# Agent-Based Simulation for "Strategic Leadership and Organizational Excellence in Higher Education"

This repository contains the supplementary code for the manuscript titled "Strategic Leadership and Organizational Excellence in Higher Education: A Mixed-Methodology Analysis Combining Survey Data and Agent-Based Simulation" by Abdullah Mohammad Ghazi Al khatib, Abdullah Waleed Qazzaz, Saeed Naser Ibraheem, and Bayan Mohamad Alshaib.

### Description

This agent-based simulation model was developed in Python using the SimPy library to explore the dynamic relationship between strategic leadership and organizational excellence at a university. The model simulates daily operations over a 365-day period, incorporating stochastic crisis events and periodic strategic investments by leadership. The model is designed to be calibrated with empirical survey data, as described in the main manuscript, to provide a contextually relevant "digital twin" of the institution. It also includes a counterfactual analysis engine to test alternative leadership strategies.

### System Requirements

\* Python 3.9+

\* Python libraries as listed in `requirements.txt`

### Installation

To install the necessary Python libraries, navigate to this directory in your terminal and run the following command:

```bash

pip install -r requirements.txt

```

### Running the Simulation

To run the baseline simulation as described in the paper, execute the following command from your terminal:

```bash

python simulation\_model.py

```

\*(Note: You may need to rename your Python script to `simulation\_model.py` or change the command to match your filename.)\*

### Model Calibration

The default parameters in the `SimulationConfig` class are illustrative. As detailed in the manuscript's methodology section (Section 3.2.1), the model is designed to be calibrated using the survey data from Table 3. The `base\_effectiveness` for each leadership dimension should be set by normalizing the 5-point Likert scale mean scores using the formula:

`Score\_norm = (Mean\_Likert - 1) / 4`

### Expected Output

When the script is run, it will:

1. Print status updates of the simulation progress to the console, including crisis events and strategic investments.

2. Generate and display a multi-panel plot summarizing the simulation results.

3. Save this plot as a high-resolution image file named `leadership\_simulation\_results.png` in the same directory.

4. Run and print a summary of the counterfactual scenario comparisons to the console.

### License

This code is made available under the MIT License. See the `LICENSE` file for more details.

### Contact

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