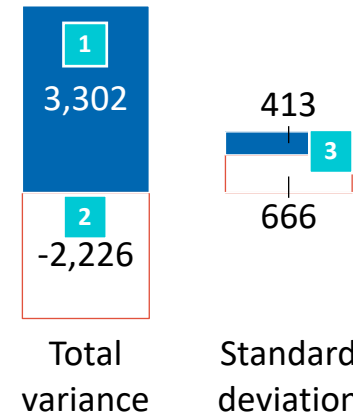
Excellence in Cash Flow Forecasting

Can your cash flow model answer these nine fundamental questions?

Navigating volatility, uncertainty and rapid changes are constants for businesses; how does your cash flow model adapt to create accurate and precise forecasts?

Monthly Cash Flows (in 000's) ■ Forecast □ Error

Total Variance (in 000's)[1]

	Forecast	Error
Jan	-152	-2,671
Feb	801	300
Mar	-143	762
Apr	755	-136
May	-135	-487
Jun	714	178
Jul	-128	328
Aug	678	367
Sep	-122	-377
Oct	645	468
Nov	-116	-1,257
Dec	615	694
Jan	-111	-394

Total variance: **3,302** / **-2,226**

Standard deviation: **413** / **666**

4 **Liquidity Events**: What signals indicate when a future liquidity event could occur?

5 **Predict Swings**: Can the model forecast large outflow/inflows?

6 **Predict Shifts**: Can it predict systemic shifts in underlying fundamentals?

7 **Initial Impact**: How would changes in DSO, DPO, DIO, headcount and payment terms impact short-term cash flow? Does reality align with expectation?

8 **Ownership**: Does each business unit leader have visibility to their cash flow and cash flow levers?

9 **Policies & Cash Balance**: What level of cash should be maintained and how frequently should target cash policies be adjusted?

1 **Accuracy**: How accurate is the model over 13 weeks? Is that good enough?

2 **Precision & Stabilizers**: What policies & actions would reduce average weekly cash flow variance?

3 **Decomposition**: Can the model show what inflows & outflows impact forecast vs. actuals variation?

1. Illustration Description: The illustration represents monthly cash flows with the cash flow forecast in blue and the actual cash flow error in red. The red error indicates forecast variance error vs. actuals. Total Variance represents the cumulative values over the time horizon. Standard Deviation represents the deviations on a monthly basis.

MOST EXISTING CASH FLOW MODELS CAN ANSWER THREE TO FIVE OF THE FUNDAMENTAL QUESTIONS WITH CONFIDENCE

In today's dynamic economic landscape, the need for agility and foresight in cash flow decision-making is essential to success. The company, lenders, private equity sponsors and capital markets require cash flow forecasts, but in many cases, the *current models leave some questions unanswered* and fail to help CFOs and business leaders continuously unlock cash in a quickly changing business environment.

Expanding on Important Elements in Cash Flow Forecasting

ELEMENT	COMMON REQUIREMENTS	WITH ML
1 **Accuracy**	Uses updated and reliable datasets to project complete and correct forecasts	ML can offer strengthened forecast accuracy by analyzing vast datasets, recognizing intricate patterns and adapting to new information
2 **Decomposition**	Cash Flow should be broken down into individual components to understand detailed inflows and outflows of cash	ML can facilitate a more in-depth and insightful assessment of cash flow dynamics through nuanced cash flow changes, risk assessment scenarios, and identification of key trends and patterns
3 **Precision**	Forecasts should be reliable, having small deviations in value	ML can increase accuracy, identify irregularities in cash flow data and enable dynamic real-time forecasting that reduces cash flow variance
4 **Adaptability**	Forecasts should be able to easily adapt and respond to changing circumstances and conditions	AI/ML integration offers predictive capabilities for shifts in the market that adapt in real time as information becomes available
5 **Scenarios**	Risk assessment should be done by creating forecasts under different scenarios that could impact cash flow	With ML, firms can consider changes in market conditions, shifts in customer behavior and unexpected events quickly and with ease
6 **Reconciliation**	Assessment of the predicted cash flows against the actual cash flows and understanding of variances	ML can minimize variances and adjust the model for future forecasts based on updated understandings
7 **Initiatives Evaluation**	Capital is deployed in alignment with the firm's objectives and supported by forward-looking analysis	ML allows firms to anticipate potential impacts to cash flow by simulating scenario analysis and predictive modeling for metrics like DSO/DPO/DIO, headcount, payment terms, etc.
8 **Ownership**	Summary-level reports that help the organization see how its cash is changing over time for types of expenses and summary receipt categories	ML models at a segment, business unit or division level can enable ownership and visibility to items that impact cash flow
9 **Policies**	Create guidelines that ensure consistency, transparency and effective financial decision-making	Using ML, firms can enable optimal policies (terms, collection policies, thresholds, etc.) and enhance critical policy decision-making

QUESTIONS FOR CFOs:

How do I know if there is enough value created by an ML implementation?

What would it take to make my organization ready to maintain and own ML forecasting solutions?

How should the organization think about and report cash flow?

Illustrative Example & Theoretical Business Value

Finance's Role to Integrate AI/ML Forecasting:

- Refine traditional cash flow model to enable ideal future state
- Clean and transform essential model feature data, receipts & disbursements
- Refine model hyperparameters, review model errors and select models
- Evaluate cash flow sensitivities against various scenarios and business actions
- Pull in external data sources like interest rates, supply/demand data or other macroeconomic factors

Target Impact:

- The ML model forecasts cash at detailed line level
- The ML model improves accuracy and precision over the driver-based model
- The ML approach identifies excess cash, thereby increasing cash savings and increasing returns on equity
- The ML model requires features that might not otherwise be assessed and therefore leads to additional insights versus those derived solely from a common driver-based model
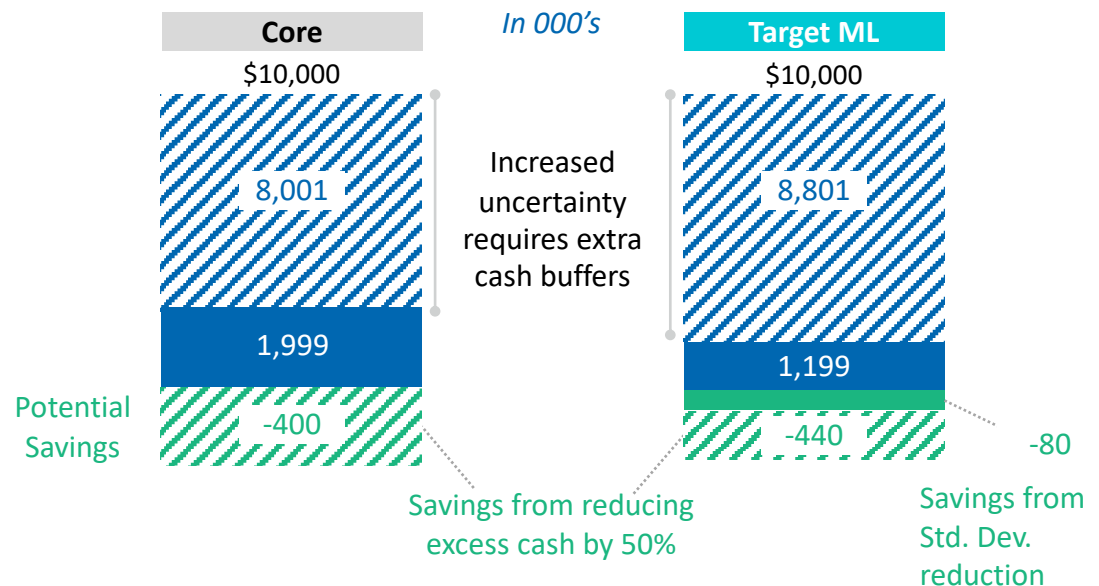
ILLUSTRATIVE SITUATION:

A CFO needs to enhance the cash flow forecast accuracy, precision and level of forecast details. The CFO had unexplainable gaps in its historical model predictions, and the overall driver model accuracy was low.
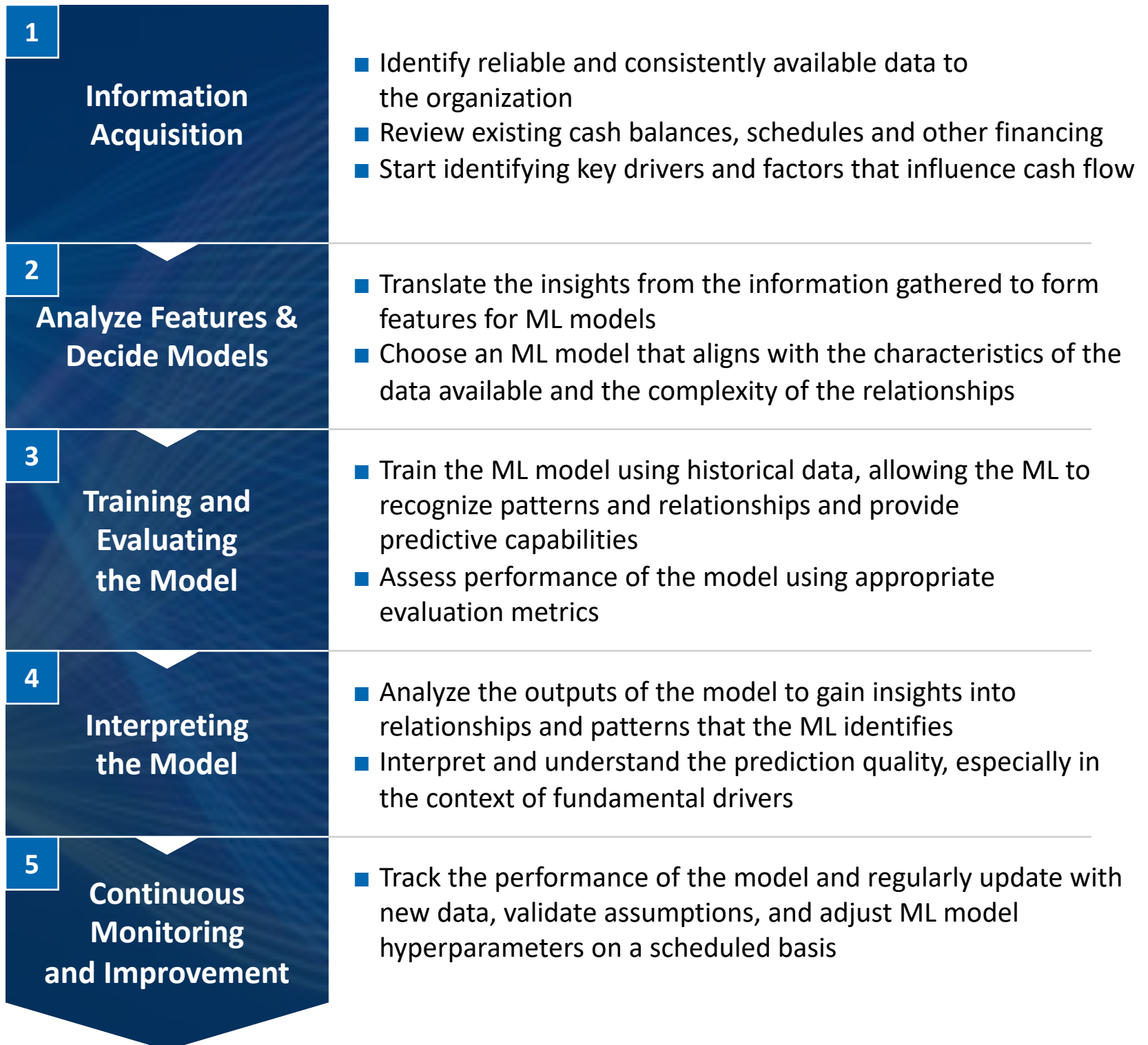
13 WEEK CF CORE METRICS

In 000's	Accuracy (Total Variance)	Precision (Avg. Std. Dev.)
Traditional	-2,226	666
Theoretical Model	-1,336	400

THEORETICAL SAVING ON $10M BALANCE

In 000's

Core — $10,000
- 8,001
- 1,999
- -400 — Potential Savings

Target ML — $10,000
- 8,801
- 1,199
- -440
- -80 — Savings from Std. Dev. reduction

Increased uncertainty requires extra cash buffers

Savings from reducing excess cash by 50%

Implementation Process:

1 — Information Acquisition

- Identify reliable and consistently available data to the organization
- Review existing cash balances, schedules and other financing
- Start identifying key drivers and factors that influence cash flow

2 — Analyze Features & Decide Models

- Translate the insights from the information gathered to form features for ML models
- Choose an ML model that aligns with the characteristics of the data available and the complexity of the relationships

3 — Training and Evaluating the Model

- Train the ML model using historical data, allowing the ML to recognize patterns and relationships and provide predictive capabilities
- Assess performance of the model using appropriate evaluation metrics

4 — Interpreting the Model

- Analyze the outputs of the model to gain insights into relationships and patterns that the ML identifies
- Interpret and understand the prediction quality, especially in the context of fundamental drivers

5 — Continuous Monitoring and Improvement

- Track the performance of the model and regularly update with new data, validate assumptions, and adjust ML model hyperparameters on a scheduled basis

Complementing ML Forecasting with Ongoing Forecasting (1/3)

01. INCREMENTAL VALUE: How do I know there is enough potential value that can be created from an ML implementation?

The chart compares driver-based model forecast features against machine learning-based model features. Although driver-based models excel in highly flexible situations, machine-learning models can offer a significant increase in value when properly implemented.

Illustration of theoretical incremental value

Legend: Core model, With ML

Strength of capability
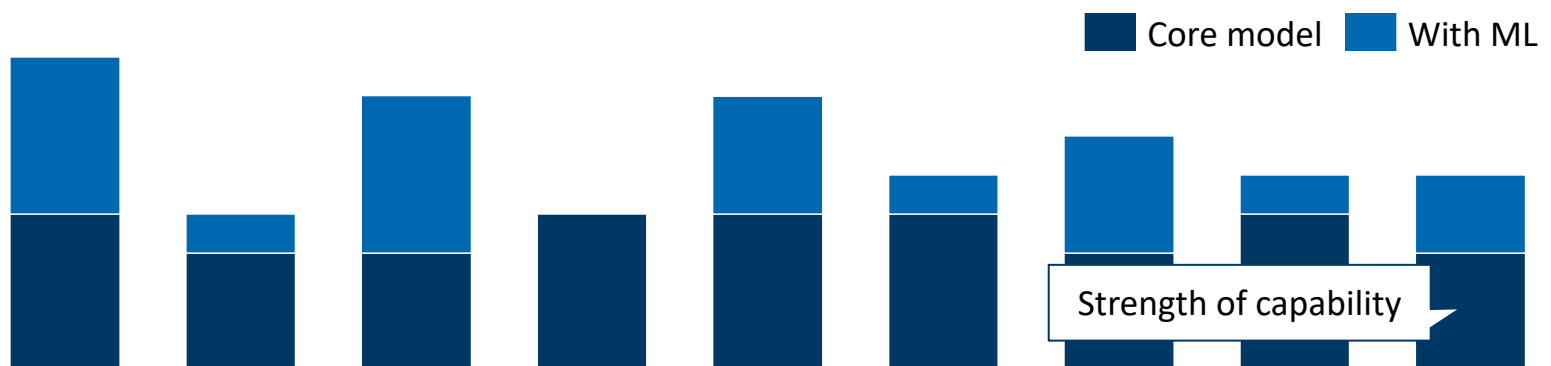
1. Accuracy
2. Decomposition
3. Precision
4. Adaptability
5. Scenarios
6. Reconciliation
7. Initiatives
8. Ownership
9. Policies

Complementing ML Forecasting with Ongoing Forecasting (2/3)

02. ORGANIZATIONAL READINESS: What would it take to ready my organization to deliver ML forecasting solutions?

Business Needs

Existing Capabilities

Strategic Objectives

What reporting requirements does the company have? How much of a cash buffer does the company hold? Is there a high-value need to be accurate and precise in this business?

What are the current team's technical capabilities? Where do advanced capabilities reside across the organization? What would it take to level-up the finance function's capabilities?

Outside of cash flow, how is the organization thinking about key business challenges and value levers, and the data catalogs needed? Is AI/ML a key strategic capability for the business?

Complementing ML Forecasting with Ongoing Forecasting (3/3)

03. DATA & MODELS: What level of data and model sensitivity is needed to deliver an effective ML forecasting solution?

1

What data is available and reliable?

2
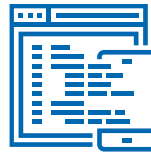
How adaptive should the model be?

3

What level of detail is needed?

Do we have reliable historical data on key drivers, and can we confidently make assumptions about their future behavior? Is there a wealth of data available, and can we leverage this data to train machine-learning models effectively?

Is the organization comfortable with a static model that relies on predefined drivers and assumptions? Does the organization require a dynamic model that can adjust to changing business conditions and incorporate new information?

Driver-based Model: Does the organization require a detailed breakdown of cash flow components driven by specific operational and financial drivers?

ML Model: Is there a need for deeper analysis that considers nonlinear relationships and patterns that may be challenging for traditional models to capture?

Proven Approach to Adopting ML Forecasts to Drive the Best Outcomes

Identify and develop talent to lead the tools (Machine learning, analytics, modelling, weekly cash flow reports, forecasts), have ownership of the cash flow process, and ensure operational and financial goals are accomplished

Work with the organization to create a well-defined reporting model that provides visibility to essential KPIs, including any generated from ML

Utilize complementary advanced analytics with the cash flow models to enhance and accelerate cash flow decision-making and cash conversion

Ensure that a clear data strategy is in place, along with the necessary governance to maintain reliable and secure data

Compare AI/ML capability among existing technology solutions that the firm has already invested in, along with new tool sets

THE TOOLS TO START

Embedded ML	Low-Code / AutoML	Code Oriented	Platform ML Ops

Depending on the data maturity and current technology stack, there are numerous tools to help accelerate the ML delivery and ensure a smooth model handoff. Shown above are sample software solutions that can help the finance function enable machine learning.

- **Finance platforms** have ML features or plug-in solutions and enable more general finance-based ML solutions. These platforms can vary in maturity, control and ML capabilities.

- **Low-code platforms** allow less-technical finance users to transform, build and deploy repeatable, limited ML solutions that can be extended with more advanced programming plug-ins.

- **Code-oriented** protocols or platforms are aimed at more advanced users who want control over many aspects of development and deployment.

- **Platform ML operation** solutions offer end-to-end ML ops solutions, compute hosting, delivery, and integration with other infrastructure elements.

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