

# Multi Agents System

# Zanzibar Bazaar: A Multi-Agent System Project

Tommaso Tragno  
[fc64699]

Duarte Gonçalves  
[fc64465]

January 27, 2025

1. Introduction & Motivation
2. System Design and Architecture
3. Implementation Highlights
4. Results and Observations
5. Discussion and Future Work
6. Conclusion



# Introduction & Motivation

- **Historical Spice Market Simulation (18<sup>th</sup> Century Zanzibar)**
  - Merchants trade spices (clove, cinnamon, nutmeg, cardamom).
  - Prices fluctuate based on events and supply/demand.
- **Multi-Agent System (MAS) Rationale**
  - Distributed decision-making: each merchant acts autonomously.
  - Negotiation, alliance-formation, sabotage, and dynamic events.
- **Project Goal**
  - Develop a BDI-like agent architecture in JADE.
  - Compare “intelligent” vs. “random” (baseline) merchant behaviors.



# System Design and Architecture

## Key Agents:

### ➤ **BazaarAgent (Game Master)**

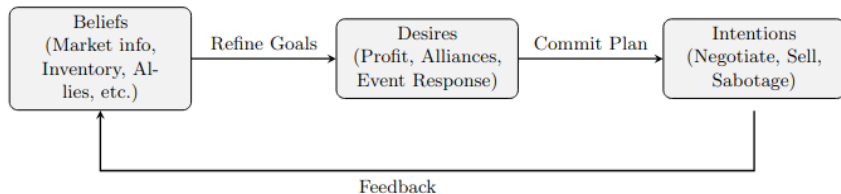
- Manages rounds and scoreboard.
- Announces events (Storm, Tax, New Trade Route).
- Requests & collects sales from merchants.

### ➤ **AdvancedPlayerAgent (BDI-like)**

- Maintains beliefs (prices, inventory, alliances).
- Forms desires to maximize profit or sabotage rivals.
- Executes intentions: propose trades, accept/reject offers, final sell decisions.

### ➤ **SimplePlayerAgent (Random)**

- Minimal logic: random acceptance, random selling.
- Baseline to compare with the BDI approach.



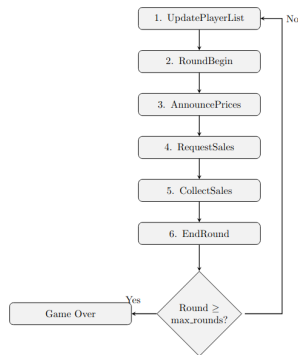
**Beliefs** (market info, prices, events),  
**Desires** (profit, alliances),  
**Intentions** (propose/accept trades, sabotage).  
*Implemented as JADE behaviors and shared state.*



# Implementation Highlights



- **NegotiationInitiatorBehavior** (ticker):
  - Periodically proposes trades to random merchants.
  - Stops after success or max attempts.
- **NegotiationResponder** (cyclic):
  - Evaluates incoming trade proposals.
  - Accept/reject based on current strategy (value ratio, alliances/rivals).
- **AllianceProposer / Responder**:
  - Attempts or replies to alliance formation requests.
- **SabotageBehavior**:
  - Sends false “rumor” messages to rivals randomly.



1. **RoundBegin**: BazaarAgent announces new round, checks DF for players.
2. **AnnouncePrices**: Includes random event (Storm, Tax, Trade Route).
3. **Negotiation & Trading**: Each merchant attempts trades; alliances and sabotage can occur.
4. **SellRequest & SellResponse**: Each merchant decides how much to sell (BDI or random).
5. **EndRound**: BazaarAgent updates scoreboard, adjusts prices, or ends game at maxRounds.



# Results and Observations

- **5 Rounds** with 1 BazaarAgent, 3 BDI merchants, 2 random merchants.
- **Results:**
  - BDI Agents significantly outperformed random merchants.
  - Alliances occasionally formed but often not long-lasting.
  - Storm & Tax events influenced short-term profits.
- **Final Scores Example:**
  - Player\_1 (BDI): 612 coins
  - Player\_2 (BDI): 420 coins
  - Player\_3 (BDI): 259 coins
  - Merchant\_1 (Random): 132 coins
  - Merchant\_2 (Random): 116 coins

- **BDI Forecasting** boosted profits by selectively holding or selling depending on event predictions.
- **Random Agents** missed profitable trades, selling at suboptimal times.
- **Limitations:**
  - Many trade proposals were rejected (strict acceptance thresholds).
  - Minimal sabotage effect: rumors rarely changed competitor behavior.
  - Alliances did not store historical outcomes (only short-term synergy).



# Discussion and Future Work

## ➤ Strengths

- Clear demonstration of BDI vs random logic in a dynamic market.
- Flexible event-driven architecture with JADE behaviors.

## ➤ Challenges

- Trade acceptance logic is simplistic, leading to frequent rejections.
- Sabotage & alliances underutilized.

## ➤ Potential Extensions

- Machine Learning for price forecasting or dynamic negotiation.
- More robust alliance formation and sabotage strategies.

## **Zanzibar Bazaar** demonstrates:

- Feasibility of using BDI-like agents in a JADE-based marketplace.
- Significant advantages of a more “cognitive” approach over random strategies.
- Flexibility for future expansions (learning, advanced negotiation).

*In sum, a dynamic, event-driven MAS that highlights key BDI features for agent-based trade simulations.*



**Thanks for your attention!**