# Optimizing FedEx Air Freight Cargo Loading with AI

START


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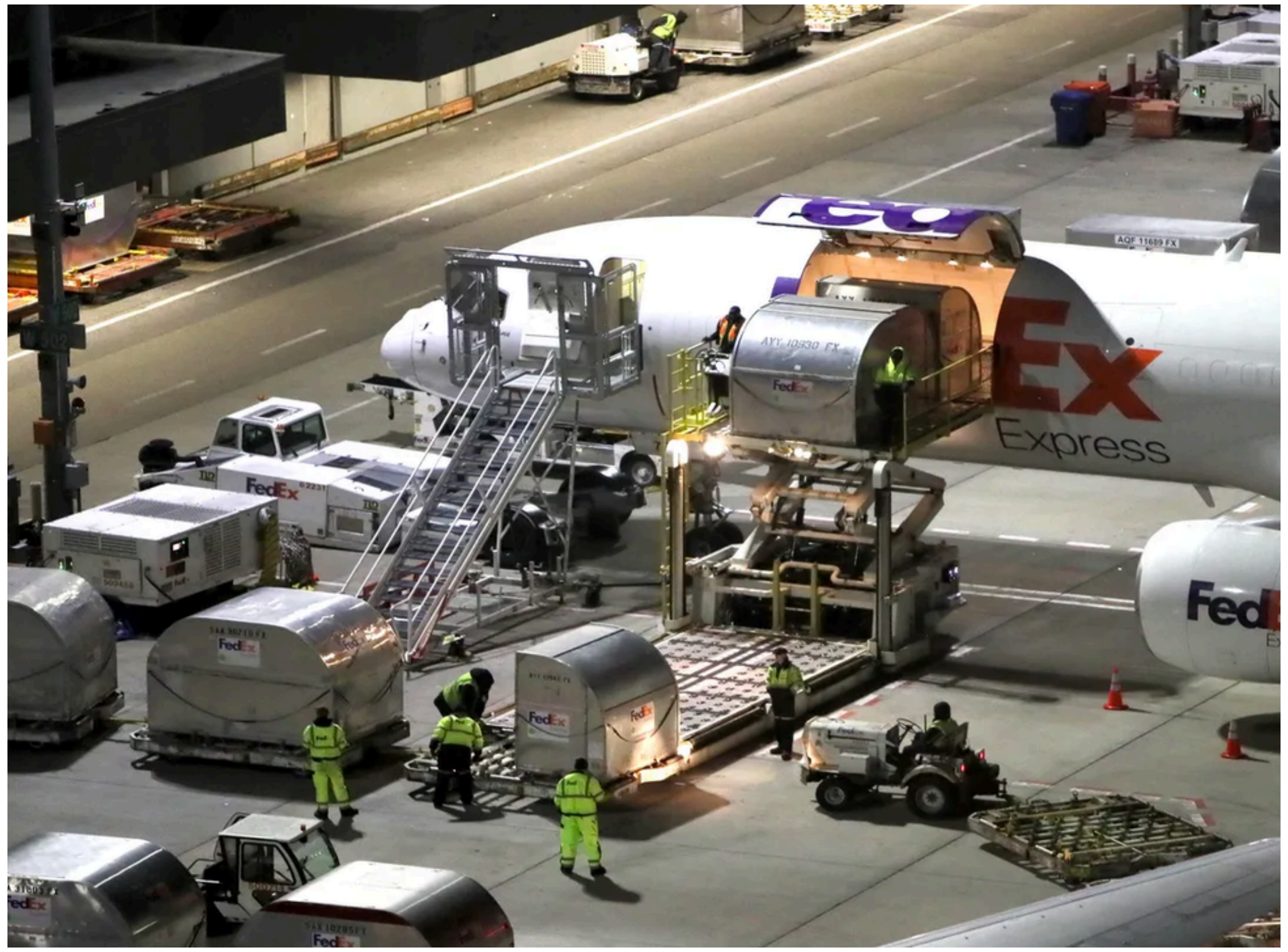
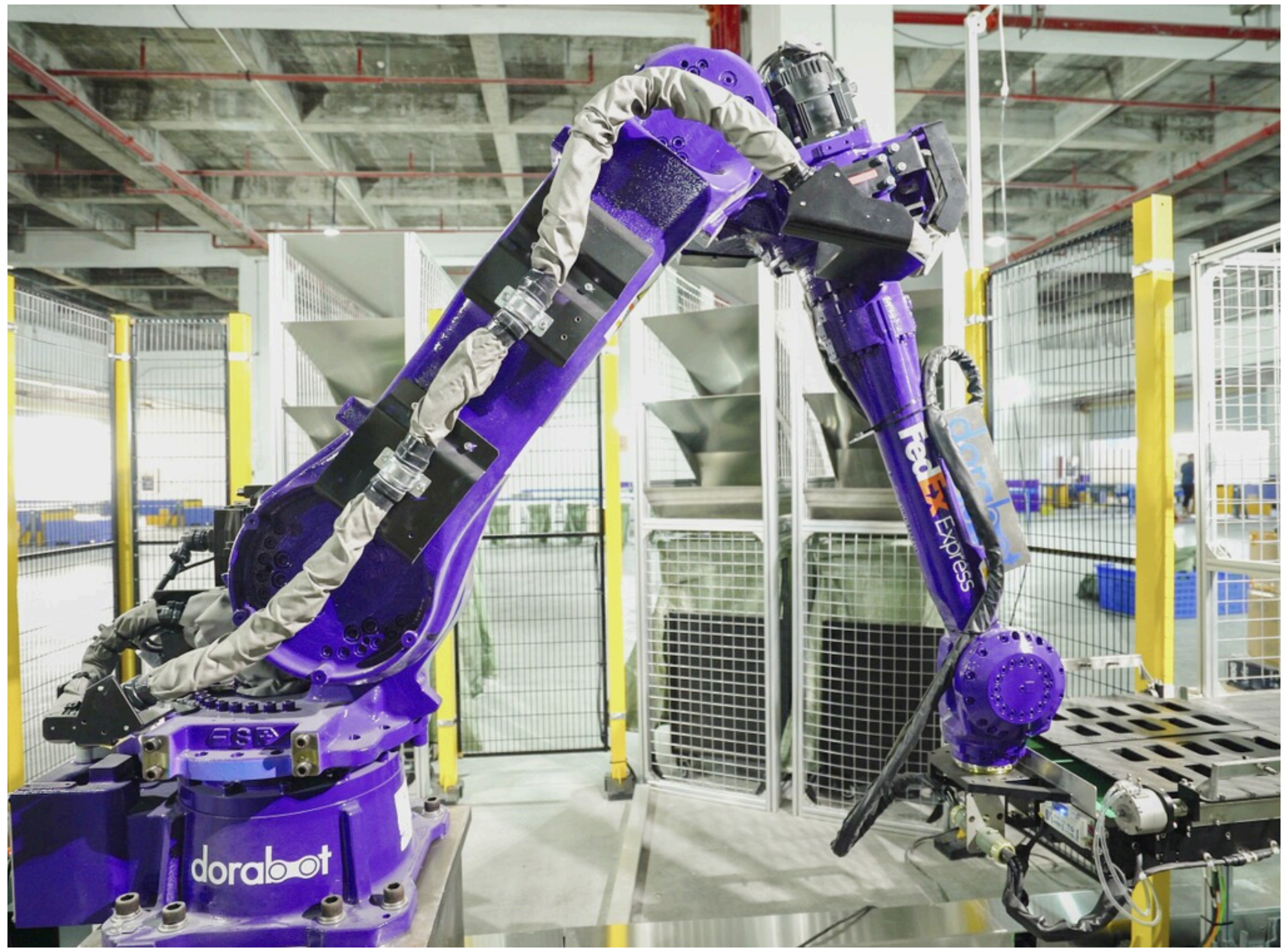
# Optimizing Air Freight Cargo Loading with AI

MBAN TEAM 2




FedEx and the Air Cargo Industry

AI's Role in Transforming Air Cargo Logistics

INTRODUCTION

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PROPOSED AI STRATEGY


FedEx Boeing 777 Aircraft

## automate cargo-loading plans

- KG — ideal weight distribution
- space utilization
- RULES — adherence to aircraft safety rules

BACKGROUND OF THE STRATEGY

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## Optimal Space Utilization

## Sustainability Impact

## Reduced Loading Time

## Dynamic Load Balancing for Fuel Efficiency

## Cost Reduction

## Operational Flexibility & Scalability

OBJECTIVES AND BENEFITS

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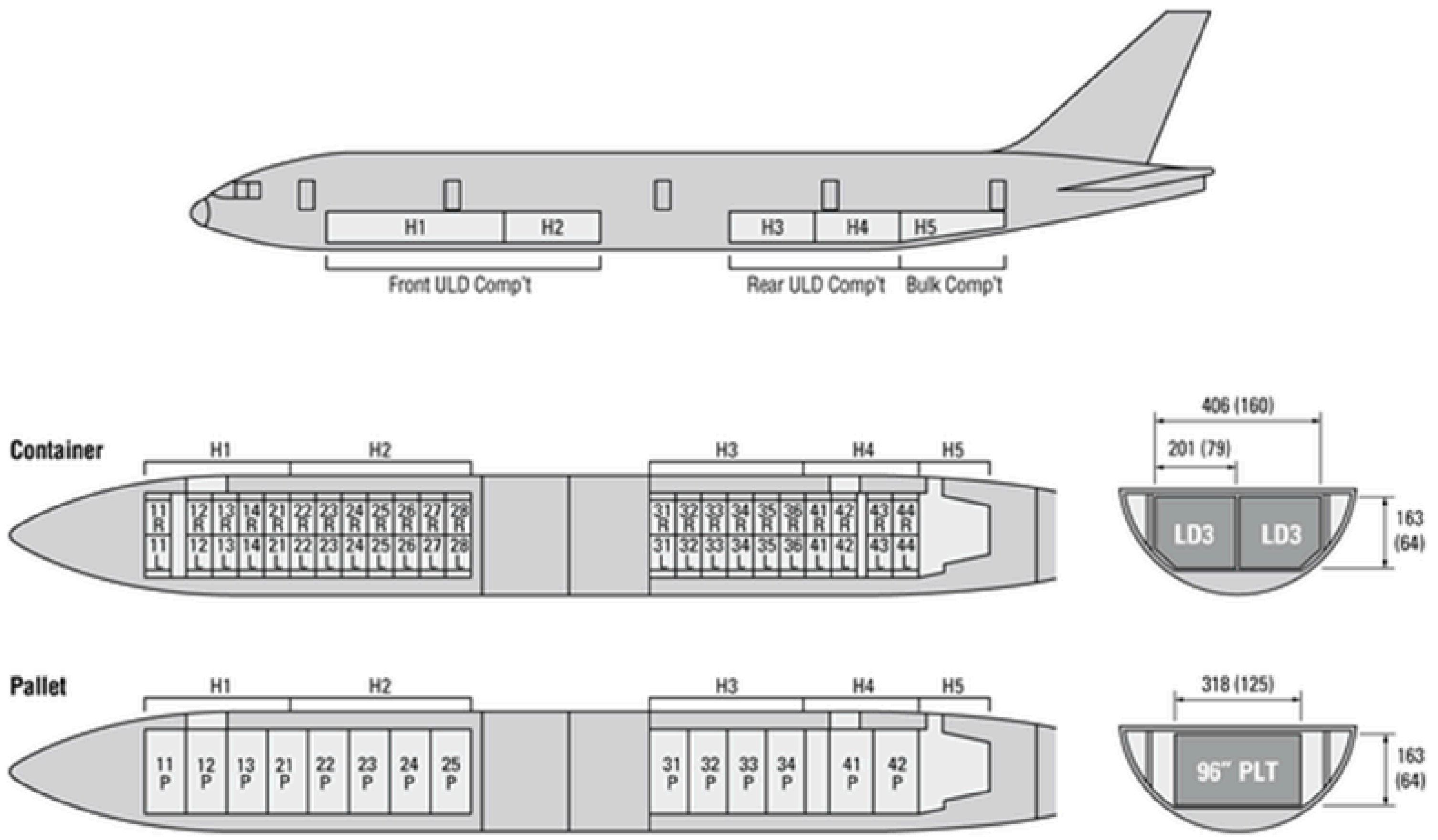



The cargo loading procedure at significant FedEx hubs, like the Memphis World Hub, has always depended on **human judgement and manual planning.**

*COMPARISON TO THE CURRENT SYSTEM*

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1-3 months
1
Research, Feasibility Study & Risk Assessment

4-8 months
2
Model Development & Data Infrastructure Setup

9-12 months
3
Integration, Prototyping & Compatibility Testing

13-18 months
4
Pilot Implementation & Change Management

19-24+ months
5
Full-Scale Rollout, Performance Monitoring & Continuous Improvement

*IMPLEMENTATION STRATEGY*

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“RACE TO THE BOTTOM” PRESSURE

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## Security Risks

Low | Medium | High | Critical

| Risk Description | Likelihood | Impact | Risk Level | Contingency Plan |
|---|---|---|---|---|
| Cyberattacks on AI cargo systems | | | | Conduct regular cybersecurity audits and phishing simulations for employees. |
| AI failure causing cargo mismanagement | | | | Human oversight in AI decisions for critical shipments (e.g., hazardous materials). |
| Automation bias in cargo screening | | | | |
| Cargo theft due to tracking vulnerabilities | | | | Use blockchain technology for real-time cargo tracking and security validation. |

EVIDENCE OF "RACE TO THE BOTTOM" PRESSURE

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## Ethical Risks

Low | Medium | High | Critical

| Risk Description | Likelihood | Impact | Risk Level | Contingency Plan |
|---|---|---|---|---|
| AI bias in cargo prioritization | | | | Use diverse training datasets to reduce biases in AI cargo prioritization. |
| Job displacement in logistics | | | | Implement reskilling programs for displaced workers. |
| Safety risks from cost-driven AI decisions | | | | Create an AI Safety Board to review incidents caused by AI decisions. |
| Environmental harm from AI-optimized loading | | | | Ensure AI considers eco-friendly route optimization to reduce emissions. |

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## Regulatory Risks

Low Medium High Critical

| Risk Description | Likelihood | Impact | Risk Level | Contingency Plan |
|---|---|---|---|---|
| FAA/IATA non-compliance | | | | Develop AI governance frameworks aligning with FAA/IATA standards. Implement pre-deployment regulatory testing before AI solutions go live. |
| GDPR/CCPA data privacy violations | | | | Implement privacy-by-design in AI systems to comply with GDPR/CCPA. Establish data retention policies and AI-generated data deletion procedures. |
| AI compliance fines (EU AI Act) | | | | Assign a Chief AI Compliance Officer to oversee evolving regulations. Engage with regulatory bodies to ensure proactive compliance. |
| FAA/IATA non-compliance | | | | Develop AI governance frameworks aligning with FAA/IATA standards. Implement pre-deployment regulatory testing before AI solutions go live. |

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## Reputational Risks

Low Medium High Critical

| Risk Description | Likelihood | Impact | Risk Level | Contingency Plan |
|---|---|---|---|---|
| Customer distrust due to AI-related failures | | | | Provide real-time AI performance monitoring dashboards for stakeholders. |
| Brand damage from security incidents | | | | Establish an AI incident response team for rapid mitigation of AI failures. Create public communication strategies for AI-related security breaches. |
| Competitor advantage in responsible AI | | | | Adopt an AI Ethics Certification to differentiate from competitors. Showcase responsible AI usage in sustainability and corporate responsibility reports. |

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DATA ANALYTICS AND FINDINGS →

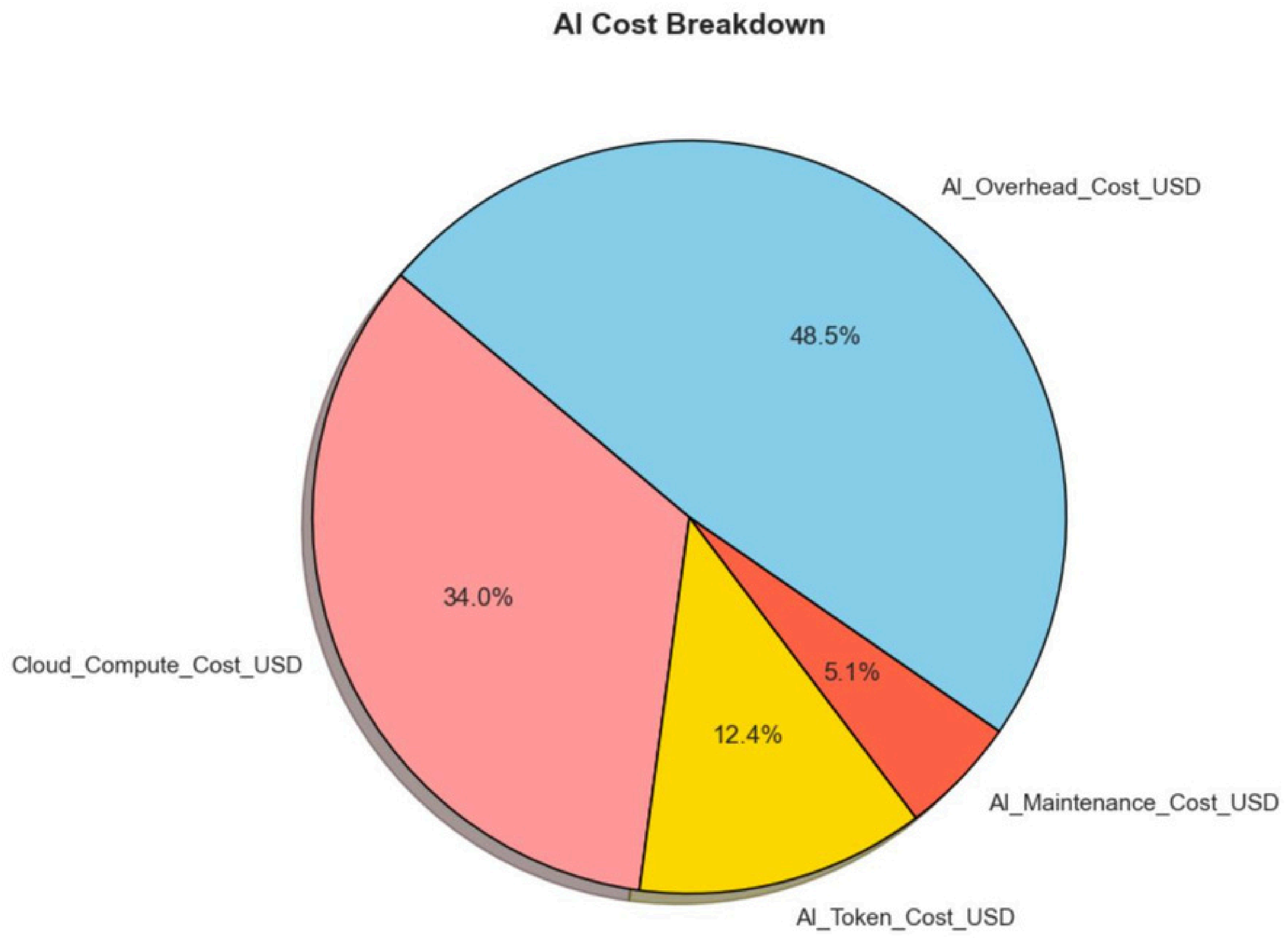


*Figure 5. AI Cost Breakdown*

- Cloud Compute maintains the highest percentage of 34%
- AI Overhead at 48.5%
- AI Tokens at 12.4%
- Maintenance stands at 5.1%.

*AI COST ANALYSIS*

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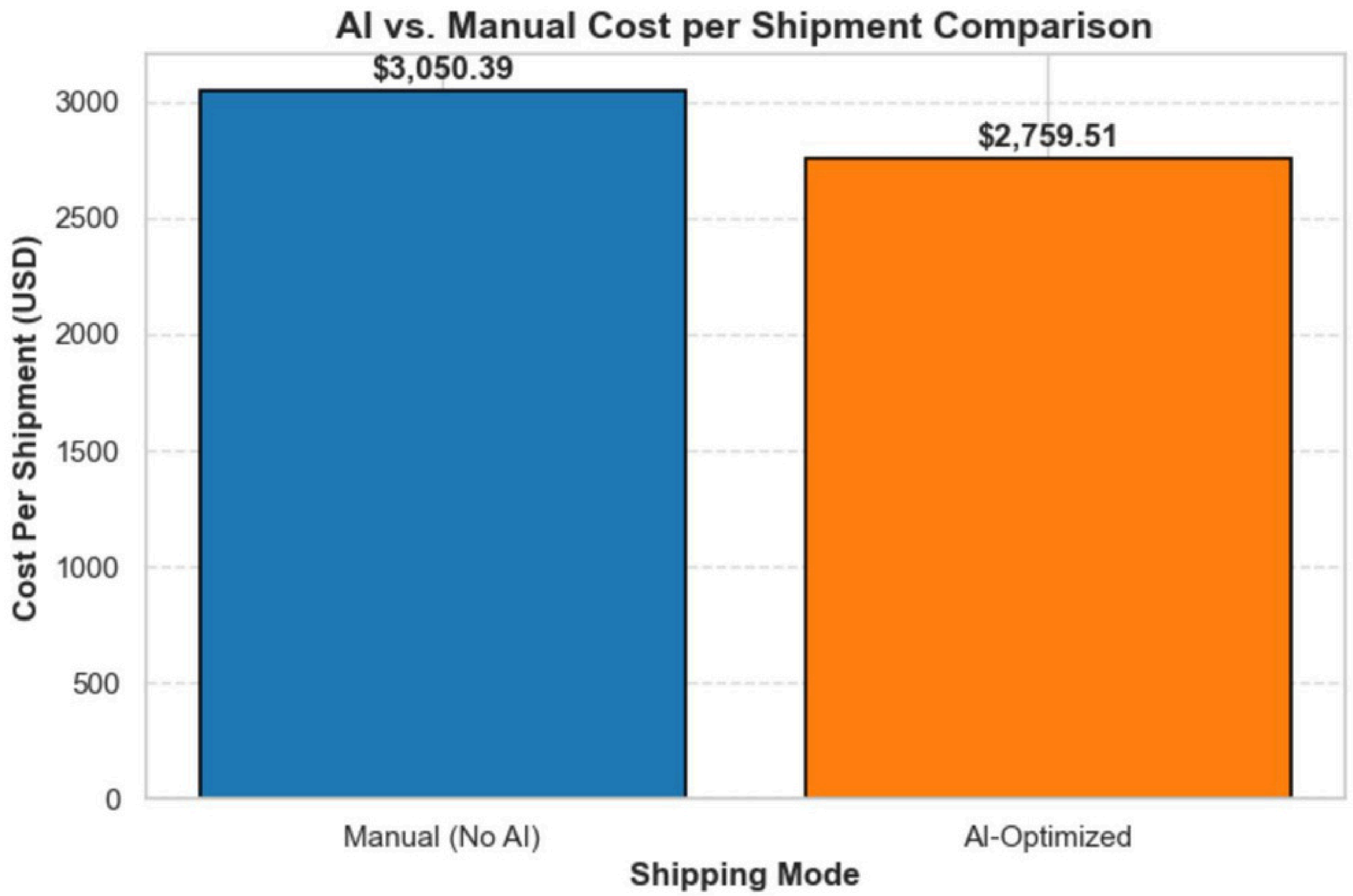


*Figure 5. AI Cost Breakdown*

- Manual shipment management costs $3,050.39 per shipment
- AI-optimized logistics reduces this amount to $2,759.51 per shipment.
- Operating with AI-based systems reduced shipping expenses to $2,759.51 from the original $3,050.39 which represented an approximate 10% savings.

*AI OPTIMIZATION IMPACT ON COST AND EFFICIENCY*

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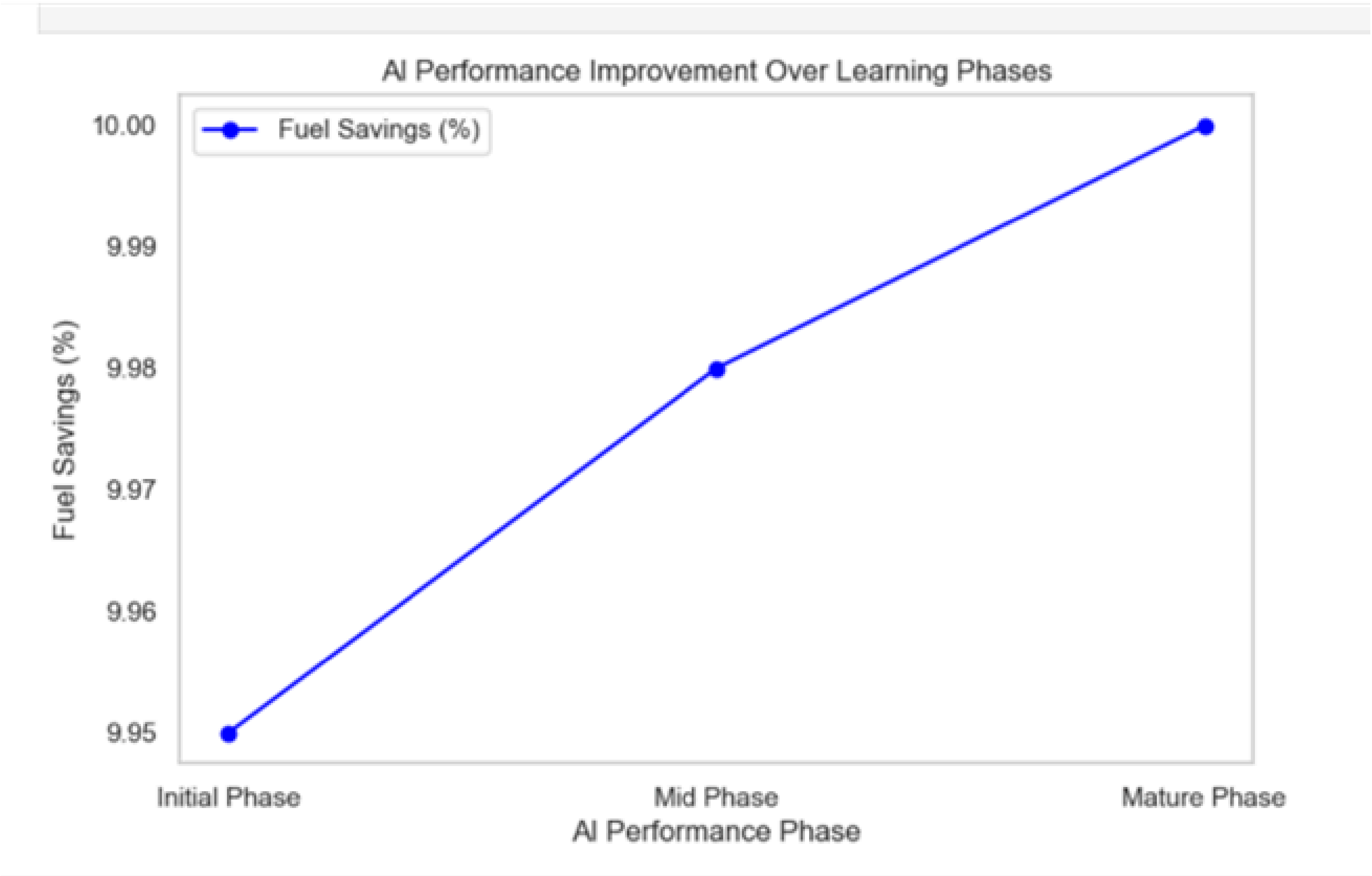


*Figure 7. AI Learning Curve Impact on Fuel Savings*

- AI models achieved an enhancement of fuel efficiency during every operational stage while operating continuously.
- During operational phases the fuel savings rose from 9.95% in the beginning to 10.00% in the final stage.

*AI OPTIMIZATION IMPACT ON COST AND EFFICIENCY*

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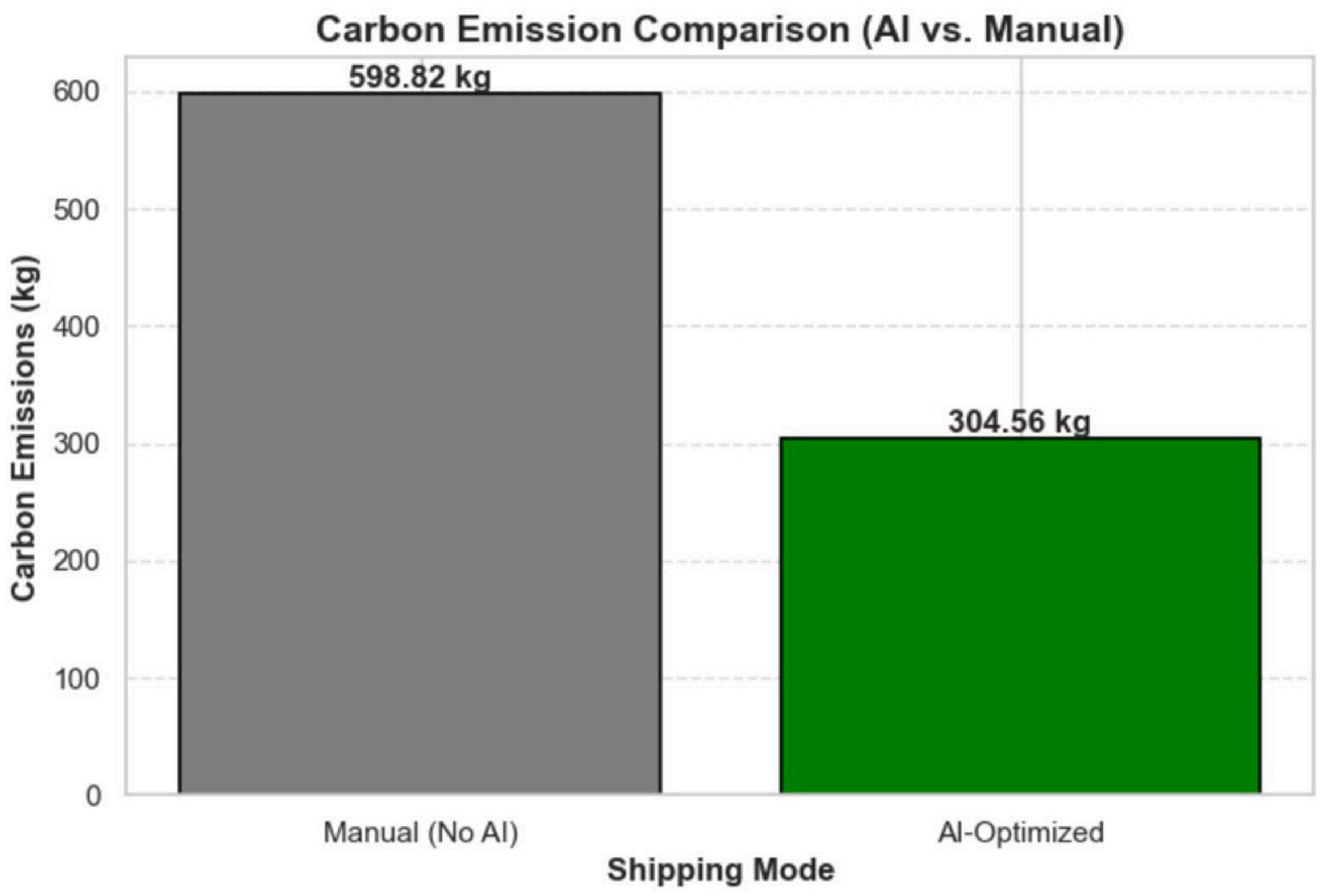


*Figure 8. AI's Impact on Carbon Emissions*

- Carbon emissions per shipment were significantly reduced from 598.82 kg (manual) to 304.55 kg (AI-driven), a 49% reduction in emissions.

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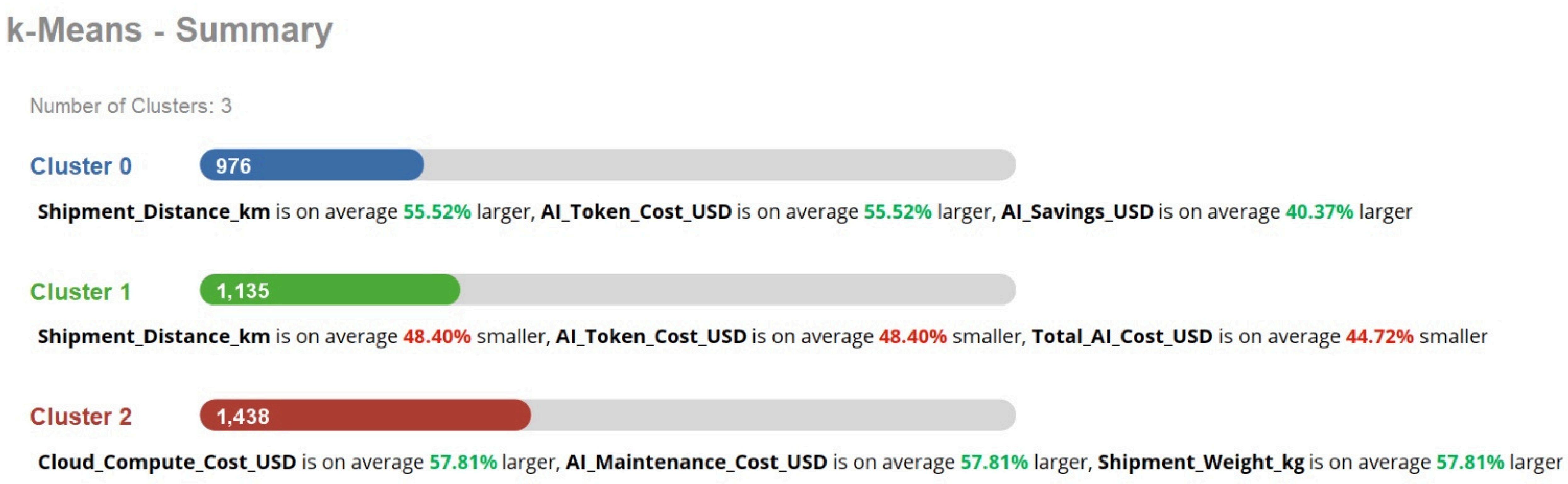


*Figure 9. K-means Cluster Summary*

Goals:

1) shipment pattern identification and 2) optimization of AI-driven air cargo operations.

K-MEANS CLUSTERING ANALYSIS

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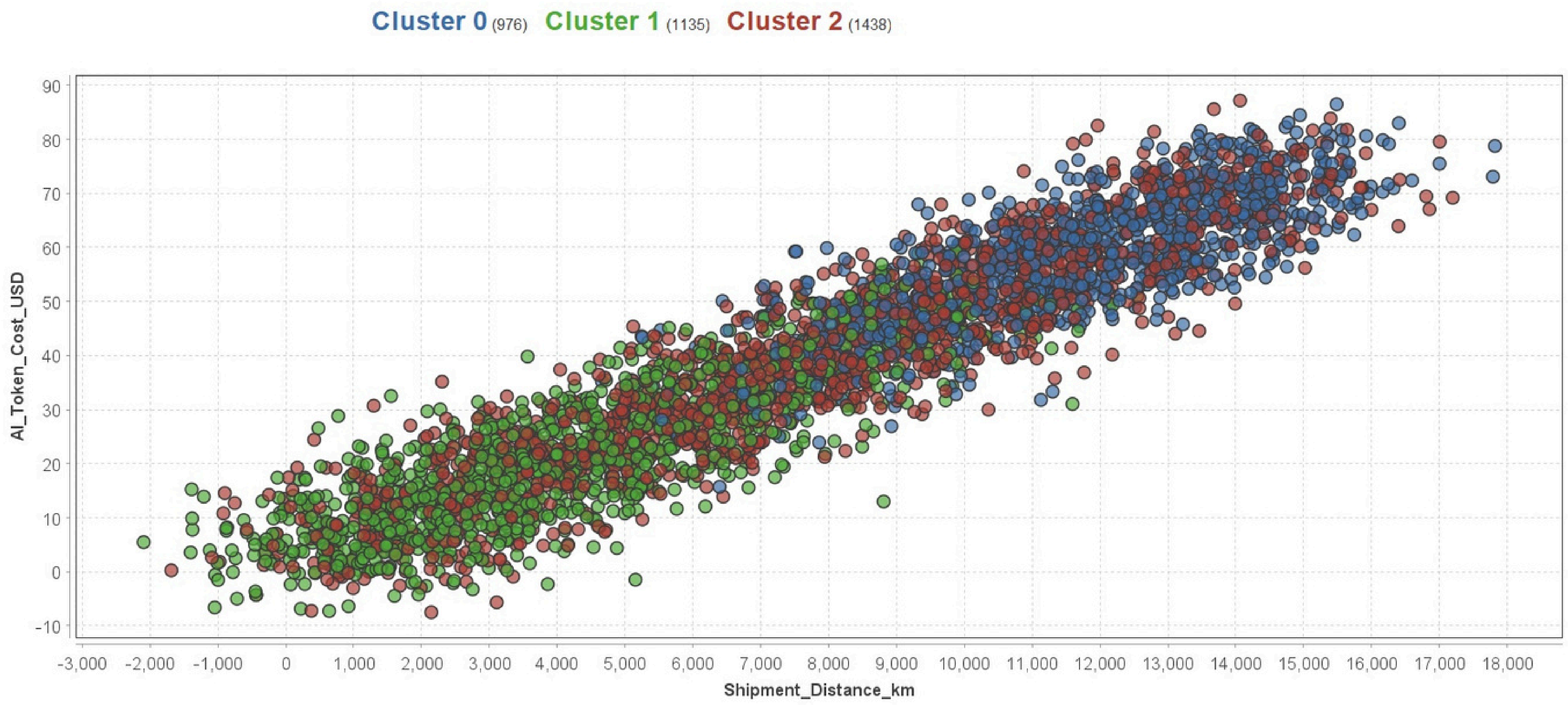


*Figure 10. K-Means Cluster distribution over AI_Token cost_USD vs Shipment_Distance_km*

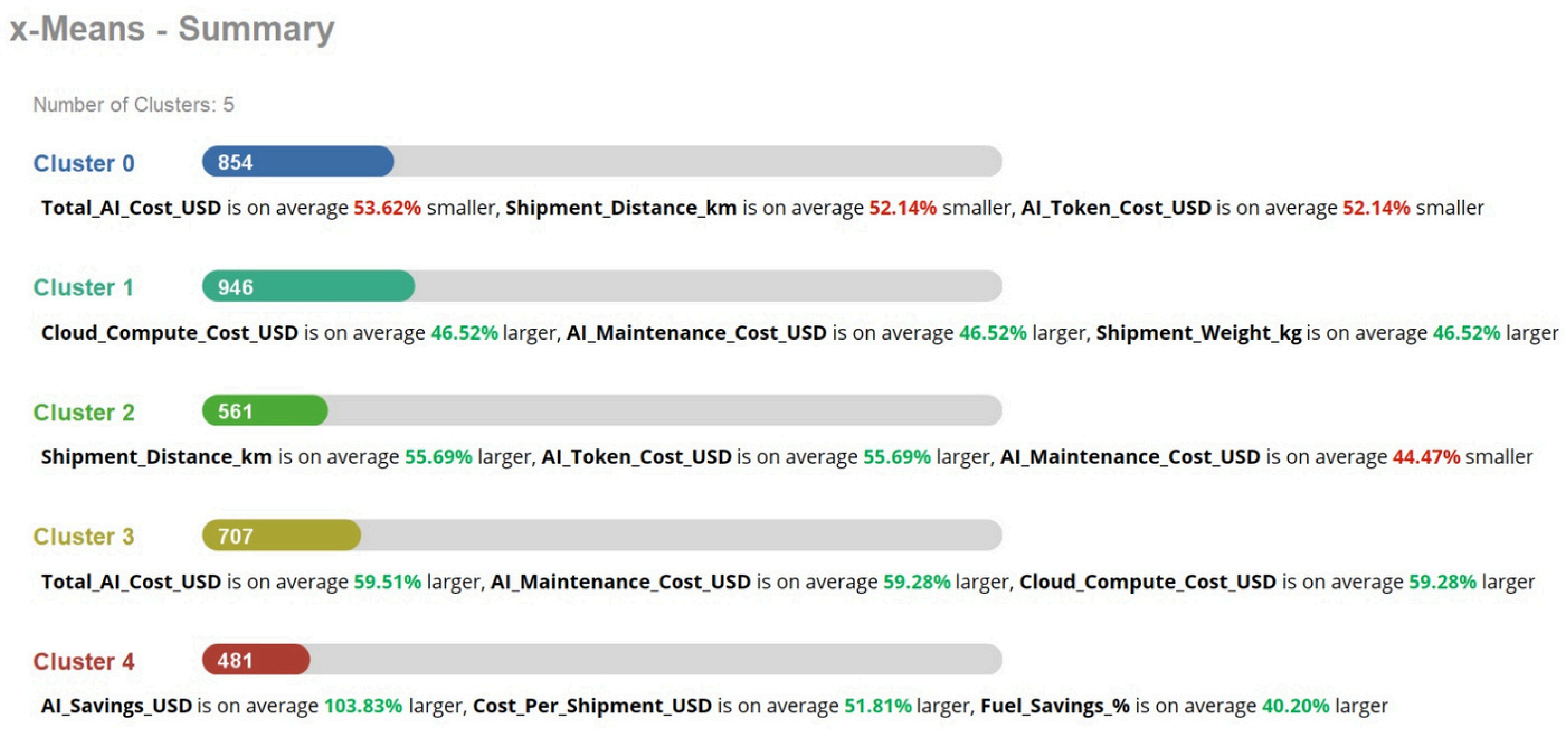


*Figure 11. X-Means Cluster Summary*

X-MEANS CLUSTERING ANALYSIS

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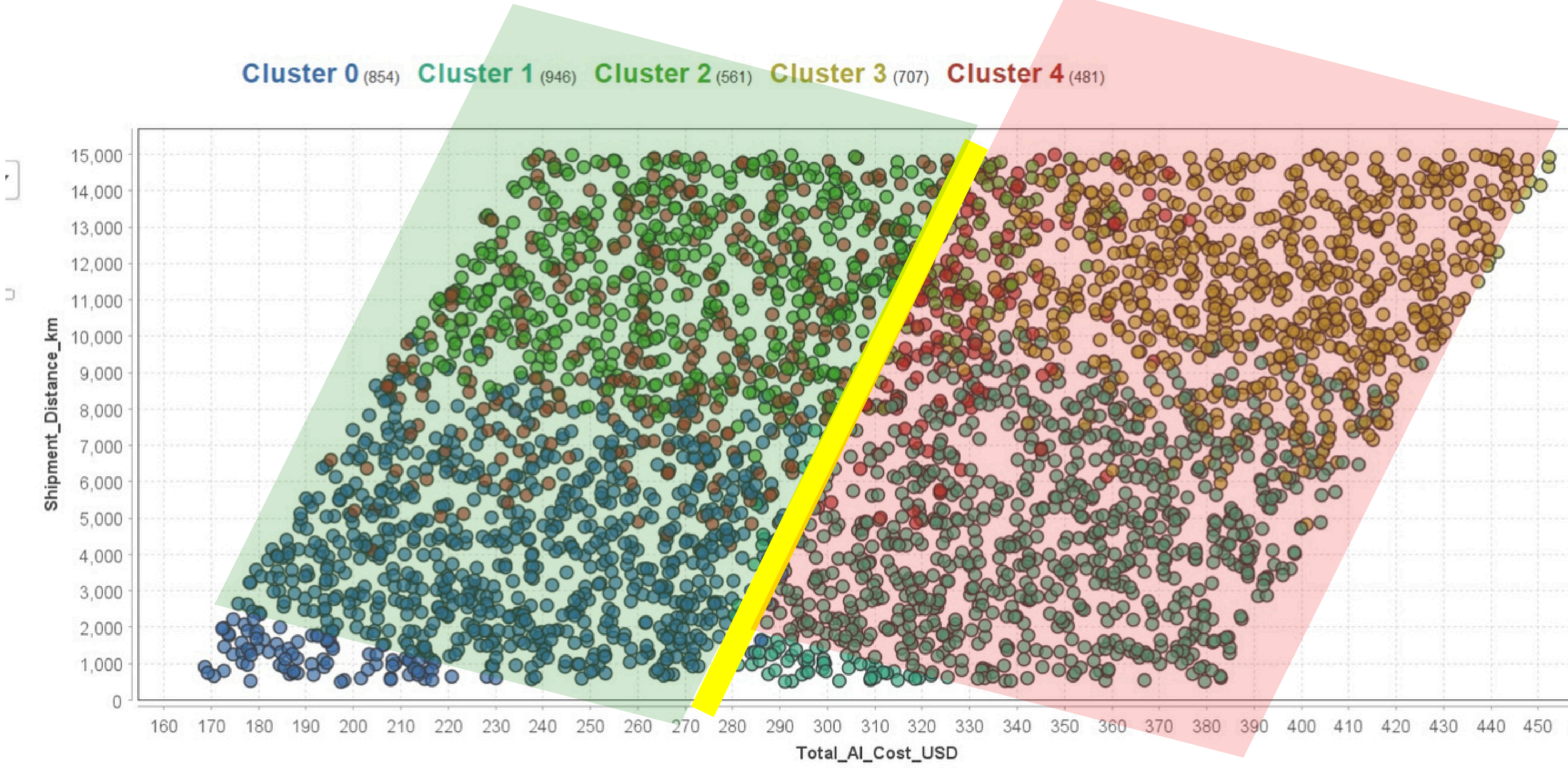
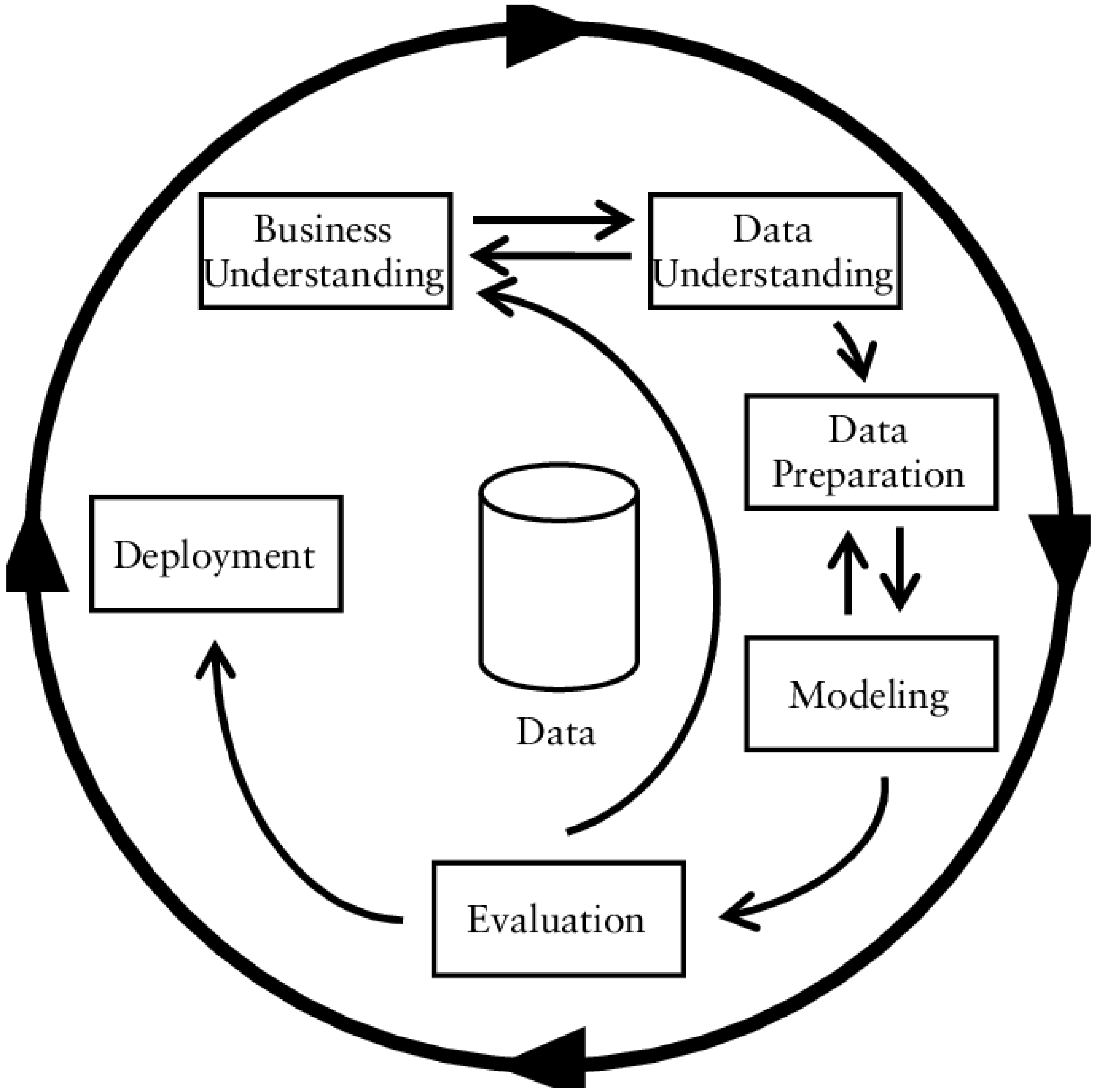



*Figure 12. X-Mean Cluster distribution over Shipment_distance_km vs Total_AI_Cost_USD*

X-MEANS CLUSTERING ANALYSIS

**TRACK ⟶**




## Business Understanding

*Lowering shipment expenses while enhancing fuel economy measures and measuring AI performance against its competitors including DHL and UPS and Amazon Air*

## Data Understanding

*Analyzed variables including shipment distances and artificial intelligence cost components and maintenance along with fuel efficiency and carbon emission counts*

*CRISP-DM METHODOLOGY*

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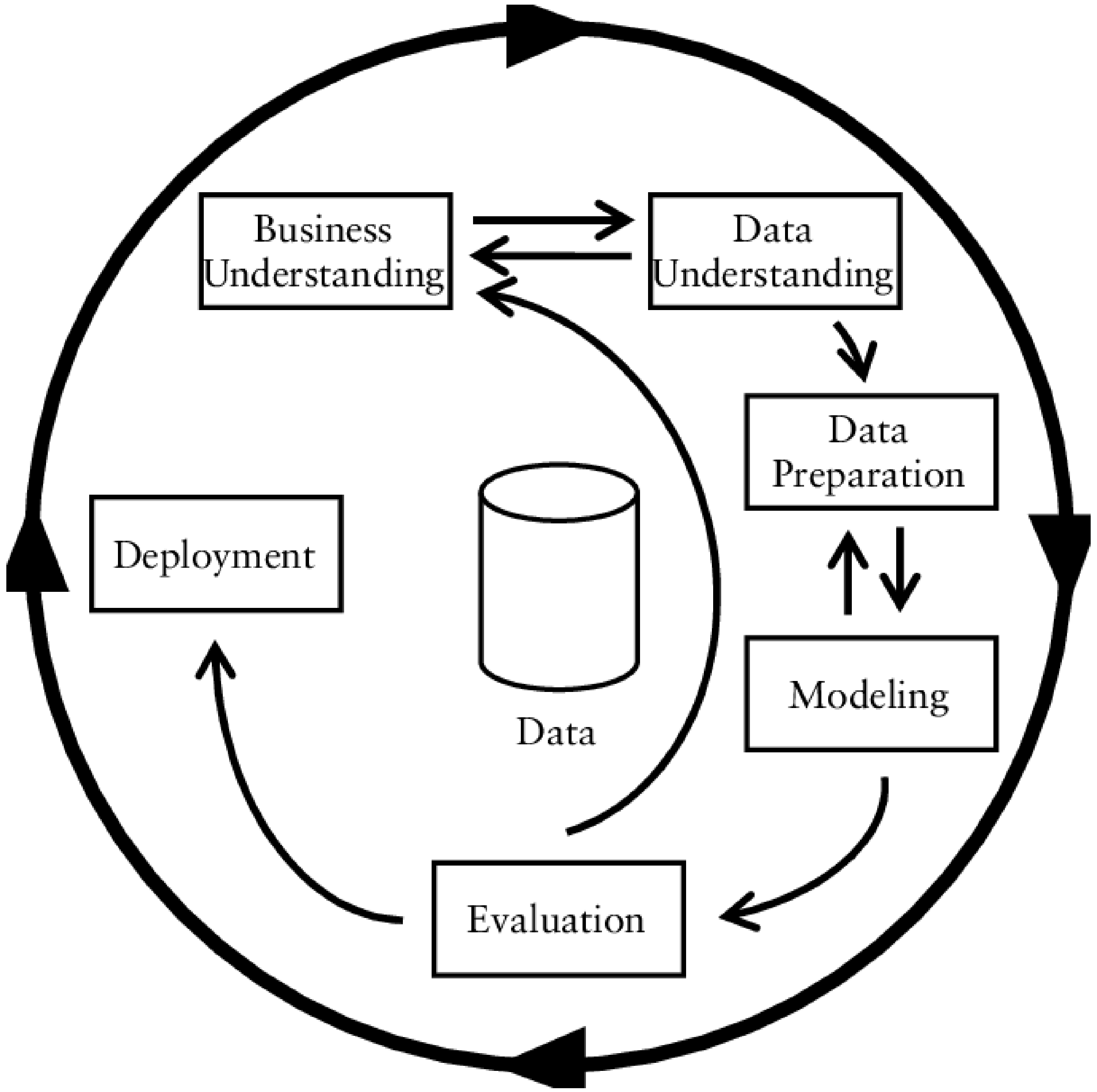
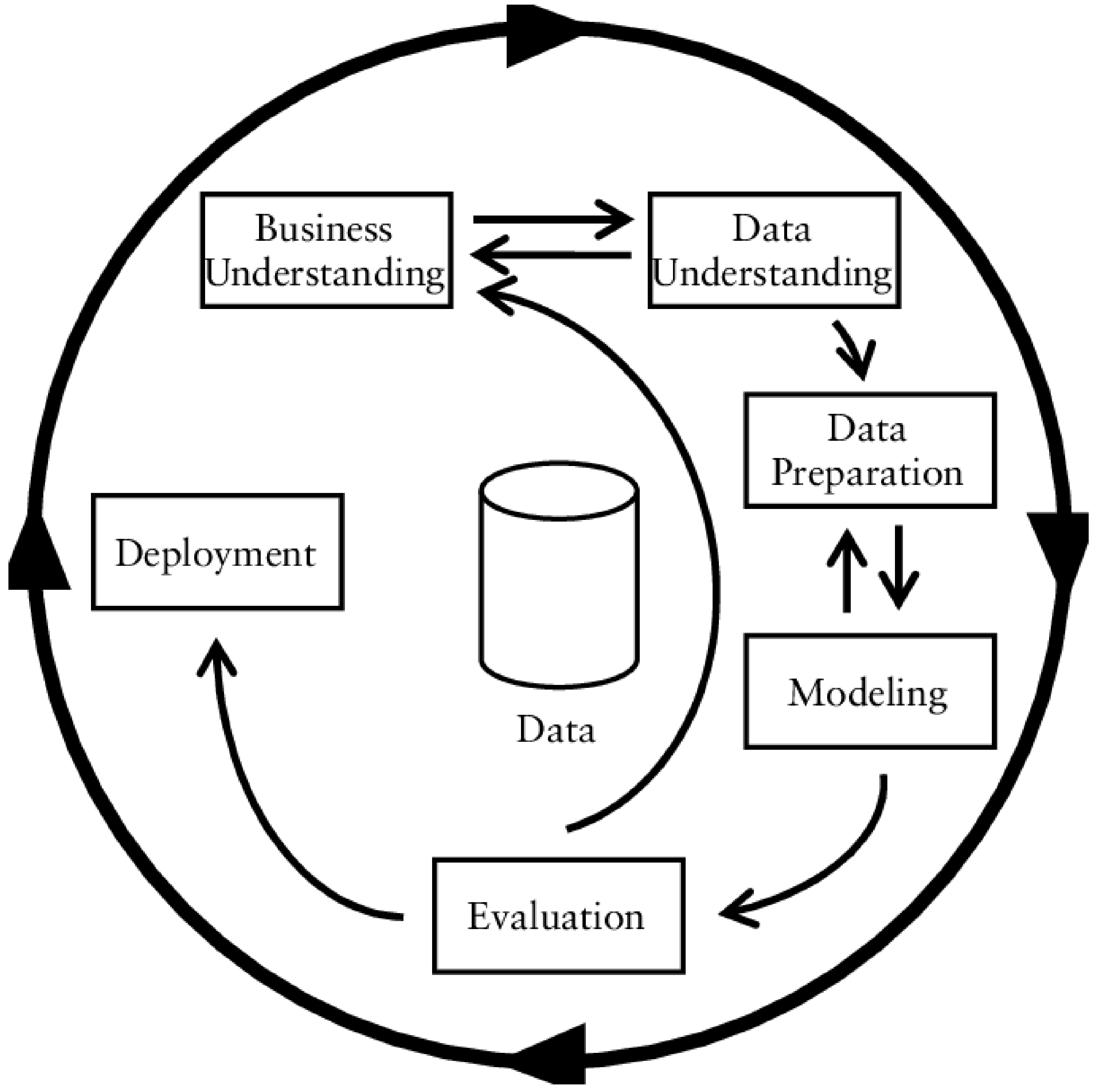



## Data Preparation

*Deleted unnecessary columns and turning numerical variables into the new categories Distance_Category and AI_Performance_Phase*

## Modeling

*K-Means and X-Means clustering algorithms were used to model shipments into groups based on artificial intelligence efficiency costs.*




## Evaluation

*AI optimization led to an evaluation-assessed decrease in costs by 10% which resulted in both better fuel conservation and minimized carbon releases by 49%.*

## Deployment

*FedEx can prioritize AI investment in long-haul shipments, refine AI cost structures to reduce overhead, and further optimize fuel efficiency strategies.*

*CRISP-DM METHODOLOGY*

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CONCLUSION

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# Optimizing Air Freight Cargo Loading with AI

| | | |
|---|---|---|
| *greater efficiency* | *accurate weight distribution* | *decrease loading times* |
| *cost-effective* | *real-time data analysis* | *increase fuel economy* |
| *sustainable* | *maximize space utilization* | *predictive analytics* |

# Optimizing Air Freight Cargo Loading with AI

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