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The X-Supply Game

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Introduction Motivation

- A need for experiential approaches in SCM education
 - Experience challenges of managing supply chains
- A need for a tool to facilitate game mechanics
 - Participants to focus on decision making analysis rather than weekly accounting of game operations



Introduction

Key features

- On-line, synchronized, multi-player, and team-based
- Simulates on a small-scale system dynamics found in real supply chains

XSG vs. other games

- Configurable supply chain network and scenario setup
- Payer analysis includes Shipping and Ordering decisions
- Triple bottom line objective
- Source code released under GPLv3 open source license



Configurable Supply Chain Network

- XSG is capable of modeling virtually any supply chain network topology, as long as it does not include closed loops
 - ► Hence, the name, where X can be virtually any supply chain



Configurable Scenarios Setup

- Game setup can be configured to create an expansive range of scenarios
 - Each node may have different configurations
 - Stations' decisions can be partially or fully automated

Parameters for	Parameter	Description	Example
	Name	Unique demand point name	Customer
demand point nodes	Demand	An array of weekly demand values (units)	[98, 135, 176, 124]

Parameter	Description	Example
Name	Unique station name	Retailer
Auto-shipping	Use auto shipping logic	False
Auto-ordering	Use auto ordering logic	True
Holding cost	Cost of holding a unit of product for a week (\$/unit/week)	\$1
Backorder cost	Cost of not fulfilling a unit ordered for a week (\$/unit/week)	\$2
Transport cost	Cost of shipping one truckload (\$/truck)	\$220 per truck
Transport size	Truck capacity (units/truck)	200 units per truck
Shipping delay	Shipment transit time between a supplier and a customer (weeks)	2 weeks
Ordering delay	Processing time before a supplier receives a customer order (weeks)	1 weeks
Queue initial value	Value used to initialize order/shipment queues for week 1 (units)	50 units
Initial inventory	Inventory count at the start of simulation (units)	200 units
Safety stock	Target safety stock; used in auto ordering logic (units)	50 units
Ordering minimum	An array of weekly throughput minimums (units)	[0, 0, 50, 50]
Ordering maximum	An array of weekly throughput maximums (units)	[200, 300, 300, 200]

Parameters for station nodes

Deploying XSG in Class Rooms

- Game takes about 80m to introduce, play 45wks, and debrief
- Players connect to a central web server and take on the roles of virtual station managers
- Each week, stations stats are updated reflecting players' decisions made across the supply chain in previous weeks
- Next, players analyze their stations' stats and make their decisions

Welcome to XSG, what would you like to do? Try demo game Join game Create game Advanced menu ➡>

XSG's Player Screen





Player Decisions

Each week players are faced with two decisions:

- Fulfillment decisions to immediate customers' demand
- Inventory replenishment decisions to immediate suppliers
- Use available supply chain information to balance between the risks of backorders and excess inventory
- Multiple competing objectives;
 - Minimize cost of operations (inventory holding, backorder, transportation costs)
 - Satisfy customer demand (fulfillment rate)
 - Minimize environmental footprint (utilization of trucks)

Player Decisions Fulfillment Decision (Shipping)

- If sufficient inventory is available to fulfill all customers demand, the decision becomes a transportation utilization one
 - For example, how to ship 230 demanded items. Trucks capacity of 200 items has a cost of \$220 per truck
- If inventory is insufficient to fulfill all customers demand, the decision becomes a prioritization one
 - Must decide how to split the available inventory between the demanding customers, while considering transportation cost



Player Decisions Replenishment Decision (Ordering)

- In deciding the amount to order from each supplier, players must:
 - engage in demand forecasting in one form or another
 - Consider: backorders, inventory level, outstanding orders, and planned shipments (replenishment decision)
 - consider ordering limits in the coming weeks and plans for outages if they exist
 - decide on how to split the total needed replenishment quantity between the suppliers



Player Preparation

- To lower the learning curve, players can try a single-player demo on the night before the class simulation
 - ► Learn the interface
 - Understand inputs and outputs of their decisions
 - Go at their own pace



SXSG

- The The X-Supply Game (XSG) is an educational game designed to help participants Game explore the dynamics of real supply chains. This demo is a single-player version of the game, where you will manage a virtual station in a simple supply chain. The game is played in turns, in which you'll analyze the weekly standing of your station and decide on orders to suppliers and shipments to customers. Your goal is to reduce costs, improve customer satisfaction, and minimize transportation environmental impact.
- The This demo supply chain network consists of 5 stations and 2 demand points, as Demo illustrated bellow. You will assume the role of the wholesaler manager, and will be responsible for ordering supplies from the manufacturers in order to mort the demands of the retailers, and ultimately the clients. The remaining stations are automated. Each game turn is a week in a 45 weeks simulation. You will have 3 minutes to complete each turn.



Details A demo game has been created with the below details. To keep the server from crowding, this game will be automatically deleted after 1 hour. After clicking on the 'Start Demo' button below you will be automatically legged into the game. You can also access this game from the main mens 'Join game' option using the below player name and password. After completing the game, you can view your results from the 'Advanced mens' **>** 'Advanced mens' **>**.

Game:	demo_530	
Player name:	DemoPlayer	
Play password:	530	
Admin password:	530	
Start	Demo	





Total weekly orders for the supply chain (top) and for a select set of stations (bottom)







Net weekly available inventory for the supply chain (top) and for a select set of stations (bottom)







Game scenario results

Station (Player)	Inventory	Backorder	Transport	Total	Fulfillment	Transport Utilizatio
Local_Warehouse_1 (Yousefco)	\$35,250	\$12,500	\$19,800	\$67,550	72%	74%
Local_Warehouse_2 (Reem)	\$38,050	\$12,700	\$20,240	\$70,990	74%	72%
Regional_DC_1 (Almazrouei)	\$45,850	\$28,000	\$17,820	\$91,670	75%	84%
Regional_DC_2 (Khulood)	\$19,450	\$14,700	\$18,260	\$52,410	79%	79%
Manufacturer_1 (Halima)	\$29,350	\$8,600	\$17,160	\$55,110	86%	86%
Manufacturer_2 (Ayesha)	\$17,000	\$7,300	\$18,040	\$42,340	87%	83%
Total (\$) / Average (%)	\$184,950	\$83,800	\$111,320	\$380,070	79%	80%



Post-Game Debriefing

Use graphs to guide the debriefing discussion:

- How did you feel while playing the game? Did you feel in control?
- How was your team's performance? What are the main performance issues? What are the sources of these performance issues?
- Who is to blame?
- Which KPI did you focus on? Why?
- If this performance occurred in a real-world supply chain, what would be the impact?
- What would you do differently if you could play again?

Additional Teaching Points

- Managing Unpredictable Demand
- Multi-sourcing decisions and channel balancing
- Supply chain risks
- Impact of longer delays on player decisions
- Role of information sharing in SCM



Game Implementation

- XSG is designed to run on most internet capable devices without needing additional software
- All simulation logic is implemented on the server side, and only minimal UI logic remains on the client side
- The simulation engine is implemented using:
 - Python and its Flask web-framework library
 - ► HTML, CSS, and JavaScript

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XSG		About Home
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Try XSG

ZU Server <u>https://istm.zu.ac.ae/xsg</u>

Git hub https://sinansalman.github.io/xsg/

- Or contact me: <u>sinan.salman@zu.ac.ae</u>
- Upcoming paper on the Humanitarian Aid Relief Distribution (HARD) Game

Local Wandhouse I

