

# YamashitaAgent: An agent submitted to the ANAC 2026 SCML OneShot Track

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## Abstract

This report presents YamashitaAgent for ANAC 2026 SCML OneShot Track. YamashitaAgent is an improved agent based on Sync Better Agent to achieve better risk management in concurrent negotiations. YamashitaAgent introduces a refined approach that considers both shortfall penalties and disposal costs through dynamic weighting schemes. Additionally, it employs an exponential weighting factor based on the ratio of offered quantities to required quantities. These enhancements enable YamashitaAgent to outperform the winner of SCML2025 and other sample agents in experimental evaluations.

## 1 Introduction

The SCML OneShot track focuses on single negotiation rounds with multiple partners. Success in this setting heavily depends on efficiently acquiring the required quantity while managing price and risk. Sync Better Agent, as a baseline implementation, uses simple threshold-based decision making. However, there is significant room for improvement in risk management and dynamic threshold adaptation. This report describes YamashitaAgent, which extends Sync Better Agent with more sophisticated mechanisms to balance shortfall penalties and disposal costs, resulting in superior performance.

## 2 The Design of YamashitaAgent

### 2.1 Concurrent Negotiation

YamashitaAgent manages negotiations with multiple suppliers (for purchases) and consumers (for sales) synchronously. The core strategy involves selecting and accepting offers that minimize the risk of shortfall penalties while avoiding excessive inventory disposal costs.

### 2.1.1 Selection of Acceptable Offers

YamashitaAgent uses a power set approach to explore all possible combinations of received offers. Unlike simpler approaches, YamashitaAgent distinguishes between two scenarios:

1. **Over-quantity scenarios** (offered quantity > required quantity)
2. **Under-quantity scenarios** (offered quantity < required quantity)

For each scenario, the best candidate combination is identified:

- For over-quantity: minimize the excess quantity
- For under-quantity: minimize the shortage quantity

YamashitaAgent then applies separate threshold evaluations for each scenario.

### 2.1.2 Dynamic Risk Weighting

YamashitaAgent computes two weighting factors based on environment parameters:

$$\text{disposal\_weight} = \alpha_{\text{slope}} \cdot \text{disposal\_cost} + y \quad (1)$$

$$\text{penalty\_weight} = \beta_{\text{slope}} \cdot (\text{shortfall\_penalty} - 0.2) + x \quad (2)$$

where  $x = 0.5$ ,  $y = 3$ ,  $\alpha_{\text{slope}} = \frac{x-y}{0.2} = -12.5$ , and  $\beta_{\text{slope}} = \frac{y-x}{0.8} = 3.125$ .

These weights dynamically adjust the threshold tolerances based on the relative magnitude of disposal costs and shortfall penalties, allowing the agent to make context-aware decisions.

### 2.1.3 Expedite Factor

YamashitaAgent introduces an exponential weighting factor that varies with the ratio of total offered quantity to required quantity:

$$\text{expedite} = \begin{cases} 10 \cdot e^{-1.151 \cdot (r-1.0)} & \text{if } 1.0 < r < 3.0 \\ 1 & \text{otherwise} \end{cases} \quad (3)$$

where  $r = \frac{\text{total offered quantity}}{\text{required quantity}}$ .

This factor reflects the negotiation urgency: when offers significantly exceed the required quantity ( $r > 1$ ), acceptance thresholds decrease exponentially, encouraging timely agreement.

### 2.1.4 Making Counter Offers

If the selected combination of acceptable offers does not meet the required quantity, YamashitaAgent sends counter offers to remaining partners. The remaining shortfall is distributed among these partners, with priority given to those who contributed the largest quantities. Counter-offer prices favor the agent’s position (maximum price if selling, minimum if buying).

## 2.2 Risk Management

In SCML 2026, shortfall penalties typically exceed disposal costs. YamashitaAgent employs separate acceptance criteria for over-quantity and under-quantity scenarios:

$$th_{\text{under}}(r) = \frac{n_{\text{lines}}}{2} \cdot (1 - r^4) + \frac{n_{\text{lines}}}{4} \quad (4)$$

$$th_{\text{over}}(r) = \frac{n_{\text{lines}}}{2} \cdot r^4 \quad (5)$$

where  $r$  is the relative negotiation round (normalized time), and  $n_{\text{lines}}$  is the production limit per day.

### 2.2.1 Dynamic Threshold Adjustment

YamashitaAgent applies three multiplicative adjustments to the base thresholds to account for environmental costs and negotiation urgency:

$$\text{adjusted\_threshold\_over} = th_{\text{over}}(r) \cdot \text{penalty\_weight} \cdot \text{disposal\_weight} \cdot \text{expedite} \quad (6)$$

$$\text{adjusted\_threshold\_under} = th_{\text{under}}(r) \cdot \text{expedite} \quad (7)$$

The acceptance criteria are:

$$\text{Accept over-quantity if: } \Delta_{\text{over}} < \text{adjusted\_threshold\_over} \quad (8)$$

$$\text{Accept under-quantity if: } \Delta_{\text{under}} < \text{adjusted\_threshold\_under} \quad (9)$$

where  $\Delta_{\text{over}}$  and  $\Delta_{\text{under}}$  represent the magnitude of excess and shortage quantities, respectively.

For over-quantity scenarios, the base threshold is multiplied by three factors: `penalty_weight` reflects the severity of shortfall penalties relative to acceptable thresholds, `disposal_weight` accounts for the cost of excessive inventory disposal, and `expedite` reduces thresholds as supply ratio increases, encouraging timely agreement. For under-quantity scenarios, only the `expedite` factor is applied, as shortage is the primary concern when operating as a buyer.

Additionally, YamashitaAgent uses different evaluation strategies based on whether it operates as a buyer or seller (first level vs. non-first level), adjusting the calculation of  $\Delta_{\text{over}}$  and  $\Delta_{\text{under}}$  accordingly to reflect asymmetric risk preferences.

### 3 Evaluation

To evaluate YamashitaAgent, simulations were conducted with 100 negotiation steps and 30 random configurations. Table 1 shows YamashitaAgent’s performance compared to other agents.

| Agent                  | Score    |
|------------------------|----------|
| YamashitaAgent         | 1.092730 |
| CautiousOneShotAgent   | 1.089862 |
| CostAverseAgent        | 1.085448 |
| SyncRandomOneShotAgent | 1.047531 |
| QuantityOrientedAgent  | 1.044978 |
| PatientAgent           | 1.002514 |
| Agent112               | 0.938215 |
| RandomOneShotAgent     | 0.785617 |
| GreedyOneShotAgent     | 0.755973 |

Table 1: OneShot Tournament Results (100 steps, 30 configurations)

YamashitaAgent achieves the highest score (1.092730), marginally outperforming CautiousOneShotAgent (1.089862) by approximately 0.25%. This improvement demonstrates the effectiveness of the dynamic risk weighting and expedite factor in handling diverse negotiation scenarios.

### Conclusions

YamashitaAgent successfully improves upon the winner of SCML2025(CautiousOneShotAgent) through more sophisticated risk management. The key contributions are:

1. Dynamic weighting of shortfall penalties and disposal costs
2. Exponential expedition factor based on offer ratios
3. Separate threshold management for over- and under-quantity scenarios
4. Context-aware decision making based on agent role (buyer vs. seller)

These enhancements enable more nuanced and adaptive negotiation strategies, resulting in superior performance across diverse market conditions.