

Ysi Agent Strategy Report

ANAC 2026 Supply Chain Management League – OneShot Track

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1 Objectives and Assumptions

Ysi is an autonomous negotiating agent for the SCML OneShot track. In this track, each simulation consists of repeated independent days. On each day, an agent is assigned to either the lower production level $L0$ or the upper production level $L1$. The $L0$ agent receives exogenous input contracts and negotiates to sell the intermediate product, while the $L1$ agent receives exogenous output contracts and negotiates to buy the intermediate product. Because inventory is not carried over to the next day, the central operational problem is to make the total bought quantity and the total sold quantity match as closely as possible while still obtaining favorable prices.

Ysi pursues three goals:

1. **Quantity balance:** avoid both excess input and shortfall in output contracts.
2. **Margin improvement:** sell at high prices and buy at low prices whenever this does not excessively reduce the probability of reaching agreement.
3. **Robustness to partner behavior:** learn which partners tend to reach agreement, and allocate quantities accordingly.

The design is built on a conservative OneShot baseline that uses current-day needs, and then adds three main mechanisms: acceptance-probability portfolio allocation for $L0$ sales, patient cost-averse purchasing for $L1$, and market-adaptive selling aggressiveness.

2 Agent Architecture

Ysi is implemented as a synchronous OneShot agent. It observes the current day, the feasible issue ranges, its current supply and sales needs, its role in the supply chain, and the offers received in all concurrent negotiations. The agent uses a centralized controller: instead of responding to each negotiation in isolation, it evaluates subsets of offers across all partners on the same side of the market.

Let Q_t^B and Q_t^S denote the agent’s remaining buying and selling needs on day t . The baseline need estimate is

$$Q_t^B = \max(0, \text{needed_supplies}), \quad Q_t^S = \max(0, \text{needed_sales}). \quad (1)$$

All offers are restricted to the current day. This is appropriate for OneShot because the negotiated contract concerns the current day’s intermediate-product trade rather than future inventory planning.

Ysi uses the following strategic modules:

1. **Partner statistics:** maintain, for each partner, an empirical acceptance rate that is used mainly as a tie-breaker when several offer combinations match the daily need equally well.

2. **Combination-based acceptance:** choose a subset of offers whose total quantity maximizes utility or best matches current needs.
3. **Portfolio allocation:** when selling from $L0$, distribute requested quantities according to estimated acceptance probabilities derived from realized negotiation outcomes.
4. **Cost-averse purchasing:** when buying as $L1$, anchor at the lowest feasible price and open the acceptable price range only as far as the shortfall-to-disposal cost ratio requires.
5. **Market-adaptive selling:** when selling, adjust price concession speed according to an estimated market favorability signal.

3 Partner Statistics

Ysi maintains two distinct and *independent* partner statistics, which is important to state precisely because they serve different modules and are computed from different events.

Selection-side rate σ_i . For each partner i , Ysi records the number of times it *accepted* an offer from i , denoted s_i , and the number of offers from i that were considered, denoted n_i . It maintains

$$\sigma_i = \frac{s_i}{n_i}, \quad (2)$$

with new partners initialized to a neutral value. Note that σ_i measures how often *Ysi itself* chose to accept partner i 's offers, not how often partner i accepts Ysi's offers. This counter is updated only on the selling ($L0$) side, where the combination-acceptance routine is active.

In principle σ_i can be used to rank partners and prefer those with a higher rate. In the submitted configuration, however, offers are distributed to all available partners (the selection ratio is effectively one), and the $L0$ selling proposals are produced by the portfolio allocator described in Section 5, which does not order partners by σ_i . Consequently, in practice σ_i acts mainly as a small tie-breaking term: when two offer combinations are otherwise equally good, the combination containing higher- σ_i partners is slightly preferred. This design assumes that past acceptance behavior within the same simulation carries some information about future responsiveness; it is an empirical assumption rather than a rule of the game.

Acceptance probability p_i . Separately, and used *only* by the portfolio allocator, Ysi estimates a genuine acceptance probability p_i from realized negotiation outcomes (success or failure callbacks). This estimator is defined in Section 5 and does not share its counts with σ_i .

4 Quantity Control and Combination Acceptance

A key difficulty in OneShot is that each agent negotiates with many partners simultaneously. Accepting a good-looking offer in one bilateral negotiation can be harmful if several other offers are also accepted and the total quantity then exceeds the daily need. Ysi therefore evaluates combinations of offers.

Given a candidate set C of offers from one side of the market, the agent considers subsets $A \subseteq C$ and their total offered quantity

$$q(A) = \sum_{i \in A} q_i. \quad (3)$$

The baseline policy prefers subsets whose quantity is close to the remaining need Q_t . If the SCML utility function is available, Ysi evaluates candidate subsets with the actual utility function:

$$A^* = \arg \max_{A \subseteq C} u(A). \quad (4)$$

If utility evaluation fails, it falls back to a quantity-distance heuristic that also incorporates the σ_i tie-breaker. A small amount of excess can be allowed later in the negotiation, especially when shortfall is more costly than disposal. This is controlled by a time-dependent excess allowance.

Let r_t be the relative negotiation time. A simplified form of the allowable excess is

$$E_{\max}(t) = \lfloor \lambda r_t Q_t \rfloor, \quad (5)$$

where λ is larger on the buying side if shortfall penalties are high. This relaxation is designed to prevent the agent from rejecting all feasible offers late in the negotiation merely because they are not a perfect quantity match.

5 Acceptance-Probability Portfolio Allocation for $L0$ Sales

The main original mechanism of Ysi is the portfolio allocator used when the agent is an $L0$ seller. The problem is similar to a newsvendor problem under uncertain demand: if Ysi sends too little quantity, it may fail to sell enough; if it sends too much quantity to partners who accept, it may become overcommitted.

For each buyer i , Ysi estimates an acceptance probability from realized negotiation outcomes, using a Beta-style smoothed estimator

$$p_i = \frac{s_i + a}{n_i + a + b}, \quad (6)$$

where s_i and n_i here are the number of successful agreements and the total number of negotiations with partner i (counted from negotiation success/failure events), and the implementation uses a symmetric prior $a = b = 1$. These counts are tracked independently of the selection-side rate σ_i of Section 3. If Ysi offers quantity q_i to partner i , the actually accepted quantity is modeled as

$$S = \sum_i q_i X_i, \quad X_i \sim \text{Bernoulli}(p_i). \quad (7)$$

The objective is to minimize the expected penalty caused by under-selling and over-selling:

$$J(q) = c_{\text{under}} \mathbb{E} \left[(Q - S)^+ \right] + c_{\text{over}} \mathbb{E} \left[(S - Q)^+ \right]. \quad (8)$$

Here Q is the target quantity for the day. The under-selling cost estimates lost revenue and possible disposal of unused input, while the over-selling cost estimates the shortfall penalty from promising more than can be supplied.

Ysi approximates S by a normal distribution, using

$$\mu = \sum_i q_i p_i, \quad v = \sum_i q_i^2 p_i (1 - p_i). \quad (9)$$

It then greedily adds one unit at a time to the partner that most decreases $J(q)$, subject to the partner's quantity issue range and a total allocation cap. The cap is important because otherwise the optimizer may place too much quantity when acceptance probabilities are low. In the final design, the cap is reduced to control tail risk.

6 Buyer-Side Cost-Averse Purchasing

When Ysi is an $L1$ buyer, the dominant risk is asymmetric: failing to secure enough input triggers a shortfall penalty on the exogenous output contracts, which is typically more expensive than the disposal cost of a small over-purchase. Ysi therefore buys according to a *cost-averse* policy whose aggressiveness is governed by the estimated ratio between the shortfall penalty and the disposal cost.

Let $\rho = c_{\text{short}}/c_{\text{disp}}$ be this shortfall-to-disposal ratio, obtained either from the agent’s utility function or from the reported penalty coefficients. Ysi anchors its proposals at the lowest feasible price $p_{\min}$ and sets both its acceptable price level and the amount of deliberate over-ordering as increasing functions of ρ : when shortfall dominates ($\rho \gg 1$) the agent widens the acceptable price range and slightly over-orders to guarantee coverage, whereas when the two costs are comparable it stays close to $p_{\min}$ and buys only what is needed. Conceptually, the acceptable threshold opens from the low anchor toward higher prices as the negotiation proceeds and as ρ grows,

$$\theta_r = p_{\min} + (p_{\max} - p_{\min}) g(\rho, r), \quad (10)$$

with g a monotone opening schedule. Only offers with $p_i \leq \theta_r$ are considered for acceptance; among these, Ysi again chooses a subset by utility or quantity fit, while more expensive offers are countered at the current threshold.

This buying module deliberately follows the cost-averse purchasing approach that has proven robust across OneShot fields in prior competitions. In Ysi it is used as a dependable foundation for quantity coverage, so that the agent’s own contribution can be concentrated on the $L0$ selling modules of Sections 5 and 7. The mechanism is intentionally asymmetric: the agent is patient on price early in the negotiation but still becomes willing to cover quantity later, because an overly strict low-price policy can cause costly shortfall if negotiations end without enough input.

7 Market-Adaptive Selling Price

Ysi also adjusts its selling concession speed according to a public market signal. The agent computes a favorability score from the current trading prices, catalog prices, production cost, and disposal cost. A simplified expression is

$$f = \text{clip}_{[0,1]} \left(\frac{1}{2} \frac{p^{\text{out}} - p^{\text{in}} - m}{s_m p^{\text{out}}} + \frac{1}{2} \left(1 - \frac{d}{s_d} \right) \right), \quad (11)$$

where p^{out} and p^{in} are output and input price references, m is the private production cost, d is the current disposal-cost coefficient, and s_m and s_d are scaling constants.

The selling price is based on a concession curve. If r_t is relative time, the normalized hold level is approximately

$$h(r_t) = (1 - r_t)^\gamma. \quad (12)$$

For sellers, a larger hold level means staying closer to the maximum price. Ysi modifies the exponent according to market favorability:

$$\gamma' = \max(0.2, \gamma(1 - G(f - 0.5))). \quad (13)$$

When the market looks favorable, $f > 0.5$, the exponent decreases and the hold level remains higher; Ysi therefore concedes more slowly and attempts to capture upside. When the market looks unfavorable, the exponent increases and Ysi concedes earlier to protect quantity balance.

8 Counter-Offer and Response Policy

Ysi’s response policy can be summarized as follows.

1. Remove invalid offers, wrong-day offers, and zero-quantity offers.
2. On the buying side, filter out offers whose price is above the current patience threshold.
3. Enumerate candidate subsets of offers on the same market side.

4. Accept the subset that maximizes utility or best balances quantity, while respecting the current excess tolerance.
5. If the remaining need is positive, send counter-offers to the remaining partners using the current concession price and distributed quantities.
6. If the need is already satisfied, reject or end the remaining negotiations to avoid over-contracting.

This policy differs from a purely bilateral strategy. A bilateral strategy asks whether one offer is acceptable by itself. Ysi instead asks whether a set of simultaneous offers is acceptable as a portfolio. This distinction is important because OneShot scoring is strongly affected by the daily aggregate mismatch between input, output, and production capacity.

9 List of Symbols

Symbol	Description
Q_t^B	Remaining buying need on day t
Q_t^S	Remaining selling need on day t
q_i	Quantity offered to or received from partner i
σ_i	Rate at which Ysi accepts offers from partner i (tie-breaker)
p_i	Smoothed acceptance probability of partner i (from realized outcomes)
S	Random total accepted quantity
c_{under}	Cost coefficient for selling too little
c_{over}	Cost coefficient for selling too much
ρ	Estimated shortfall-to-disposal cost ratio (buying side)
$p_{\min}, p_{\max}$	Feasible unit-price range
θ_r	Buying-side acceptable price threshold at round r
f	Market favorability score
γ'	Market-adjusted price-holding exponent

10 Conclusion and Contributions

Ysi is a quantity-first OneShot agent with market-sensitive price control. Its main contribution is to treat simultaneous negotiations as a portfolio rather than as independent bilateral decisions. The $L0$ selling module estimates the probability that each partner reaches agreement and allocates quantities by minimizing an expected under/over penalty. The $L1$ buying module adopts an established cost-averse policy, anchoring at a low price and opening the acceptable range in proportion to the shortfall-to-disposal cost ratio, thereby balancing margin against shortfall risk. The selling price curve is further adapted to market favorability so that the agent can be more aggressive in good conditions and more conservative when excess risk is high.

The expected advantage of this design is not that it always maximizes the price of each individual agreement, but that it improves the consistency of daily portfolio outcomes. In OneShot, a slightly worse price can be acceptable if it helps avoid a large quantity mismatch, while a very good price can still be bad if it causes excess or shortfall. Ysi's strategy is therefore designed to optimize the combined effect of price, quantity, timing, and partner reliability.