

COW

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Abstract

This report presents COW for SCML 2026. COW is an autonomous negotiating agent for the Supply Chain Management League (SCML) Standard environment. COW extends AS0 by introducing two improvements: partner selection based on both negotiation success rates and transaction prices, and a pricing strategy with aggressive initial offers and stepwise concessions. Partners are evaluated based on a composite score of negotiation success rate and price, and trading quantities are distributed proportionally according to this score. Experimental results in the SCML Standard 2025 environment show that COW consistently outperformed AS0 and achieved the highest average score among all compared agents. These results demonstrate the effectiveness of combining price-based partner evaluation with pricing strategies.

1 Introduction

This report presents COW agent for SCML 2026 [1]. COW is an autonomous agent developed to maximize profit by optimally distributing resources based on past transaction records and by engaging in flexible price negotiations. COW is based on the strategy of AS0, the winner of the Standard track in 2025, and incorporates two improvements into its initial offer and counteroffer strategies: prioritized partner selection and a pricing strategy. Specifically, the partner selection introduces a price score that evaluates how favorable past transaction prices were to the agent, enabling distribution toward partners expected to yield higher profit. The pricing strategy adopts an aggressive initial offer and stepwise concessions to improve profit and the success rate. The response strategy for deciding whether to accept or reject an offer is inherited directly from AS0 without modification.

2 Proposed Method

2.1 Distribution Strategy

In AS0, partners are primarily evaluated based on their success rate (the proportion of past negotiations that reached an agreement) and partners with higher success rates are prioritized for negotiation. Resources are distributed equally among the selected partners. However, this partner evaluation and distribution method considers only negotiation success and does not explicitly take transaction prices into account. To address this limitation, COW introduces a new price score that relatively evaluates how favorable past agreed prices were for the agent. For each partner, COW combines the success rate and the price score to calculate a priority score that determines prioritized partners and resource distribution.

2.1.1 Priority Score Calculation

Each partner i is evaluated along two axes: the success rate and the price score. The overall priority score $S(i)$ ranges from 0.0 to 1.0, with larger values indicating a partner that is more likely to accept the agent's offers and more willing to concede. The priority score $S(i)$ is calculated by

$$S(i) = W_s R_{\text{success}}(i) + W_p S_{\text{price}}(i). \quad (1)$$

- **Success rate:** $R_{\text{success}}(i)$ is the success rate of partner i . $R_{\text{success}}(i)$ is defined by

$$R_{\text{success}}(i) = \begin{cases} 0.5 & \text{if no negotiation data,} \\ \frac{\text{number of agreements concluded with partner } i}{\text{total number of negotiations}} & \text{otherwise.} \end{cases} \quad (2)$$

- **Price score:** $S_{\text{price}}(i)$ is the price score of partner i . Let the minimum negotiable price be $P_{\min}$, the maximum be $P_{\max}$, the price range $M = P_{\max} - P_{\min}$, and the average agreed price in past transactions with partner i be P_{avg} . $S_{\text{price}}(i)$ is calculated by

$$S_{\text{price}}(i) = \begin{cases} \frac{P_{\text{avg}} - P_{\min}}{M} & \text{if selling,} \\ \frac{P_{\max} - P_{\text{avg}}}{M} & \text{otherwise.} \end{cases} \quad (3)$$

- **Weights:** W_s is the weight for the success rate and W_p is the weight for the price score. The weights are set so that $W_s + W_p = 1$. In our implementation we set $W_s = 0.8$ and $W_p = 0.2$ to prioritize reliable agreement completion.

2.1.2 Score-Based Distribution

Similar to AS0, COW selects promising partners as prioritized partners and distributes trading quantities to them preferentially. However, the proposed method is distinguished by its specific approach to distribution. In partner selection, AS0 evaluates partners solely based on their success rates, whereas the proposed method evaluates partners using the priority score $S(i)$, which also takes past transaction prices into account. Furthermore, while AS0 distributes equal quantities among prioritized partners, the proposed method allocates quantities proportionally according to $S(i)$.

The number of selected prioritized partners k varies according to remaining time and current inventory. For example, if the inventory is low, k may increase to select more partners; if remaining time is short, k may shrink to focus on the most promising partners. COW selects the top k partners based on $S(i)$. To explore a wider range of partners, up to two additional partners are randomly selected from the remaining candidates to form the final negotiation partner set.

For the selected partners, a minimum quantity of 1 is assigned to each selected partner first. The remaining resources are then proportionally distributed according to $S(i)$, concentrating resources on the most promising prioritized partners.

2.2 Pricing Strategy

While AS0 uses a smart price mechanism that adjusts offer prices based on partner reliability, COW implements a rule-based strategy. This strategy switches between aggressive and conciliatory behaviors depending on partner responses.

- **Initial Offer:** The agent always proposes the most favorable price for itself. Sellers therefore propose $P_{\max}$ and buyers propose $P_{\min}$ to probe the partner's concession range.
- **Stepwise Concessions in Counteroffers:** $\text{concession}(i)$ is the amount of concessions to partner i at each step. The agent makes stepwise concessions based on the number of counteroffers r_i made toward partner i within a negotiation step. The concession amount at each step is defined as 30% of the negotiable price range M :

$$\text{concession}(i) = 0.3Mr_i. \quad (4)$$

The trading price P_{trade} is determined from this concession amount and the initial ideal price:

$$P_{\text{trade}} = \begin{cases} \max(P_{\min}, P_{\max} - \text{concession}(i)) & \text{if selling,} \\ \min(P_{\max}, P_{\min} + \text{concession}(i)) & \text{otherwise.} \end{cases} \quad (5)$$

This mechanism ensures that negotiations begin with an aggressive opening. It also ensures that the agent moves toward realistic prices when partners prolong negotiations.

3 Experiments

We evaluated COW in the SCML Standard 2025 environment to examine its performance and stability in multi-agent tournaments. The comparison agents were AS0, BetterAgent, AdaptiveAgent, LearningAgent, KATSUDONAgent, PriceTrendStdAgent and UltraSuperMiracleSoraFinalAgentZ. Number of distinct world configurations was 10. Number of simulation days (n_{steps}) was set to 50, 100, and 200. We used the average score achieved by each agent as the evaluation metric.

Table 1 shows the experimental results. COW achieved the highest mean scores across all simulation days, outperforming AS0. These results indicate that concentrating resources on promising partners using price-based scoring and adopting stepwise concession logic for counteroffers are effective improvements over the base AS0 strategy.

Table 1: Experimental results: Comparison of mean scores among agents

Agent	$n_{\text{steps}}=50$	$n_{\text{steps}}=100$	$n_{\text{steps}}=200$
COW	0.7693	0.9134	0.9386
AS0	0.7594	0.9002	0.9360
BetterAgent	0.6540	0.9125	0.8816
PriceTrendStdAgent	0.7454	0.8983	0.9040
AdaptiveAgent	0.6132	0.8857	0.8325
LearningAgent	0.6074	0.8639	0.7621
UltraSuperMiracleSoraFinalAgentZ	0.4644	0.9053	0.7941
KATSUDONAgent	0.4006	0.6582	0.5164

4 Conclusion

We developed COW, an agent that extends AS0 by introducing price-based scoring for partner selection and stepwise concessions for price setting to pursue higher profit. COW retains AS0’s dynamic negotiation caps tuned to inventory and time while introducing two main improvements: prioritizing partners based on both success rate and price score, and starting negotiations from an ideal price while widening concessions according to the number of counteroffers. Tournament experiments showed that COW outperformed AS0, demonstrating that the introduced mechanisms contributed to consistent profit improvement.

References

- [1] Y. Mohammed, A. Greenwald, K. Fujita, M. Klein, S. Morinaga, and S. Nakadai. Supply Chain Management League (Standard): Automated Negotiating Agents Competition, 2026.