Beyond Traditional ESG Screening

MarketSenseAI-Driven Adaptive Stock Selection and Portfolio Optimization

KM Cube — ESG Pilot within the FAME Project

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Agenda

AI-Enhanced ESG Portfolio Optimization

1. **FAME Project** — Our role in the federated data marketplace
2. **ESG Challenge** — Why traditional approaches fail
3. **Our Solution** — MarketSenseAI + ESG optimization
4. **Results** — Performance across multiple configurations
5. **Implementation** — Production systems and roadmap

Expected duration: 25-30 minutes including Q&A

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FAME Project Context

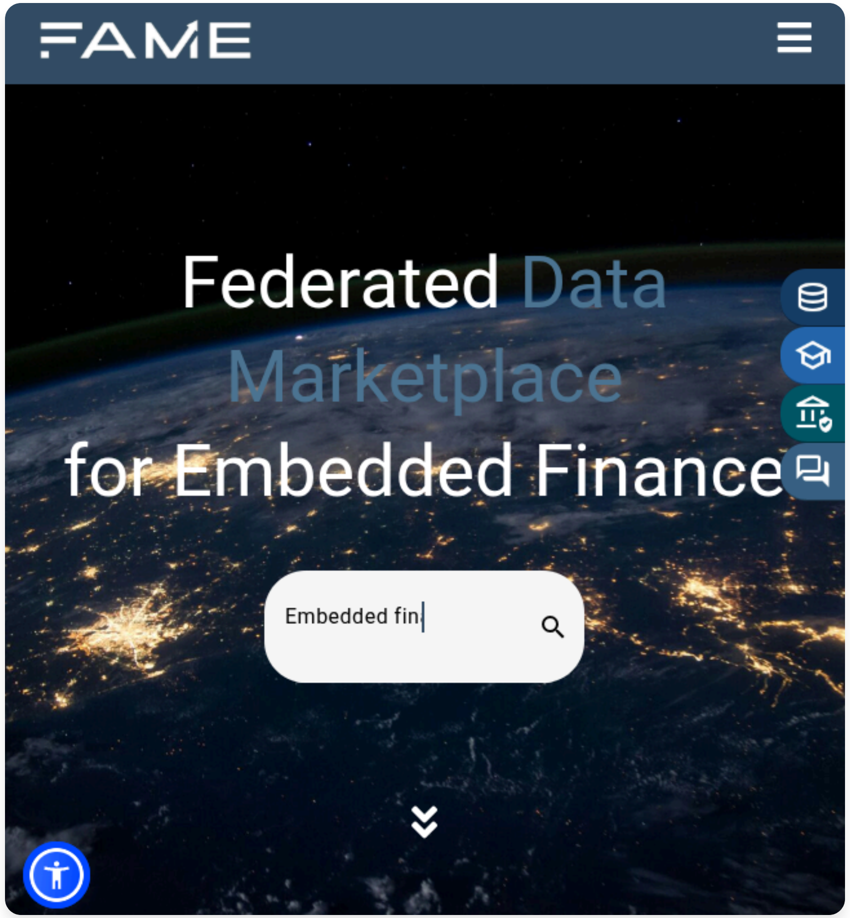
Federated Data Marketplace

🏛️ What is FAME?

- **Horizon Europe project** (2023-2025, ~€16M budget)
- **30+ partners** across industry and academia
- **Goal:** Trusted, decentralized data marketplace for Embedded Finance
- **Technology:** Blockchain tokenization, federated architecture, explainable AI

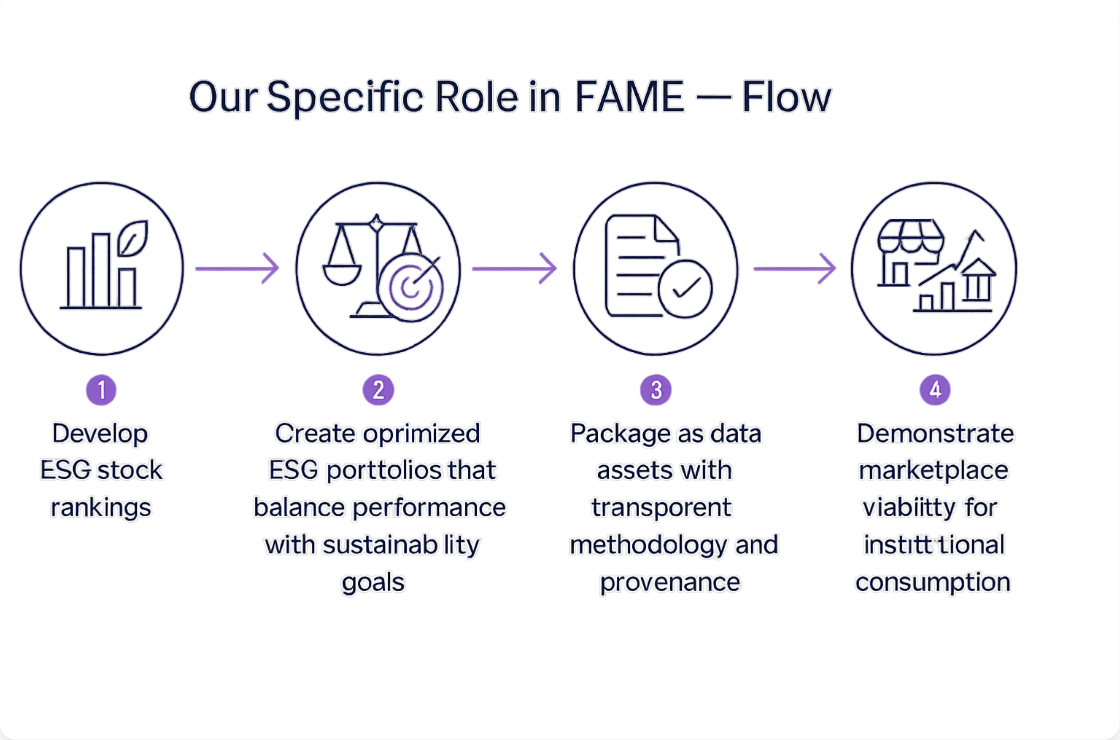
🎯 Core Capabilities

- **Data tokenization:** Assets as tradeable, queryable tokens
- **Programmable pricing:** Dynamic, usage-based monetization
- **Federated governance:** No single point of control
- **Compliance-first:** GDPR, financial regulation alignment



🎯 KM Cube's FAME Mandate

Develop ESG stock rankings and portfolios in the marketplace



What is ESG?

> ***Definition****: A framework to assess corporate practices and risks across three pillars.*

Pillars

- Environmental — emissions, energy use, waste, climate risk
- Social — labor standards, safety, diversity, supply-chain practices
- Governance — board independence, incentives, internal controls

Three interconnected pillars for sustainable investing

Financial Jargon: ESG Terms Explained

Term	Explanation	Is it a regulation or directive	Region	Target
UN PRI	United Nations Principles for Responsible Investment - voluntary ESG investment principles	Principles	Global	Fund Managers
TCFD	Task Force on Climate-related Financial Disclosures - framework for climate risk reporting	Framework	Global	Companies
GRI	Global Reporting Initiative - standards for sustainability reporting	Standards	Global	Companies
SASB	Sustainability Accounting Standards Board - industry-specific ESG metrics	Standards	Global	Companies
ISSB	International Sustainability Standards Board - global baseline for sustainability reporting	Standards	Global	Companies
SFDR	Sustainable Finance Disclosure Regulation - requires financial firms to disclose ESG risks and impacts	Regulation	EU	Fund Managers
CSRD	Corporate Sustainability Reporting Directive - mandates ESG reporting for large companies	Directive	EU	Companies
EU Taxonomy	Classification system for environmentally sustainable economic activities	Regulation	EU	Both
Article 8	SFDR classification for products promoting environmental/social characteristics	Regulation	EU	Fund Managers
Article 9	SFDR classification for products with sustainable investment as objective	Regulation	EU	Fund Managers

Key regulatory frameworks and standards shaping ESG investing landscape

ESG Market Context: Size and Growth

The ESG Investment Landscape

📈 Market Size Evolution

- **2012:** $13.6 trillion in ESG assets globally
- **2018:** $30.7 trillion
- **2020:** $35.3 trillion
- **2022:** $30.3 trillion (methodology change)
- **2030E:** $40+ trillion projected

🌍 Regional Leadership

- **Europe:** 46% of global ESG assets ($16.9T)
- **United States:** 28% market share ($11.6T)
- **Asia-Pacific:** Fastest growing region (+25% CAGR)

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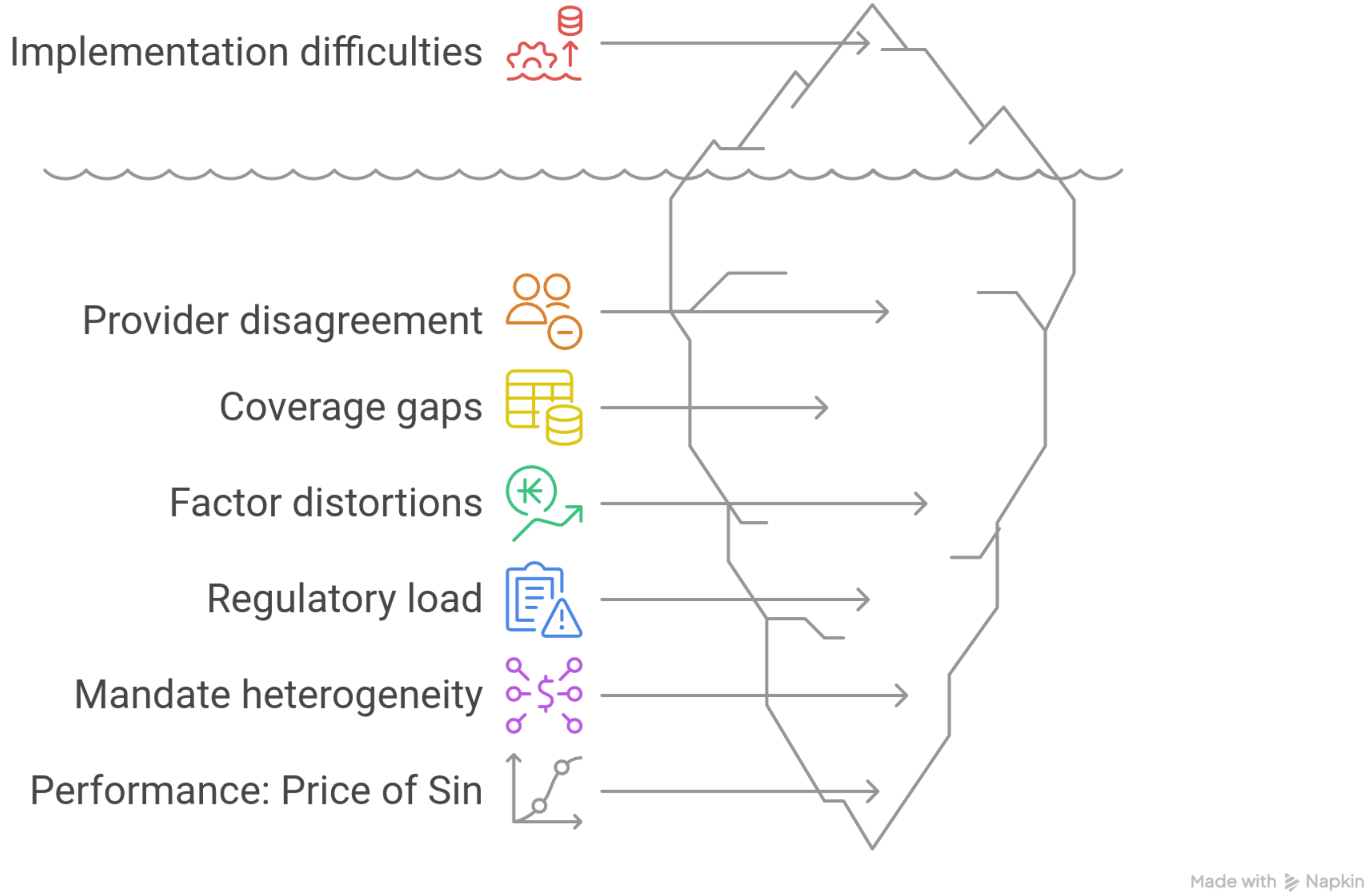
🎯 Key Drivers

- Regulatory mandates (SFDR, EU Taxonomy)
- Institutional investor requirements
- Climate risk awareness
- Millennial wealth transfer
- Corporate sustainability commitments

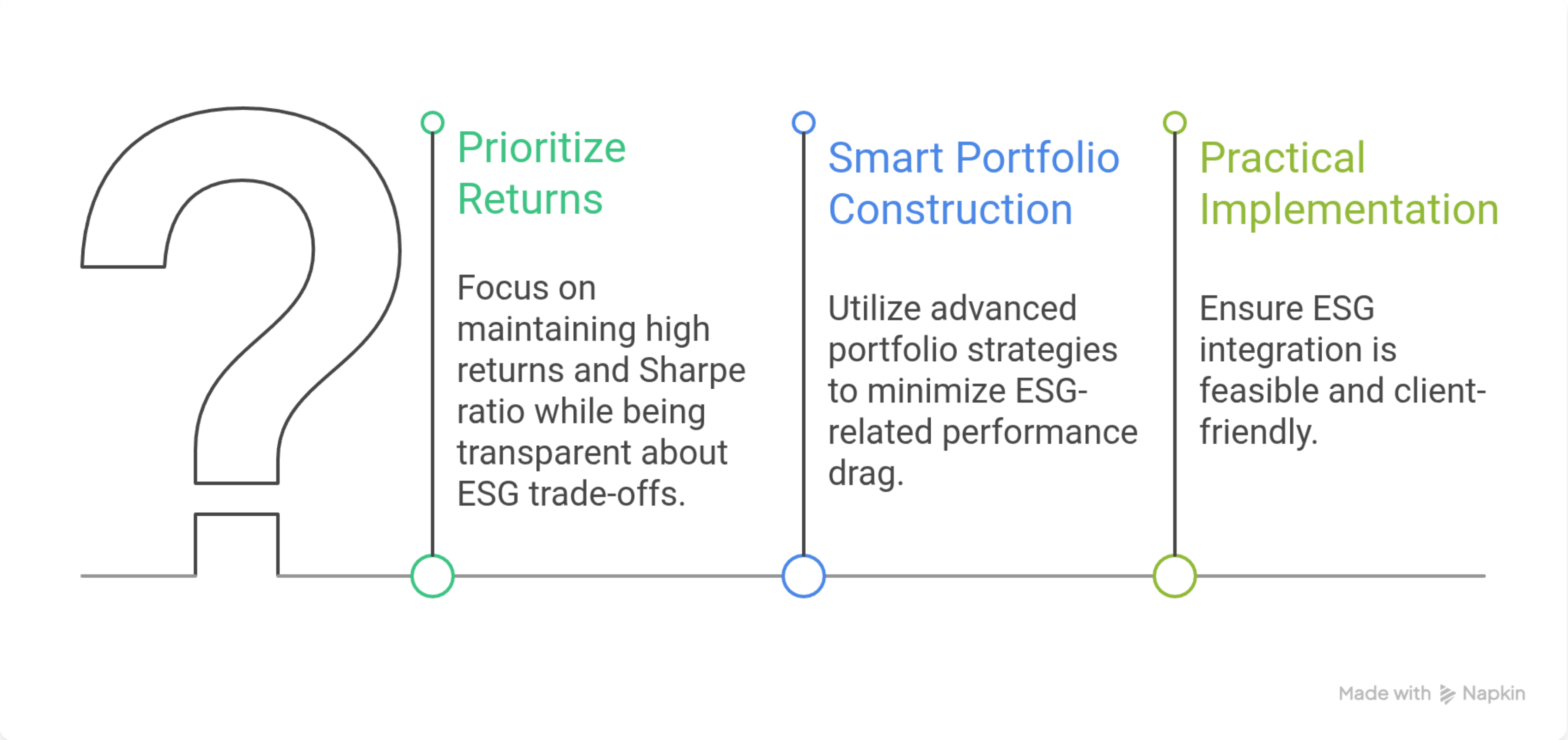
> ***Market Reality:*** *ESG is no longer optional—it's becoming the standard for institutional portfolios*

Why ESG is hard to implement in practice



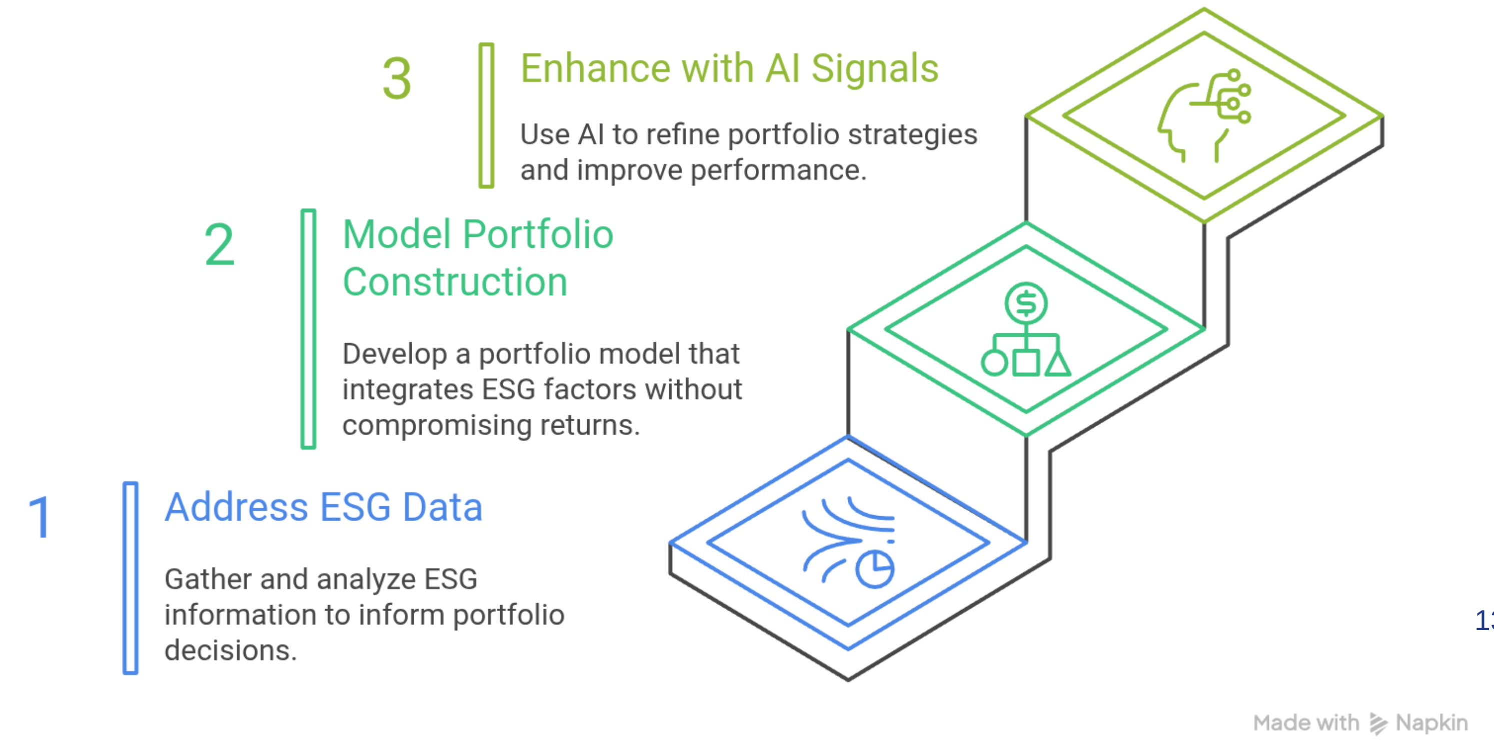
Our Goal: performance-first, ESG-aligned options

> ***Provide a pragmatic, simple solution that integrates ESG without materially penalizing performance***



Our Thought Process

- Step 1: Address ESG Information and Data
- Step 2: Modeling approach
- Step 3: Use MarketSenseAI as our "secret sauce"



Step 1: Address ESG Data

- Data sample: S&P 100 since 2020
- Available sources: Bloomberg, Sustainalytics, Refinitiv, **EOD Historical Data**

Table 1: NVIDIA ESG Scores by Year (Example)

Year	E	S	G	ESG
2016	58.34	63.17	64.43	61.49
2017	59.21	63.76	65.20	62.23
2018	58.79	64.18	64.61	62.11

Our Data Handling Process:

1: 60-day lag for releases

2: Sector adjustments

3: Client-specific weighting

Step 2: Modeling approach

Let's evaluate the "price of sin"

MS021 (SPX100, 2020) — ESG quantile exclusions (equal-weight)

ESG Quantile	Total Return	Sharpe	Max DD	Volatility
0.0 (no tilt)	124.6%	0.96	34.3%	24.6%
0.3	120.3%	0.95	35.4%	24.3%
0.5 (strong)	110.7%	0.89	35.1%	24.8%

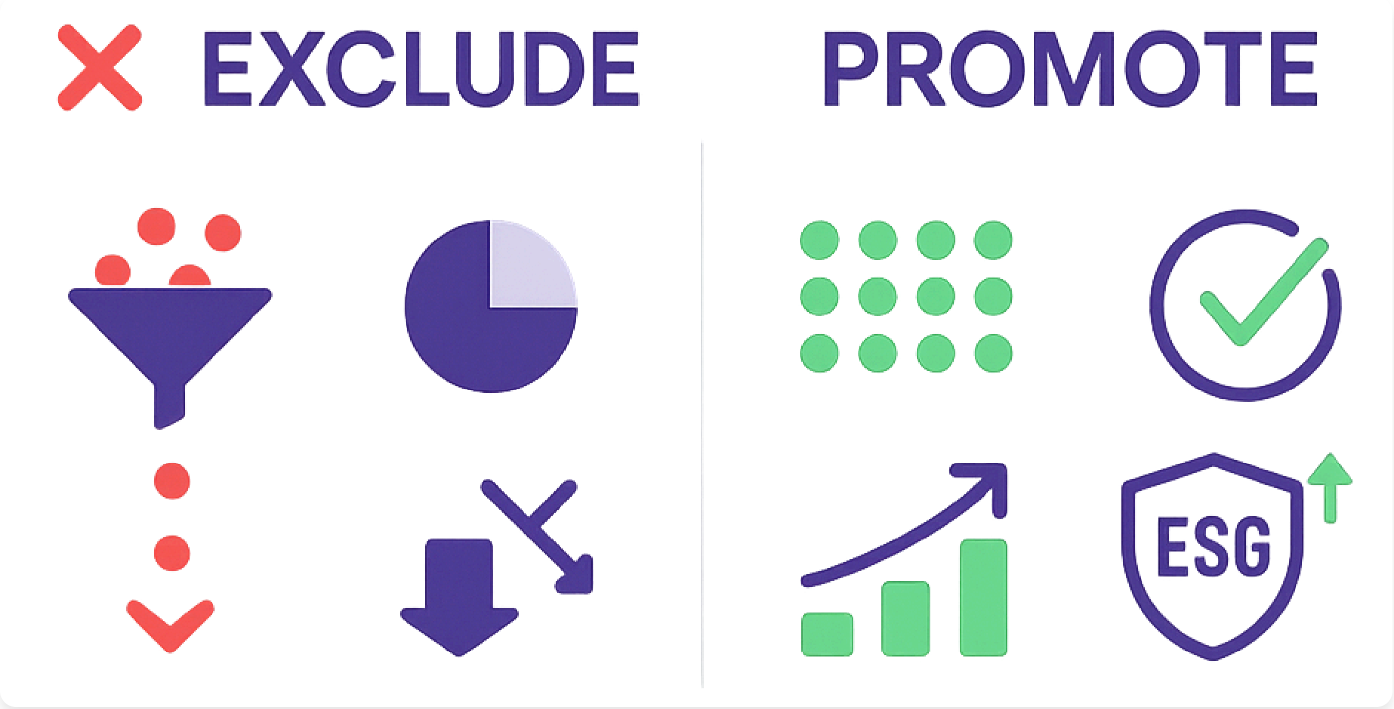
Source: Research Action `20250910_003` (MS021_EsgQuantileEqWStrategy, SPX100 2020)

> *These exclusions-only results serve as our baseline for the next steps.*

From Hard Exclusions to Soft Optimization

The Core Idea: Promote, Don't Exclude

Instead of excluding low-ESG stocks, we keep the entire universe but ***promote*** *stocks with higher ESG scores through portfolio optimization.*



The Mathematical Framework

What We Do:

Instead of excluding low-ESG stocks, we use portfolio optimization to **promote** high-ESG stocks while keeping the entire universe.

The Formula:

$$\max_{w} \frac{w^{\top}\left(\mu - \lambda_{esg} \cdot ESG\_penalty\right)}{\sqrt{w^{\top}\Sigma w}} \quad \text{subject to: } \sum_{i} w_i = 1,\ 0 \leq w_i \leq w_{max}$$

Key Components:

- **w**: Portfolio weights (what we optimize)
- **μ**: Expected returns
- **λ_esg**: ESG penalty strength (tunable dial)
- **ESG_penalty**: Penalty for low-ESG stocks
- **Σ**: Risk covariance matrix

Result: All stocks stay in the universe, but high-ESG stocks get higher weights

Empirical Results

Step-by-Step Progression — SPX100, Long Period (2020–2025)

Evolution Step	Strategy	Approach	λ_esg	Total Return	Sharpe	Max DD	Improvement
1. Baseline	MS021	Equal-weight ESG	0.0	124.6%	0.96	34.3%	Starting point
2. Add optimizer	MS022	Sharpe optimization	0.0	**154.8%**	**1.47**	**19.3%**	+53% Sharpe
3. Add ESG penalty	MS022	Sharpe + ESG	1.0	127.9%	1.28	23.2%	Shows ESG drag

- **Equal-weight → Sharpe**: 0.96 → 1.47 Sharpe (+53% improvement, -15pp drawdown)
- **No ESG → ESG penalty**: 1.47 → 1.28 Sharpe (-13% drag, +4pp drawdown)
- **Key insight**: Optimization works, but ESG constraints have real costs

Sources: Research Actions 20250910_003 (MS021), 20250912_001 (MS022)

Step 3: Can we do more?

Enhance ESG portfolios using MarketSenseAI signals

What is MarketSenseAI?

MarketSenseAI is an advanced AI-driven platform that enhances investment decision-making by analyzing diverse financial data sources using Generative AI. The platform integrates real-time market dynamics, financial news, company fundamentals, and macroeconomic indicators to provide comprehensive and actionable investment insights.

Core components:

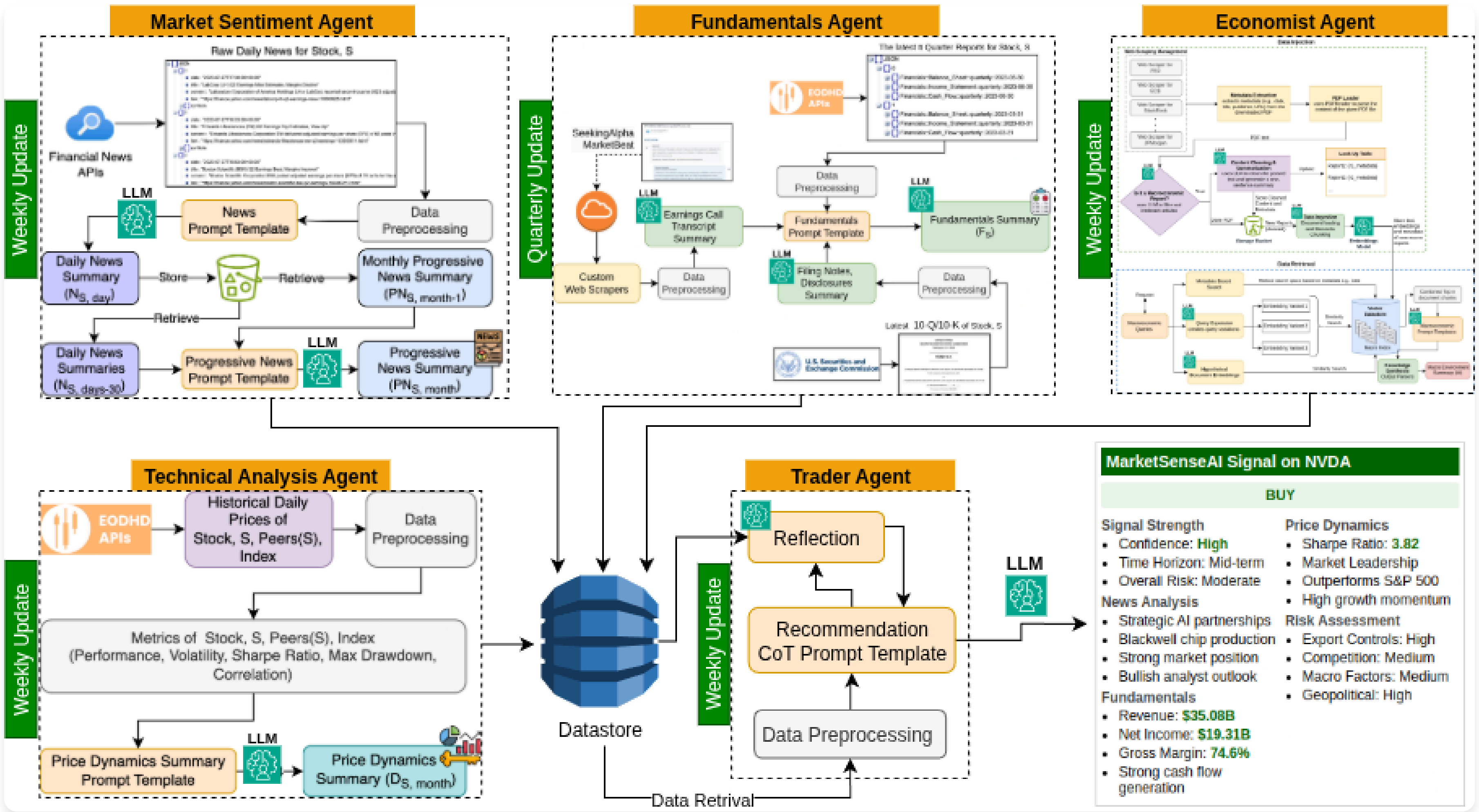
- **Progressive News Summarizer**: Aggregates influential news impacting stock performance
- **Fundamentals Summarizer**: Analyzes financial statements for health and growth prospects
- **Stock Price Dynamics**: Examines price movements vs. similar stocks and broader market
- **Macroeconomic Environment**: Provides insights on central bank policies and economic indicators

Published research: "Can Large Language Models Beat Wall Street? Unveiling the Potential of AI in Stock Selection"

Our integration: Use MarketSenseAI rankings as alpha signal to offset ESG constraints

Demonstrates capability to emulate decision-making processes of prominent investment teams

MarketSenseAI System Architecture



End-to-end pipeline from data ingestion to portfolio integration

Adding MarketSense Signals to ESG Portfolios

The Core Idea: Boost High-Ranked Stocks

*Instead of just penalizing low-ESG stocks, we also **boost** high-ranked stocks using MarketSenseAI signals to offset ESG drag.*

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The Enhanced Mathematical Framework

What We Do:

Combine ESG penalties with MarketSenseAI alpha signals to create portfolios that maintain ESG alignment while improving returns.

The Enhanced Formula:

$$\max_{w} \frac{w^{\top}\left(\mu + \lambda_{ms} \cdot MS\_boost - \lambda_{esg} \cdot ESG\_penalty\right)}{\sqrt{w^{\top}\,\Sigma\,w}}$$

Key Components:

- **λ_ms**: MarketSense signal strength (tunable dial)
- **MS_boost**: Positive return adjustment for high-ranked stocks
- **λ_esg**: ESG penalty intensity (tunable dial)
- **ESG_penalty**: Penalty for low-ESG stocks

Result: MarketSense alpha offsets ESG drag while maintaining ESG alignment

MarketSense Results: Offsetting ESG Drag

MS023 Dual-Signal Results — Two Time Periods

Medium Period (2023–2025, 2.5 years)

Configuration	λ_ms	λ_esg	Total Return	Sharpe	Max DD	Key Insight
Pure MarketSense	3.0	0.0	**66.0%**	**1.88**	12.8%	Best performance
Balanced blend	1.0	1.0	63.8%	1.76	11.3%	ESG + alpha
ESG only	0.0	1.0	58.6%	1.59	10.8%	ESG constraint
Sharpe optimizer	0.0	0.0	56.4%	1.56	12.0%	Pure optimizer

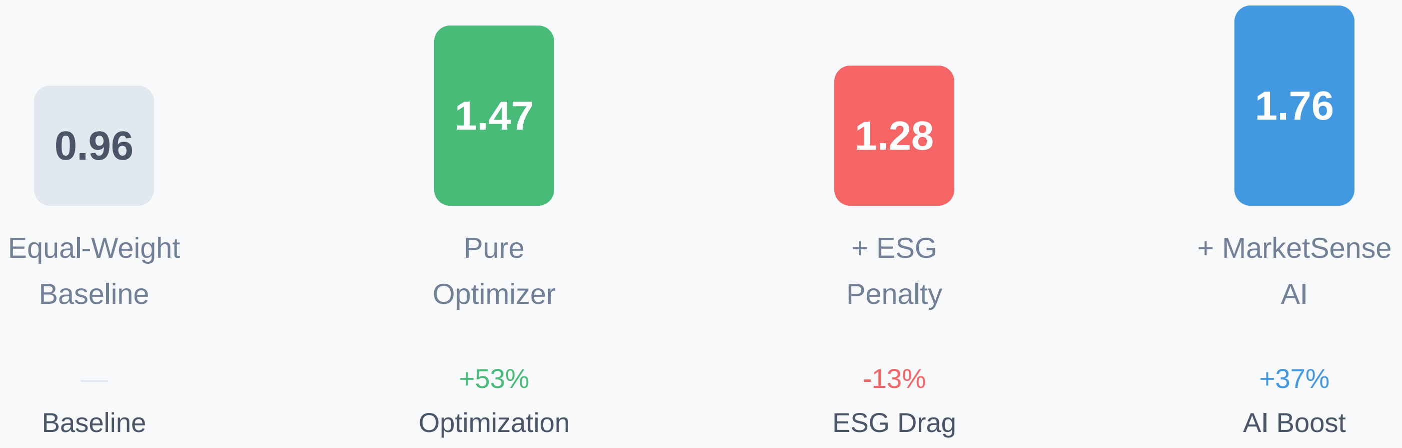
Short Period (2024–2025, 1 year)

Configuration	λ_ms	λ_esg	Total Return	Sharpe	Max DD	Key Insight
Pure MarketSense	3.0	0.0	**24.1%**	**1.89**	8.2%	Consistent alpha
Balanced blend	1.0	1.0	21.8%	1.74	7.9%	Robust balance
ESG only	0.0	1.0	14.9%	1.26	11.0%	ESG constraint
Sharpe optimizer	0.0	0.0	13.4%	1.14	12.0%	Pure optimizer

Sources: Research Actions 20250913_001 (short), 20250913_002 (medium)

Visualizing the Performance Impact

Sharpe Ratio Progression



Production Implementation

FAME Portfolio Archetypes: Parameter Mapping

Translating Investor Preferences to Optimization Parameters

FAME Portfolio Type	Risk Profile	ESG Focus	vol_cap	λ_esg	λ_ms
Conservative Traditional	Low risk	Low ESG	0.10	0.2	1.0
Conservative Sustainable	Low risk	Medium ESG	0.10	0.8	1.0
Conservative Conscious	Low risk	High ESG	0.10	1.2	1.0
Balanced Standard	Medium risk	Low ESG	0.15	0.3	1.0
Balanced ESG-Aware	Medium risk	Medium ESG	0.15	0.7	1.0
Balanced Impact	Medium risk	High ESG	0.15	1.0	1.0
Aggressive Growth	High risk	Low ESG	0.20	0.2	1.0
Aggressive ESG-Selective	High risk	Medium ESG	0.20	0.6	1.0
Aggressive Sustainable	High risk	High ESG	0.20	1.0	1.0

Design Philosophy:

- **λ_ms = 1.0**: Balanced MarketSense integration across all portfolios
- **vol_cap**: Risk tolerance (0.10 = Conservative, 0.15 = Balanced, 0.20 = Aggressive)
- **λ_esg**: ESG emphasis (0.2-0.3 = Traditional, 0.6-0.8 = Aware, 1.0-1.2 = Conscious)

Platform demo (video placeholder)

- Switch to live/demo video of the FAME asset and workflow
- Show listing, metadata, and sample outputs

Future Roadmap & Scaling Opportunities

Next Steps for ESG-AI Portfolio

Thank You & Questions

Thank you for your attention.

Contact Information & Discussion

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Ready for questions and discussion about:

- ESG portfolio optimization methodology
- FAME marketplace integration
- MarketSenseAI implementation
- Partnership opportunities