Project Title

Supply Chain Optimization with Reinforcement Learning

Project Lead and Members

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Organisation(s) Involved

ALPS Pte Ltd

Healthcare Family Group Involved in this Project

Healthcare Administration

Specialty or Discipline

Procurement

Aims

To optimize stock replenishment process with a state-of-the-art reinforcement learning method

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below

Lessons Learnt

See poster appended / below

Conclusion

See poster appended / below

Additional Information

Singapore Healthcare Management (SHM) Conference 2021 – Shortlisted Project (Supply Chain Management Category)

Project Category

Technology, Digital Health, Data Analytics, Machine Learning, Care & Process Redesign, Value Based Care, Operational Management, Supply Chain, Procurement, Inventory Management

Keywords

Lean Warehousing Operation, SAP Material Requirement Planning, Deep-Q Network, Reinforcement Learning

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Supply Chain Optimization with Reinforcement Learning

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ALPS
Synergies in Healthcare Supply Chain

Introduction:

Stock replenishment process plays a crucial role in warehousing operation. The art of the process is all about balancing between keeping minimal stock level while achieving high stock availability.

In the warehouse managed by ALPS, the supply chain team uses the SAP Material Requirement Planning (MRP) to manage the replenishment process.

We want to explore how to optimize this process with a state-of-the-art reinforcement learning method.

Reinforcement Learning:

Reinforcement learning is an area of machine learning concerned with how intelligent agents take actions in an environment to maximize the outcome.

When the agent performs a correct action, it receives a reward. Otherwise, it gets a penalty. After repeated training, the agent will learn which is the best steps to take.

Methodology:

Actual data from 150 SKUs was used to train a Deep-Q Network (DQN) based on the strategy by rewarding the agent for keeping a low stock level, penalizes for out of stock and over stock up situation.

Based on the reward and penalty received, the agent make decision on when and how much to trigger a reorder based on the forecast, current inventory level and incoming shipment quantity.

Result:

As compared to the actual data, simulation run from 80 SKUs shows DQN model can reduce average inventory turnover by 50%, with minimum impact to stock availability and number of goods receives (GR) needed.

Model	Turn Over (Days)	Stock Availability (%)	No. of GR
DQN Model_1	20	88%	16
DQN Model_2	29	95%	19
Actual Data	59	99%	20

Conclusion:

Reinforcement learning is a very new research area. Our study demonstrated its effectiveness in the context of healthcare supply chain management. In future, we can plan for lean warehouse operations by harness the latest technology that will significantly reduce inventory holding cost.